

# Family Caregiver Knowledge, Patient Illness Characteristics, and Unplanned Hospital Admissions in Older Adults With Cancer

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**Purpose/Objectives:** To explore factors related to unplanned hospital admissions and determine if one or more factors are predictive of unplanned hospital admissions for older adults with cancer.

**Design:** A prospective longitudinal design and a retrospective chart review.

**Setting:** Adult oncology outpatient infusion centers and inpatient units at Orlando Regional Medical Center in Florida.

**Sample:** A convenience sample of 129 dyads of older adults with cancer and their family caregivers.

**Methods:** Family caregiver demographic and side effect knowledge data were collected prospectively during interviews with family caregivers using a newly developed tool, the Nurse Assessment of Family Caregiver Knowledge and Action Tool. Patient demographic and clinical data were obtained through a retrospective chart review. Descriptive statistics and logistic regression analyses were used to evaluate data and examine relationships among variables.

**Main Research Variables:** Patient illness characteristics; impaired function; side effects, such as infection, fever, vomiting, and diarrhea; family caregiver knowledge; and unplanned hospital admissions.

**Findings:** Unplanned hospital admissions were more likely to occur when older adults had impaired function and side effects, such as infection, fever, vomiting, and diarrhea. Impaired function and family caregiver knowledge did not moderate the effects of these side effects on unplanned hospital admissions.

**Conclusions:** Findings suggest that the presence of impaired function and side effects, such as infection, fever, vomiting, and diarrhea, predict unplanned hospital admissions in older adults with cancer during the active treatment phase. Side effects may or may not be related to chemotherapy and may be related to preexisting comorbidities.

**Implications for Nursing:** Nurses can conduct targeted assessments to identify older adults and their family caregivers who will need additional follow-up and support during the cancer treatment trajectory. Information gained from these assessments will assist nurses to provide practical and tailored strategies to reduce the risk for unplanned admissions.

Older adults comprise the majority of patients with cancer (63%) and are the recipients of the greatest amount of chemotherapy (American Cancer Society, 2016; Lichtman et al., 2007; Siegel, Ma, & Jemal, 2014). However, older adults with cancer experience more chemotherapy side effects (Balducci, 2007; Flores & Ershler, 2010; Hurria, 2008; Hurria & Lichtman, 2007; Jakobsen & Herrstedt, 2009; Lichtman et al., 2007) because of the higher prevalence of comorbidities and poorer physical and mental health and well-being compared to those without cancer (Smith et al., 2008). The effect of aging and comorbidities on chemotherapy side effects suggests that those factors may increase the risk for unplanned hospital admissions in older adults with cancer.

Most cancer treatment is delivered in outpatient settings; however, hospitalizations account for more than 50% of Medicare costs during the first year after a cancer diagnosis (Anhang Price et al., 2012; Jencks, Williams, & Coleman, 2009; Yabroff et al., 2008). This is concerning because these hospitalizations are most likely unplanned (Bottle et al., 2012), and Medicare is reducing payment reimbursement to hospitals with high readmission rates (Centers for Medicare and Medicaid Services, 2016). In addition, unplanned hospital admissions may result in hospital-acquired infections (Magill et al., 2014), which may interrupt scheduled cancer treatment and affect survivorship and quality of life.

A variety of physiologic and psychosocial factors, such as fever and dehydration, have been reported to be associated with unplanned hospital admissions (Bowles, McCorkle, & Nuamah, 2008; Flood et al., 2006; Grant, Cooke, Bhatia, & Forman, 2005; Manzano, Luo, Elting, George, & Suarez-Almazor, 2014; Weaver et al., 2006). Few studies address the factors that predict unplanned hospital admissions in older adults with cancer.

## Literature Review

A paucity of research examines risk for an unplanned hospital admission during cancer treatment, particularly in the older adult population. Four studies have identified physiologic, psychological, and social factors related to unplanned hospital admission in older adults during treatment for cancer.

Preexisting illness characteristics identified included being aged 70 years or older (Bowles et al., 2008; Manzano et al., 2014); being diagnosed with gastrointestinal (Flood et al., 2006; Manzano et al., 2014; Weaver et al., 2006), lung, hematologic, or breast cancer (Flood et al., 2006); and being diagnosed with late-stage disease (Bowles et al., 2008). Comorbidities, such as diabetes, chronic pulmonary disease, and congestive heart failure, were also identified (Manzano et al., 2014).

Functional impairments related to mobility have been identified as a predictor of unplanned hospital admission (Bowles et al., 2008). Limitations or dependence in activities of daily living (ADLs) or instrumental ADLs (IADLs) are also related to unplanned hospital admission (Flood et al., 2006).

