Systematic Review of Hospital Readmissions Among Patients With Cancer in the United States

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Purpose/Objectives: To review the existing literature on readmission rates, predictors, and reasons for readmission among adults with cancer.

Data Sources: U.S.-based empirical studies reporting readmission rates from January 2005 to December 2015 were identified using four online library databases—PubMed, CINAHL®, EconLit, and the online bibliography of the National Cancer Institute's Surveillance Epidemiology and End Results Program. Some articles were identified by the authors outside the database and bibliography searches.

Data Synthesis: Of the 1,219 abstracts and 271 full-text articles screened, 56 studies met inclusion criteria. The highest readmission rates were observed in patients with bladder, pancreatic, ovarian, or liver cancer. Significant predictors of readmission included comorbidities, older age, advanced disease, and index length of hospital stay. Common reasons for readmission included gastrointestinal and surgical complications, infection, and dehydration.

Conclusions: Clinical efforts to reduce the substantial readmission rates among adults with cancer may target high-rate conditions, infection prevention, proactive management of nausea and vomiting, and nurse-led care coordination interventions for older adult patients with multiple comorbid conditions and advanced cancer.

Implications for Nursing: Commonly reported reasons for readmission were nursing-sensitive patient outcomes (NSPOs), amenable to nursing intervention in oncology settings. These findings underscore the important role oncology nurses play in readmission prevention by implementing evidence-based interventions to address NSPOs and testing their impact in future research.

Cancer care has been declared a crisis in the United States because of the growing demand for services, increasing complexity of treatment, and dramatically rising costs of care (Institute of Medicine [IOM], 2013). Some 1.6 million individuals are diagnosed with cancer each year, and the number of cancer survivors is projected to increase dramatically because of the aging population and improvements in treatment (American Cancer Society [ACS], 2016; IOM, 2013). By 2020, cancer care costs are expected to reach $173 billion, reflecting a considerable increase from $72 billion in 2004 (ACS, 2014; Smith & Hillner, 2011). At the same time, national reports criticize the quality of cancer care, calling for greater patient-centered focus; improved care coordination, with management of care transitions across settings; and cost containment through the reduction of preventable healthcare use (IOM, 2013; Smith & Hillner, 2011).

Programs and policies to reduce hospital readmissions are increasingly viewed as promising avenues to reduce spending and improve healthcare quality and efficiency as well as patient experiences (Naylor, Aiken, Kurtzman, Olds, & Hirschman, 2011; Robert Wood Johnson Foundation [RWJF], 2013; Schoen, Os-

born, How, Doty, & Peugh, 2009). Hospital stays are stressful and inconvenient for patients and their families, and substantially contribute to out-of-pocket healthcare costs. One aim of the Patient Protection and Affordable Care Act is to reduce healthcare spending through improved outpatient management of chronic disease and reduced hospital readmissions (Carroll & Frakt, 2013; Kocher & Adashi, 2011). Likewise, the Center for Medicaid and Medicare Innovation instituted a five-year Community Care Transitions Program to test models for improving patient transitions from hospitals to other settings and avoiding unnecessary readmissions (Agency for Healthcare Research and Quality [AHRQ], 2014; Kocher & Adashi, 2011). Such initiatives are built on the assumption that some readmissions are preventable; the validity of readmission rates as indicators of healthcare quality depends on this premise (Goldfield et al., 2008).

Oncology nurses play important roles in preventing readmission from the moment patients are admitted to hospitals by identifying and addressing complications and adverse inpatient events that may increase readmission risk, assessing patient and family knowledge, providing education throughout the hospital stay and in preparation for discharge, assisting with medication management, supporting advanced care planning, and coordinating care transitions between inpatient and community-based providers and services (Feigenbaum et al., 2012; Naylor et al., 2011). Indeed, a growing body of evidence suggests that multicomponent interventions focused on care transitions and incorporations of strategies—such as comprehensive discharge planning and instructions with follow-up, home visits, individualized care planning, clinical management, education, and behavioral support—may be effective in reducing readmission rates (Coleman, Parry, Chalmers, & Min, 2006; Epstein, Jha, & Orav, 2011; Feigenbaum et al., 2012; Hansen, Young, Hinami, Leung, & Williams, 2011; Hari & Rosenzweig, 2012; Jack et al., 2009; Naylor et al., 2011; Peikes, Chen, Schore, & Brown, 2009; VanSuch, Naessens, Stroebel, Huddleston, & Williams, 2006).

Successful nursing interventions to reduce readmission depend on identifying groups at risk for preventable readmission; however, the burden of readmissions for patients with cancer is not well described in extant literature, nor is the extent to which readmissions are preventable in this population. To date, cancer-specific readmission rates are not publicly reported, and the Centers for Medicare and Medicaid Services (CMS) penalties for readmissions do not apply to cancer hospitals (Horwitz et al., 2012). In a predictive model of avoidable readmissions developed at a large academic medical center (Donzé, Aujesky, Williams, & Schnipper, 2013), discharge from an oncology service was a significant risk factor, even when excluding planned readmissions for chemotherapy. Similarly, a Canadian study (Ji, Abushomar, Chen, Qian, & Gerson, 2012) found that the all-cause readmission rates of patients with cancer were higher than the rates of patients with other conditions. Whether these findings are relevant to the unique U.S. clinical, payment, and healthcare policy environment is unknown.

Studies of readmissions among patients with cancer in the United States are needed to ascertain the extent of this population's risk for readmission, to identify subgroups that might benefit from interventions to reduce readmissions, and to provide benchmarks against which to measure the success of such interventions. Accordingly, this systematic literature review had three related aims focused on patients with cancer: (a) to examine the proportion of patients with cancer who are readmitted to the hospital within 30 days of discharge, (b) to enumerate the reasons for and predictors of readmissions, and (c) to assess whether and how current studies identify potentially preventable readmissions.

Methods

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009), the authors of the current study searched three electronic library databases (PubMed, CINAHL®, EconLit) and the online bibliography of the National Cancer Institute's Surveillance Epidemiology and End Results (SEER) Program. The Medical Subject Heading (MeSH) terms *patient readmission* and *neoplasms* or *neoplasm metastasis* or *carcinoma* were employed in the PubMed search. The keywords *readmission*(*s*) or *rehospitalization*(*s*) were used in the EconLit search, which was limited to publications in analysis of healthcare markets, health, government policy, regulation, public health, and health production. The subject headings *readmission* and *neoplasms* were employed in the CINAHL search. The SEER bibliography search focused on the keywords *readmission*(*s*) or *rehospitalization*(*s*) in abstracts and titles. In addition, the authors identified relevant articles outside the database and bibliography searches.

Inclusion and Exclusion Criteria

The inclusion criteria included (a) peer-reviewed empirical studies conducted in the United States, (b) articles published from January 1, 2005, to December 31, 2015, (c) articles with sample sizes of 50 or

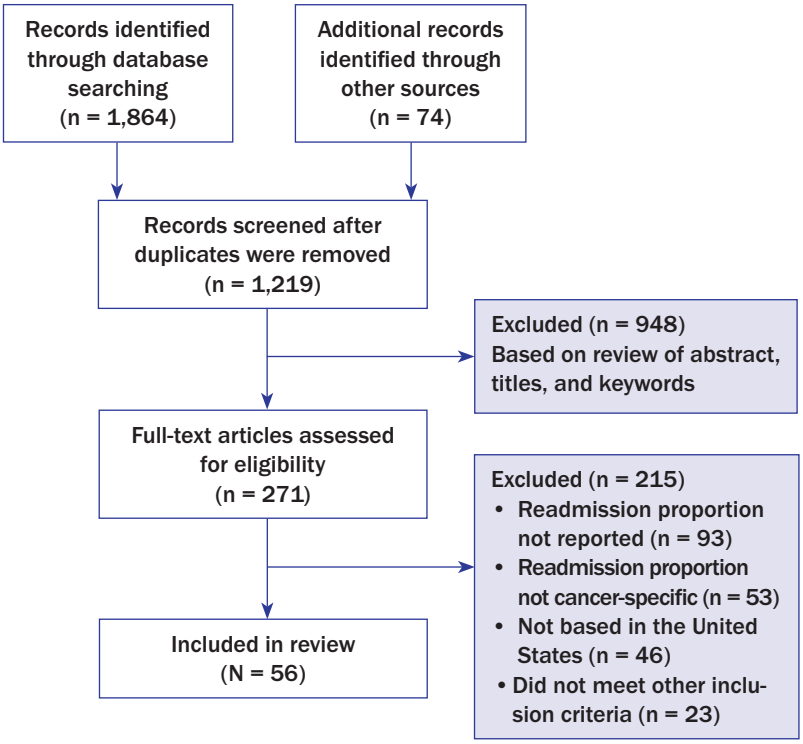

FIGURE 1. Selection of Studies Examining Hospital Readmissions

more, and (d) studies that identified the proportion of readmissions among patients with cancer aged 18 years or older. Articles were excluded if they were (a) reports of a literature review, meta-analysis, commentary, or case study; (b) focused solely on health service use at the end of life, given higher expected rates of readmissions attributed to confounding by progression of disease; or (c) presented readmission rates that were not exclusive to patients with cancer.

Screening Process

All citations were managed in EndNote X7, and duplicates were discarded. A two-stage screening process was applied to assess whether articles met inclusion criteria, with all articles screened by the lead author and at least one other investigator. In the first stage, the authors searched all EndNote fields, including titles and abstracts, for the keywords *readmission*(*s*) or *rehospitalization*(*s*). Articles were retrieved and the full text examined if they could not be included or excluded based on the EndNote keyword search, as in the case of scanned papers. In the second stage of the review, the full text of all included papers from the first stage was obtained and examined against the inclusion and exclusion criteria independently by at least two investigators. All the references of the included articles, meta-analyses, and review papers identified during the review were iteratively examined.

Data Abstraction

Included studies were sorted into one of two groups according to their focus on a single institution (hospital or medical center) or multiple institutions. A standardized abstraction form was developed to systematically collect and summarize key data elements from each article. The authors of the current study calculated 30-day readmission rates for articles presenting readmission rates in time frames other than 30 days, assuming a constant rate of readmission over time. This approach yielded conservative 30-day readmission estimates because most readmissions occur within the first 30 days and decline afterward (Benbassat & Taragin, 2000). Most studies using alternative time frames reported readmissions within time frames longer than 30 days. Significant predictors of readmission from the results of multivariate regression models were recorded, as were the most common reasons for readmission, if specified in the articles. Finally, the authors examined the studies to ascertain whether the readmissions were classified as potentially preventable and, if so, they recorded the definition. At least 90% agreement was reached in each stage of the review, with discrepancies resolved by the consensus of all participating authors.

Results

After duplicates were discarded, a total of 1,219 articles were collected from the combined searches of PubMed, EconLit, CINAHL, the SEER bibliographic database, and studies found outside the search criteria by the authors (see Figure 1). Of these, 948 studies were excluded based on a review of the abstracts, titles, and keywords. The full text of the remaining 271 articles was reviewed, and 215 were excluded, primarily because they did not measure readmission, the readmission data were not specific to patients with cancer, or they were not based in the United States. In total, 56 studies met the inclusion criteria, including 24 single-institution and 32 multiple-institution studies (see Table 1).

Characteristics of the Studies

Almost all the studies examined readmissions following surgical (n = 53) rather than medical index admissions. Most used retrospective cohort designs (n = 52), with the remainder using prospective consecutive cohort designs. Most single-institution studies relied on a review of medical records, while cancer registry

TABLE 1. Studies of Readmissions Among Patients With Cancer (N = 56)

Study	Sample[a]	Data Source	Readmission	
			Definition	Rate[b]
Single Institution (n = 24)				
Ahmad et al., 2014	419 patients with gastric cancer, 49% at an advanced stage, with a median age of 68 years. Patients underwent surgery related to their cancer; about 50% reported comorbidities.	Hospital database, medical records	30 days	15%
AlHilli et al., 2015	538 patients with ovarian cancer, 77% at an advanced stage, with a mean age of 63 years. Patients underwent surgery related to their cancer; about 58% reported comorbidities.	Hospital database, medical records	30 days	19%
Clark et al., 2013	460 patients with ovarian cancer, 87% at an advanced stage, with a median age of 61 years. Patients underwent surgery related to their cancer; 65% reported comorbidities.	Medical records	30 days	12%
Dedania et al., 2013	70 patients with pancreatic cancer, 54% at an advanced stage, with a mean age of 66 years. Patients underwent surgery related to their cancer.	Hospital database, medical records	30 days	29%
Dickinson et al., 2015[c]	362 patients with brain cancer, with a median age of 63 years. Patients underwent surgery related to their cancer.	Hospital database, medical records	30 days	8%
Doll et al., 2014	152 patients with gynecologic cancer, 30 at an advanced stage, with a median age of 59 years. About 64% reported comorbidities.	CRPR, hospital database, medical records	30 days	12%
Fauci et al., 2011	207 patients with ovarian cancer, 84% at an advanced stage, with a mean age of 64 years. Patients underwent surgery related to their cancer.	Hospital database	30 days	16%
Glasgow et al., 2014	53 patients with gynecologic cancer, 90% at an advanced stage, with a median age of 63 years. Patients underwent surgery related to their cancer; about 42% reported comorbidities.	Medical records	30 days	34%
Grant et al., 2005	100 patients with hematologic cancer, with a mean age of 45 years. Patients underwent a medical procedure related to their cancer; 34% reported comorbidities.	Medical records	180 days	8%
Gustafson et al., 2012[c]	76 patients with hepatic cancer, with a mean age of 57 years. Patients underwent surgery related to their cancer.	CRPR, research database	30 days	15%
Hari & Rosenzweig, 2012	62 patients with pancreatic cancer underwent surgery related to their cancer.	Medical records, research database	90 days	9%
Kastenberg et al., 2013	257 patients with pancreatic cancer, with a mean age of 65 years. Patients underwent surgery related to their cancer.	Medical records	30 days	18%
Kimbrough et al., 2014	245 patients with hepatic cancer, with a median age of 59 years. Patients underwent surgery related to their cancer; about 41% reported comorbidities.	Medical records	30, 60, and 90 days	11%
Klos et al., 2014	235 patients with colon cancer, 64% at an advanced stage, with a mean age of 72 years. Patients underwent surgery related to their cancer; 91% reported comorbidities.	Medical records	30 days	8%
Liang et al., 2013	395 with endometrial cancer, with a mean age of 61 years. Patients underwent surgery related to their cancer; 62% reported comorbidities.	Medical records	90 days	< 3%
Offodile et al., 2015	249 patients with head and neck cancer, 46% at an advanced stage, with a mean age of 59 years. Patients underwent surgery related to their cancer; 74% reported comorbidities.	Medical records	30 days	15%

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TABLE 1. Studies of Readmissions Among Patients With Cancer (N = 56) *(Continued)*

Study	Sample[a]	Data Source	Readmission	
			Definition	Rate[b]
Single Institution (n = 24) *(continued)*				
Spring et al., 2015	1,141 patients with hematologic cancer, with a median age of 45 years. Patients underwent a medical procedure related to their cancer.	Medical records	30, 100+ days	21%
Stimson et al., 2010[c]	753 patients with bladder cancer, 54% at an advanced stage, with a median age of 69 years. Patients underwent surgery related to their cancer; 95% reported comorbidities.	Medical records, research database	90 days	9%
Tamandl et al., 2015	746 patients with colorectal cancer, with a median age of 58 years. Patients underwent surgery related to their cancer; 46% reported comorbidities.	Hospital database, medical records	30 days	13%
Tevis et al., 2013	355 patients with rectal cancer, 45% at an advanced stage, with a median age of 60 years. Patients underwent surgery related to their cancer.	Hospital database	30 days	9%
Walters et al., 2013	384 patients with ovarian cancer, 85% at an advanced stage. Patients underwent surgery related to their cancer.	Medical records	30 days	15%
Weber et al., 2010	2,618 patients with head and neck cancer underwent surgery related to their cancer; 52% reported comorbidities.	CRPR, ICD, medical records, research database	30 days	6%–14%
White et al., 2015	263 patients with colorectal cancer, 42% at an advanced stage, with a median age of 67 years. Patients underwent surgery related to their cancer.	ICD, medical records	30 days	13%
Worley et al., 2013	165 patients with ovarian cancer, 100% at an advanced stage, with a mean age of 75 years. Patients underwent surgery and a medical procedure related to their cancer.	Medical records	30 days	13%
Multiple Institutions (n = 32)				
Ahmad et al., 2012[c]	1,302 patients with pancreatic cancer, with a mean age of 64 years. Patients underwent surgery related to their cancer; about 34% reported comorbidities.	Hospital database, medical records, research database	90 days	6%
Brown et al., 2014	2,517,886 patients with all types of cancer underwent surgery related to their cancer.	ICD, University Health System Consortium	7, 14, 30 days	6%
Duska et al., 2015	1,873 patients with ovarian cancer, 100% at an advanced stage, with a mean age of 61 years. Patients underwent surgery and a medical procedure related to their cancer; about 39% reported comorbidities.	Medical records, research database	30 days	11%
Farjah et al., 2009	21,067 patients with lung cancer underwent surgery related to their cancer.	SEER-Medicare, CRPR, ICD	30 days	15%
Fox et al., 2014	14,790 patients with colon cancer, none at an advanced stage, with a median age of 72 years. Patients underwent surgery related to their cancer.	HCUP, ICD	30 days	12%
Friedman et al., 2008	46,392 patients with all types of cancer, with a mean age of 59–64 years. Patients underwent surgery and a medical procedure related to their cancer; 23% reported comorbidities.	HCUP, ICD	30 days	16%
Gaitonde et al., 2015	6,737 patients with esophageal cancer underwent surgery related to their cancer.	ICD, research database	30 days	18%

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TABLE 1. Studies of Readmissions Among Patients With Cancer (N = 56) *(Continued)*

Study	Sample[a]	Data Source	Readmission	
			Definition	Rate[b]
Multiple Institutions (n = 32) *(continued)*				
Goffredo et al., 2015	103 patients with adrenal cancer, 26% at an advanced stage, with a mean age of 53 years. Patients underwent surgery related to their cancer; 27% reported comorbidities.	ICD, National Cancer Database	30 days	4%
Greenblatt et al., 2010	42,348 patients with colon cancer, 32% at an advanced stage, with a mean age of 78 years. Patients underwent surgery and a medical procedure related to their cancer.	SEER-Medicare, CRPR, ICD	30 days	11%
Hansen et al., 2013	6,760 patients with colon cancer underwent surgery related to their cancer; 84% reported comorbidities.	HCUP, ICD	30 days	12%
Hechenbleikner et al., 2013	735 patients with colorectal cancer, with a mean age of 56 years. Patients underwent surgery related to their cancer.	ICD, National Surgery Quality Improvement Plan, University HealthSystem Consortium	30 days	18%
Hendren et al., 2011	477,461 patients with colon cancer, with a mean age of 77 years. Patients underwent surgery related to their cancer.	CRPR, ICD, Medicare Provider Analysis and Review files	30 days	14%–17%
Hu, Jacobs, et al., 2014	1,782 patients with bladder cancer, with a mean age of older than 65 years. Patients underwent surgery related to their cancer; 49% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	26%
Hu, McMurry, et al., 2014	11,432 patients with lung cancer, 18% at an advanced stage, with a median age of 75 years. Patients underwent surgery related to their cancer; about 62% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	13%
Huang et al., 2014	7,534 patients with prostate cancer, 2% at an advanced stage. Patients underwent surgery related to their cancer; 22% reported comorbidities.	SEER-Medicare, CRPR, ICD	90 days	3%
Hyder et al., 2013	1,488 patients with pancreatic cancer, 4% at an advanced stage, with a median age of 74 years. Patients underwent surgery related to their cancer; 97% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	21%
Kunitake et al., 2010	26,108 patients with colorectal cancer, 15% at an advanced stage, with a mean age of 68–72 years. Patients underwent surgery related to their cancer; 44% reported comorbidities.	CRPR, CCR-OSHPD, ICD	30 days	10%–13%
Langan et al., 2015	2,797 patients with lung or colon cancer, with a mean age of older than 65 years. Patients underwent surgery related to their cancer; 82% reported comorbidities.	Hospital database, ICD, medical records	30, 90 days	16%
Lucas et al., 2014	44,822 patients with colorectal cancer, with a median age of 78 years. Patients underwent surgery related to their cancer; about 15% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	12%
Moghavem et al., 2015	19,178 patients with brain cancer, with a median age of younger than 65 years. Patients underwent surgery related to their cancer.	HCUP, ICD	30 days	17%
Puri et al., 2015	129,893 patients with lung cancer, 15% at an advanced stage, with a mean age of 67 years. Patients underwent surgery related to their cancer; 47% reported comorbidities.	ICD, National Cancer Database	30 days	4%
Reddy et al., 2009	1,730 patients with pancreatic cancer, 14% at an advanced stage, with a median age of 73 years. Patients underwent surgery related to their cancer; 36% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	16%

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TABLE 1. Studies of Readmissions Among Patients With Cancer (N = 56) *(Continued)*

Study	Sample[a]	Data Source	Readmission	
			Definition	Rate[b]
Multiple Institutions (n = 32) *(continued)*				
Schneider et al., 2013	120,832 patients with colorectal cancer, 15% at an advanced stage, with a mean age of 76 years. Patients underwent surgery related to their cancer.	SEER-Medicare, CRPR, ICD	30 days	11%
Schneider, Hyder, Brooke, et al., 2012	149,622 patients with colon cancer, 63% at an advanced stage, with a mean age of 77 years. Patients underwent surgery related to their cancer; about 52% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	11%
Schneider, Hyder, Wolfgang, et al., 2012	9,957 patients with hepatic or pancreatic cancer, about 30% at an advanced stage, with a mean age of 73 years. Patients underwent surgery related to their cancer; about 47% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	16%
Skolarus et al., 2015	1,782 patients with bladder cancer, with a mean age of older than 65 years. Patients underwent surgery related to their cancer.	SEER-Medicare, CRPR, ICD	30 days	26%
Speicher et al., 2015	16,275 patients with rectal cancer, 66% at an advanced stage, with a mean age of older than 60 years. Patients underwent surgery related to their cancer; 21% reported comorbidities.	ICD, National Cancer Database	30 days	6%
Stitzenberg et al., 2015[d]	29,719 patients with bladder, lung, pancreatic, or esophageal cancer, 31% at an advanced stage, with a mean age of 74 years. Patients underwent surgery related to their cancer; 54% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	
Tan et al., 2011	8,003 patients with kidney cancer, 26% at an advanced stage. Patients underwent surgery related to their cancer; 42% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	10%–12%
Tuggle et al., 2010	2,127 patients with thyroid cancer, 48% at an advanced stage, with a mean age of 74 years. Patients underwent surgery related to their cancer; 43% reported comorbidities.	SEER-Medicare, CRPR, ICD	30 days	8%
Yermilov et al., 2009	2,185 patients with pancreatic cancer, 71% at an advanced stage, with a mean age of 66 years. Patients underwent surgery related to their cancer; 43% reported comorbidities.	CRPR, CCR-OSHPD, ICD	30 days	19%
Zheng et al., 2015	45,876 patients with colon cancer, 37% at an advanced stage, with a median age of older than 65 years. Patients underwent surgery related to their cancer; 33% reported comorbidities.	ICD, National Cancer Database	30 days	5%

[a] Advanced stage defined as overall stage III or IV; tumor, node, metastasis (TNM) stage III; or with variables indicating distant, advanced, or metastatic disease. Some studies included these variables but did not specify the sample proportions.
[b] Percentage readmitted within 30 days was calculated for studies with longer time frames, assuming a constant readmission rate over time.
[c] Prospective consecutive cohort design
[d] Rate of readmission was 30% for patients with bladder, 13% for lung, 22% for pancreatic, and 22% for esophageal cancer.
CCR-OSHPD—California Cancer Registry linked to the Office of Statewide Health Planning and Development files; CRPR—cancer registry or pathology report; HCUP—Healthcare Cost and Utilization Project; ICD—International Classification of Diseases diagnosis or procedure codes; SEER—Surveillance, Epidemiology, and End Results Program
Note. All studies were retrospective cohort unless otherwise indicated.
Note. Studies of SEER-Medicare data use ICD codes based on histology at the time of diagnosis to define cancer cases.

data linked to insurance claims served as the underlying data source for most of the multiple-institution studies. Thirty-one studies had sample sizes greater than 1,000, with smaller samples in the single- versus multiple-institution studies.

Nineteen multiple-institution studies focused on older adults, given their use of Medicare claims linked to SEER data, whereas seven of the single-institution studies focused on this population. Forty-eight studies focused on one primary cancer type, and only

two studies considered all cancer types. Thirty-three studies accounted for cancer stage or comorbidities, albeit with heterogeneous measures across the studies.

Hospitalization within 30 days of discharge from an index admission was the most commonly used readmission definition, appearing in 50 studies. Of the alternative definitions, most considered readmission within 90 days, with the remainder using time periods of as much as a year.

Rates of Readmission

The percentage of patients experiencing readmission within 30 days ranged from less than 3%–34% across the reviewed studies. Thirty-five studies reported readmission rates from 10%–19%, and the highest rates were reported in studies of patients with bladder, pancreatic, hematologic, and ovarian cancers. The lowest 30-day readmission rates were the author-calculated rates, which had been presented within longer time frames in the original studies.

Significant Predictors of Readmission

Across the studies with multivariable models (n = 30) examining predictors of readmission (see Table 2), comorbidities were consistently associated with higher rates of readmission. Most studies controlled for gender, with men having higher readmission rates than women. Other patient factors associated with significantly higher rates of readmission included older age; more advanced disease as measured by cancer stage, tumor size, or lymph node involvement; low socioeconomic status; unmarried status; African American (compared to Caucasian) and non-Hispanic race/ethnicity; and dual eligible insurance status. Residence in low population areas, rural areas, or the Midwest or South was also associated with higher readmission rates.

Surgical factors, such as postoperative complications and operative methods, were associated with higher readmission rates, as were longer and shorter index hospital stays and high and low hospital volume. Other characteristics of the index hospitalization associated with higher rates included having a medical (versus surgical) discharging physician, greater travel distance, discharge to a place other than home, and emergent admission.

Top Reported Reasons for Readmission

Of the studies reviewed, 31 reported reasons for readmission, based primarily on ICD-9 CM codes for the principal diagnosis. A tally of the top five reported reasons for readmission (see Table 3) included gastrointestinal complications (e.g., nausea, vomiting, diarrhea, ileus), infection, nutritional complications (e.g., malnutrition, dehydration, failure to thrive), surgical complications, and cardiopulmonary complications. Other reasons included genitourinary complications, disease progression or recurrence, coagulation disorders, and pain.

Definitions of Preventability

Eleven studies considered whether readmissions were potentially preventable (AlHilli et al., 2015; Brown, Burgess, Li, Canter, & Bold, 2014; Fox, Tyler, Vashi, Hsia, & Saxe, 2014; Glasgow, Shields, Vogel, Teoh, & Argenta, 2014; Grant, Cooke, Bhatia, & Forman, 2005; Hansen, Fox, Gross, & Bruun, 2013; Hechenbleikner et al., 2013; Hynes et al., 2004; Moghavem, Morrison, Ratliff, & Hernandez-Boussard, 2015; Puri et al., 2015; Tuggle, Park, Roman, Udelsman, & Sosa, 2010); only one study (Brown et al., 2014) evaluated individual cases to assess their preventability. Brown et al. (2014) concluded that 33% of readmissions within seven days of the index hospitalization were for issues deemed potentially preventable by the authors, including nausea, vomiting, dehydration, and postoperative pain, with improved discharge follow-up, care coordination, and palliative care. Most studies conceptualized readmissions as planned versus unplanned, using this dichotomy to identify and exclude planned readmissions for chemotherapy, radiotherapy, or rehabilitation (AlHilli et al., 2015; Brown et al., 2014; Fox et al., 2014; Glasgow et al., 2014; Hansen et al., 2013; Hechenbleikner et al., 2013; Puri et al., 2015; Tuggle et al., 2010). Extensions to this conceptualization included focusing on readmission diagnosis related to initial admission (Brown et al., 2014) and including only readmissions originating in the emergency department (Fox et al., 2014).

In one study (Hynes et al., 2004), an expert panel used an iterative consensus process to identify diagnosis codes for surgical complications (within 30–365 days of surgery) that could result in readmission; however, the article did not specify whether these complications were deemed potentially preventable. In another study (Grant et al., 2005), readmissions were conceptualized as unscheduled versus scheduled, again without an explicit definition, although this categorization could have been determined by the researchers through medical chart review. Moghavem et al. (2015) examined "unplanned readmissions" but did not provide a definition or otherwise explain how these readmissions were identified.

Discussion

This systematic review of 56 studies indicated that 30-day hospital readmission rates among patients with cancer were comparable to and sometimes exceeded

those of patients with cardiovascular (15%), cardiorespiratory (21%), and general medical (18%) conditions (Horwitz et al., 2012; Macartney, Stacey, Carley, & Harrison, 2012; Van Walraven, Bennett, Jennings, Austin, & Forster, 2011). The wide range of readmission rates in this population is likely attributable to the heterogeneity of cancer case definitions, settings, and populations across the available literature—factors that also complicate the comparison of rates across studies. Collectively, the reviewed articles do not include cancer-specific rates for all cancer types, pointing to the need for future population-based research to more fully enumerate cancer readmission rates.

The reported rates, particularly from single-institution studies, may underestimate the true burden of readmissions among patients with cancer because not all studies in this review accounted for readmission to different facilities. Readmissions do not always occur at the index admitting facility; for instance, in a study of patients discharged after pancreaticoduodenectomy (Yermilov et al., 2009), 47% were readmitted to different hospitals. This issue may be particularly salient if patients receiving ongoing care from relatively distant regional cancer facilities seek local readmission for symptoms, such as pain or dehydration, which may be effectively treated in ambulatory care settings or with care management interventions. In addition, some individuals may elect to seek care at alternative hospitals because of perceived or actual deficiencies in care during the index admission (RWJF, 2013), resulting in underestimates of readmissions from poor quality care.

The studies focused almost exclusively on readmissions following surgical procedures; few examined readmissions following index admissions for nonsurgical indications, although one study (Brown et al., 2014) reported that discharge by a physician with a medical versus surgical specialty was a significant predictor of readmission. The authors of the current study would have preferred to present results separately for readmissions following index medical versus surgical admissions; however, few studies focused on readmissions following medical index admissions. Studies or readmission after index hospitalizations for medical indications are required to understand differences in the reasons and risk factors for readmissions following index medical versus surgical admissions. Such a focus is of particular importance, as the results of the current review suggest that the rates of readmission may be higher following an index medical admission (Brown, Bornstein, & Wilcox, 2012; Schneider et al., 2013).

The exemption of cancer specialty hospitals from CMS readmission penalties and the exclusion of medical oncology admissions from the hospitalwide, all-cause unplanned readmission rate (Horwitz et al., 2012) create the impression that the reasons and risk factors for readmissions among patients with cancer may differ from those of other inpatient groups. However, the authors found that many sociodemographic predictors of readmission among patients with cancer are consistent with those reported in other work (Kansagara et al., 2011). Cancer-specific variables (e.g., disease stage, treatment, operative method) also had significant independent effects. The reasons for readmissions across the studies were broadly categorized, with the most reported complications (e.g., gastrointestinal, infection, nutritional, surgical) arguably preventable. Future research is needed to better understand potentially preventable healthcare use among patients with cancer, and to more fully examine readmissions after medical procedures and their underlying reasons.

As others have noted (Van Walraven et al., 2011), the value of hospital readmissions as quality indicators depends on the ability to identify the proportion of avoidable readmissions. In one large study of Medicare beneficiaries with the highest costs (Carroll & Frakt, 2013), only 10% of spending was attributed to preventable hospital (re)admissions or emergency care, suggesting that a focus on readmission may not yield the savings some have anticipated. The extent to which this finding applies to readmission among patients with cancer is unknown. Most of the studies that considered the issue of preventability in this review did so only indirectly. In fact, none of the studies presented rates for the presumed preventable readmissions as a proportion of all oncology readmissions. Instead, they presented summary readmission rates for only those hospitalizations meeting their definition of potentially preventable. Although Brown et al. (2014) concluded that 33% of readmissions within seven days were because of issues deemed potentially preventable, the rate was presented for a subset already restricted to readmissions meeting the University Health Consortium definition of related readmissions, all of which are considered potentially preventable (Hechenbleikner et al., 2013). Accordingly, the rates presented in these studies cannot be interpreted as the proportion of preventable readmissions for patients with cancer.

The infrequent consideration of the preventability of readmissions among patients with cancer may reflect the lack of consensus in the literature, generally, about how to identify preventable healthcare use. A review by Van Walraven et al. (2011) suggested that 5%–79% of readmissions for all conditions, including cancer, may be preventable, with the wide-ranging estimates resulting from the use of subjective criteria to determine preventability. None of the reviewed

TABLE 2. Predictors of Higher Rates of Readmission Among Patients With Cancer

Predictor	Studies (N)	Significant		Not Significant	
		n	Studies	n	Studies
Patient Characteristic					
Comorbidities (greater number or specific condition)	25	22	Ahmad et al., 2014; AlHilli et al., 2015; Farjah et al., 2009; Fauci et al., 2011; Hendren et al., 2011; Hu, Jacobs, et al., 2014; Hu, McMurry, et al., 2014; Hyder et al., 2013; Kimbrough et al., 2014; Kunitake et al., 2010; Langan et al., 2015; Lucas et al., 2014; Moghavem et al., 2015; Puri et al., 2015; Schneider et al., 2013; Schneider, Hyder, Brooke, et al., 2012; Schneider, Hyder, Wolfgang, et al., 2012; Spring et al., 2015; Stitzenberg et al., 2015; Tuggle et al., 2010; Yermilov et al., 2009; Zheng et al., 2015	3	Reddy et al., 2009; Stimson et al., 2010; Tan et al., 2011
Male (versus female)	21	12	Farjah et al., 2009; Greenblatt et al., 2010; Hendren et al., 2011; Hu, McMurry, et al., 2014; Kunitake et al., 2010; Lucas et al., 2014; Moghavem et al., 2015; Schneider et al., 2013; Schneider, Hyder, Brooke, et al., 2012; Schneider, Hyder, Wolfgang, et al., 2012; Stimson et al., 2010; Stitzenberg et al., 2015	9	Ahmad et al., 2014; Hyder et al., 2013; Langan et al., 2015; Puri et al., 2015; Reddy et al., 2009; Spring et al., 2015; Tan et al., 2011; Yermilov et al., 2009; Zheng et al., 2015
Older age	21	9	Farjah et al., 2009; Hendren et al., 2011; Hu, McMurry, et al., 2014; Kunitake et al., 2010; Lucas et al., 2014; Puri et al., 2015; Schneider, Hyder, Brooke, et al., 2012; Stitzenberg et al., 2015; Yermilov et al., 2009	12	Clark et al., 2013; Fauci et al., 2011; Gaitonde et al., 2015; Greenblatt et al., 2010; Hyder et al., 2013; Langan et al., 2015; Moghavem et al., 2015; Reddy et al., 2009; Spring et al., 2015; Stimson et al., 2010; Tan et al., 2011; Zheng et al., 2015
Advanced disease stage (stage III or IV, large tumor size, lymph node involvement)	19	13	Farjah et al., 2009; Gaitonde et al., 2015; Greenblatt et al., 2010; Kunitake et al., 2010; Moghavem et al., 2015; Offodile et al., 2015; Puri et al., 2015; Schneider et al., 2013; Spring et al., 2015; Stitzenberg et al., 2015; Tuggle et al., 2010; Yermilov et al., 2009; Zheng et al., 2015	6	Hendren et al., 2011; Hyder et al., 2013; Puri et al., 2015; Reddy et al., 2009; Stimson et al., 2010; Tan et al., 2011
Other factors (low socioeconomic status, unmarried, African American, dual eligible)	16	7	Gaitonde et al., 2015; Hendren et al., 2011; Hu, McMurry, et al., 2014; Moghavem et al., 2015; Puri et al., 2015; Stitzenberg et al., 2015; Zheng et al., 2015	9	Dickinson et al., 2015; Farjah et al., 2009; Hendren et al., 2011; Hyder et al., 2013; Kunitake et al., 2010; Langan et al., 2015; Reddy et al., 2009; Spring et al., 2015; Tan et al., 2011
Treatment Characteristic					
Residence (low population density, rural, Midwest, South)	8	5	Farjah et al., 2009; Greenblatt et al., 2010; Hu, McMurry, et al., 2014; Moghavem et al., 2015; Stitzenberg et al., 2015	3	Hyder et al., 2013; Kunitake et al., 2010; Puri et al., 2015
Prior chemoradiation	3	2	Hu, McMurry, et al., 2014; Puri et al., 2015	1	Dickinson et al., 2015

Continued on the next page

TABLE 2. Predictors of Higher Rates of Readmission Among Patients With Cancer *(Continued)*

Predictor	Studies (N)	Significant		Not Significant	
		n	Studies	n	Studies
Treatment Characteristic *(continued)*					
Surgical complications (infection, blood loss, postoperative complications)	21	15	Ahmad et al., 2014; AlHilli et al., 2015; Clark et al., 2013; Fauci et al., 2011; Greenblatt et al., 2010; Hendren et al., 2011; Hu, Jacobs, et al., 2014; Hu, McMurry, et al., 2014; Kastenberg et al., 2013; Kimbrough et al., 2014; Langan et al., 2015; Schneider, Hyder, Brooke, et al., 2012; Spring et al., 2015; Stimson et al., 2010; Tuggle et al., 2010	6	Hyder et al., 2013; Kunitake et al., 2010; Offodile et al., 2015; Reddy et al., 2009; Schneider, Hyder, Wolfgang, et al., 2012; Stitzenberg et al., 2015
Operative method	18	10	Ahmad et al., 2014; Farjah et al., 2009; Hu, McMurry, et al., 2014; Langan et al., 2015; Lucas et al., 2014; Puri et al., 2015; Reddy et al., 2009; Schneider, Hyder, Brooke, et al., 2012; Stitzenberg et al., 2015; Zheng et al., 2015	8	Clark et al., 2013; Fauci et al., 2011; Gaitonde et al., 2015; Greenblatt et al., 2010; Kunitake et al., 2010; Offodile et al., 2015; Schneider, Hyder, Wolfgang, et al., 2012; Stimson et al., 2010
Index Hospitalization Characteristic					
Length of stay (LOS)	14	9	**Longer LOS:** Greenblatt et al., 2010; Hendren et al., 2011; Puri et al., 2015; Reddy et al., 2009; Schneider et al., 2013; Schneider, Hyder, Brooke, et al., 2012; Schneider, Hyder, Wolfgang, et al., 2012; Stitzenberg et al., 2015; Tuggle et al., 2010 **Shorter LOS:** Tuggle et al., 2010	5	Ahmad et al., 2014; Dickinson et al., 2015; Fauci et al., 2011; Hyder et al., 2013; Stimson et al., 2010
Other (intensive care unit stay, medical versus surgical discharging physician, greater travel distance)	11	8	Greenblatt et al., 2010; Hu, Jacobs, et al., 2014; Hu, McMurry, et al., 2014; Kastenberg et al., 2013; Langan et al., 2015; Stitzenberg et al., 2015; Tuggle et al., 2010; Zheng et al., 2015	3	Kunitake et al., 2010; Puri et al., 2015; Spring et al., 2015
Discharge to a place other than home	3	3	Dickinson et al., 2015; Greenblatt et al., 2010; Stitzenberg et al., 2015	–	–
Emergent admission/urgent surgery	3	3	Greenblatt et al., 2010; Hendren et al., 2011; Moghavem et al., 2015	–	–
Hospital Characteristic					
Patient volume/hospital size	9	8	**Higher volume:** Gaitonde et al., 2015; Hyder et al., 2013; Stitzenberg et al., 2015; Zheng et al., 2015 **Lower volume:** Greenblatt et al., 2010; Kunitake et al., 2010; Tan et al., 2011; Tuggle et al., 2010; Zheng et al., 2015	1	Moghavem et al., 2015

Note. All listed predictors derived from studies, including multivariable regression models, and reported as statistically significant ($p < 0.05$)

studies used existing methods to classify potentially preventable admissions, such as the AHRQ's (2001) definitions of ambulatory care sensitive conditions; however, such approaches may be insufficient in this population, as they do not account for cancer-specific conditions.

Future studies are warranted to better understand which conditions lead to preventable readmissions and

TABLE 3. Leading Reported Reasons for Patient Readmission

Variable	Studies (N)	Studies Reporting Finding
Gastrointestinal complications (ileus, colitis, nausea, vomiting, and diarrhea)	24	Ahmad et al., 2014; AlHilli et al., 2015; Brown et al., 2014; Clark et al., 2013; Fauci et al., 2011; Glasgow et al., 2014; Grant et al., 2005; Greenblatt et al., 2010; Gustafson et al., 2012; Hansen et al., 2013; Hari & Rosenzweig, 2012; Hu, Jacobs, et al., 2014; Hu, McMurry, et al., 2014; Hyder et al., 2013; Kimbrough et al., 2014; Langan et al., 2015; Liang et al., 2013; Offodile et al., 2015; Schneider et al., 2013; Stimson et al., 2010; Tamandl et al., 2015; White et al., 2015; Worley et al., 2013; Yermilov et al., 2009
Infection (fever, cellulitis, septicemia)	21	AlHilli et al., 2015; Brown et al., 2014; Dickinson et al., 2015; Grant et al., 2005; Greenblatt et al., 2010; Hansen et al., 2013; Hari & Rosenzweig, 2012; Hu, Jacobs, et al., 2014; Hu, McMurry, et al., 2014; Kastenberg et al., 2013; Kimbrough et al., 2014; Kunitake et al., 2010; Liang et al., 2013; Moghavem et al., 2015; Offodile et al., 2015; Schneider et al., 2013; Schneider, Hyder, Brooke, et al., 2012; Tamandl et al., 2015; White et al., 2015; Worley et al., 2013; Yermilov et al., 2009
Nutritional complications (dehydration, malnutrition, failure to thrive)	17	Ahmad et al., 2014; AlHilli et al., 2015; Brown et al., 2014; Glasgow et al., 2014; Grant et al., 2005; Hansen et al., 2013; Hari & Rosenzweig, 2012; Hu, Jacobs et al., 2014; Hu, McMurry et al., 2014; Hyder et al., 2013; Kimbrough et al., 2014; Schneider et al., 2013; Schneider, Hyder, Brooke, et al., 2012; Stimson et al., 2010, White et al., 2015; Worley et al, 2013; Yermilov et al., 2009
Surgical complications (blood loss, postoperative complications)	13	Ahmad et al., 2014; Clark et al., 2013; Fauci et al., 2011; Greenblatt et al., 2010; Hansen et al., 2013; Langan et al., 2015; Moghavem et al., 2015; Offodile et al., 2015; Reddy et al., 2009; Schneider et al., 2012; Tuggle et al., 2010; White et al., 2015; Yermilov et al., 2009
Cardiopulmonary complications (respiratory complaints, pneumonia)	11	Ahmad et al., 2014; Fauci et al., 2011; Greenblatt et al., 2010; Hu, McMurry, et al., 2014; Hyder et al., 2013; Kimbrough et al., 2014; Moghavem et al., 2015; Langan et al., 2015; Tamandl et al., 2015; Tuggle et al., 2010; White et al., 2015

whether discharge follow-up, care coordination, and palliative care interventions can reduce readmission rates among patients with cancer. Such efforts are consistent with national recommendations that hospital staff interview patients and caregivers to elicit the "story behind the story" to better understand their experiences of communication, coordination, or logistical barriers leading to readmission (AHRQ, 2014).

The authors opted not to grade the quality of the evidence in this review for several reasons. First, they reported unadjusted readmission rates rather the measured effects of any exposure or intervention. Second, none of the studies could be rated as producing the highest quality evidence because randomized, controlled trials were inapplicable. Third, they separated single- versus multiple-institution studies, which could be viewed as lower versus higher quality evidence, respectively.

Limitations

Given the reliance on secondary analysis of extant administrative or clinical data, most of the reviewed studies included risk of bias. Administrative data may underreport untreated comorbid conditions or those reimbursed as part of the hospital stay (e.g., substance abuse, mental health conditions) and, subsequently, underestimate the effects of these conditions on readmissions. In addition, most of the studies lacked variables to adequately measure socioeconomic status, social support, self-care ability, transportation, health literacy, receipt of timely or ongoing follow-up care, or the quality of discharge instructions. Accordingly, the effect of these variables on readmission is unknown, although they may be just as important as those reported, or perhaps even more salient. Also, most of the studies either excluded or did not describe the proportion of individuals who died within 30 days of hospital discharge, therefore introducing bias from semicompeting risk (i.e., reduced readmission rates attributable to death), which may be particularly applicable to patients with advanced cancer.

Interpretation of the findings from this review is subject to additional limitations. The abstraction and classification are subject to interpretation, although this subjectivity was mitigated through a dual review and consensus process. The authors may have inadvertently missed relevant publications that included readmission rates among patients with cancer in their review; however, additional studies changing

the conclusions of the review is unlikely given the wide range of rates found in this literature. As noted, direct comparison of readmission rates by cancer type across studies was not undertaken because of the heterogeneity of study populations and measures that would confound such comparisons. In addition, the lack of a standard definition of readmission across the studies in the review may complicate comparison of the reported results. The authors' standardized 30-day readmission rate assumed a constant rate of readmissions over time, which may introduce bias in the rates calculated for studies using alternative time frames, particularly if systematic differences exist in the the timing of readmission rates overall or by cancer type. Although most studies reported 30-day rates, those with longer time frames for which the authors calculated 30-day rates had the lowest rates of readmission. Consistent with work illustrating rapid early accrual of readmissions using time-to-event curves (Horwitz et al., 2012), this finding suggested higher readmission rates closer to index admission discharge, with the calculated rates likely to be underestimates.

Implications for Nursing

People diagnosed with cancer—particularly bladder, pancreatic, ovarian, and liver cancer—experience high rates of readmission; however, little evidence indicates the degree to which these readmissions may be preventable. At the same time, all commonly reported reasons for readmission among patients with cancer include at least some modifiable facets within the scope of nursing practice. This assertion is consistent with findings from a retrospective chart review (Weaver et al., 2006) reporting that readmission risk may be driven by complex medical care needs as well as psychosocial issues (e.g., living alone, caregiver difficulties, financial and insurance concerns). In fact, many reasons for readmission reported in the authors' review, such as infection, nausea and vomiting, and nutritional difficulties, have been identified by the Oncology Nursing Society as nursing-sensitive patient outcomes (NSPOs), which are amenable to nursing interventions in the oncology setting (Given & Sherwood, 2005). Therefore, efforts among oncology nurses to reduce readmissions might focus on implementing evidence-based interventions to address these NSPOs through symptom management and infection prevention, particularly among high-risk patients with advanced stage cancers, older age, and multiple chronic conditions.

Oncology nurses are in a unique position to contribute to future research on the impact of specific and multicomponent nursing interventions on readmission rates. Based on work involving other chronic conditions (Coleman et al., 2006; Epstein et al., 2011; Feigenbaum et al., 2012; Hansen et al., 2011; Hari & Rosenzweig, 2012; Jack et al., 2009; Naylor et al., 2011; Peikes et al., 2009; VanSuch et al., 2006), such interventions might incorporate comprehensive discharge planning and instructions with follow-up, home visits, individualized care planning, clinical management, education, and behavioral support. Nursing perspectives that account for medical and psychosocial needs are also needed in future population-based research to more fully enumerate cancer readmission rates, to better understand preventable healthcare use among patients with cancer, and to study readmissions and their underlying reasons.

Knowledge Translation

- Readmission rates among patients with cancer are comparable to and sometimes exceed the rates of patients with other chronic conditions.
- Commonly reported reasons for readmission may be amenable to nursing intervention, as they are are nursing-sensitive patient outcomes.
- Clinical efforts to reduce readmissions among patients with cancer might target conditions with the highest rates of readmission.

Conclusion

Readmission rates among patients with cancer are substantial and comparable to those among patients with other chronic conditions. At the same time, the extent to which cancer-related readmissions and associated spending may be avoidable is unclear. The lack of consensus on the definition of preventable readmission, either general or specific to cancer, limits the authors' ability to identify specific conditions that could be influenced by care coordination or discharge planning interventions. Future research is needed to describe readmission rates by cancer type using comparable methods, to examine readmissions following medical index admissions, and to develop and assess the effectiveness of readmission reduction interventions among patients with cancer. Clinical efforts to reduce readmission among patients with cancer may target conditions with the highest rates of readmissions, and include interventions such as the prevention of infection, the proactive management of nausea and vomiting, and care coordination interventions to address patient-level risk factors, including older age, multiple comorbid conditions, and advanced cancer.

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