Cancer- or treatment-related symptoms have been identified as reasons for an unplanned hospital admission in older adults with cancer. The most common reasons for an unplanned hospital admission include gastrointestinal effects (e.g., nausea, vomiting, diarrhea, dehydration), weight loss, infection (manifested as fever or pneumonia), cardiac dysfunction (hypo- or hypertension), other organ dysfunction

(renal failure, hypoxia), and pain (Bowles et al., 2008; Flood et al., 2006; Manzano et al., 2014; Weaver et al., 2006). Receiving adjuvant therapy (chemotherapy or radiation therapy) was also identified as a predictor of unplanned hospital admissions (Bowles et al., 2008).

Flood et al. (2006) examined characteristics of older adults with cancer admitted for an acute illness and found that cognitive impairments, such as dementia or delirium, and depressive symptoms were factors related to those who experienced an unplanned hospital admission. Bowles, Naylor, and Foust (2002) did not specifically measure cognitive impairment, but they identified having “trouble concentrating” as a predictor for unplanned hospital admission in older adults with cancer.

Financial concerns related to unplanned hospital admissions were living at the poverty level and being a recipient of Medicaid (Manzano et al., 2014). Family support concerns related to unplanned hospital admission were identified as living alone and caregiver difficulty.

The limited number of studies examining factors related to unplanned hospital admission in older adults with cancer does not provide a comprehensive overview of who is most at risk for an unplanned hospital admission during cancer treatment. The studies varied in sample size and characteristics, setting, cancer diagnosis, measures, and time frame for data collection about unplanned hospital admissions. These variations make it difficult to generalize findings. However, the physiologic, psychological, and social factors identified in these studies are similar to those described in non-cancer populations of older adults who have unplanned hospital admissions. Further study and investigation of factors related to unplanned hospital admission in the population of older adults with cancer are warranted. Findings may assist with identifying high-risk patients early in the treatment trajectory and offering appropriate support to reduce the risk of unplanned hospital admissions. With the number of older adults being diagnosed and treated for cancer increasing (Extermann et al., 2012), researchers must explore the factors associated with unplanned hospital admissions in this population.

The purpose of this study is to explore factors related to unplanned hospital admissions of older adults with cancer. The specific research questions were the following:

- What are the factors that predict unplanned hospital admissions in older adults with cancer during cancer treatment?
- Are there moderating relationships between impaired function, side effects, family caregiver knowledge, family caregiver availability, and unplanned hospital admissions?

## Conceptual Framework

The conceptual model of unplanned hospital admissions in older adults with cancer used to frame this study and guide study analyses is shown in Figure 1. This model was intuitively developed and integrates physiologic, psychological, and social factors identified in the literature (Bowles et al., 2008; Flood et al., 2006; Grant et al., 2005; Manzano et al., 2014; Weaver et al., 2006) and is informed by the first author's clinical experience related to unplanned hospital admissions in older adults with cancer. The concepts within this model are characteristics of preexisting illness (age, cancer type and stage, and comorbidity), impaired function (mobility, continence, depression, and memory), side effects (fever, vomiting, and diarrhea), and family caregivers (availability and knowledge). According to this model, an unplanned hospital admission is defined as an unexpected admission to the hospital for acute care services during cancer treatment. The authors hypothesized that unplanned hospital admissions in older adults with cancer are directly related to specific cancer treatment–related side effects, which may be directly or indirectly related to various patient and family caregiver factors.

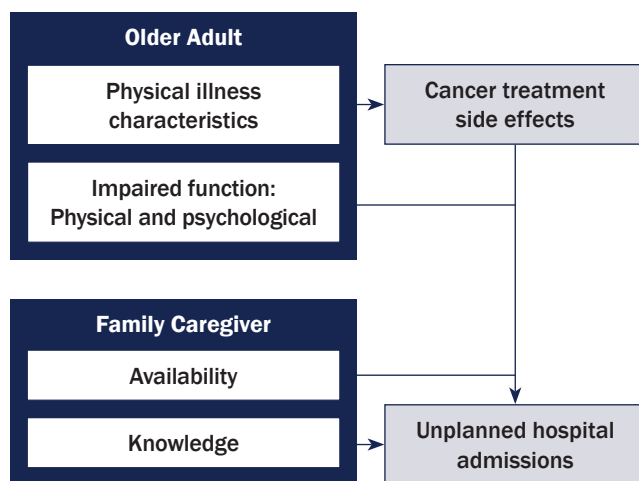
This model maintains that the factors related to unplanned hospital admissions are multidimensional, objective, and dynamic, as well as interactive with each other. One factor may influence another, and the presence or absence of these factors during treatment may directly or indirectly result in unplanned hospital admissions.

## Methods

### Design, Setting, and Sample

A prospective longitudinal design with retrospective chart review was used to follow a convenience sample of patient–caregiver dyads for four months. After enrollment, older adult patients were followed for four months during outpatient chemotherapy treatment to collect data about side effect experience and any unplanned hospital admissions. In addition, a retrospective chart review was conducted to collect pre-enrollment data regarding the presence of any comorbidities and level of function.

This study was conducted at the adult oncology outpatient infusion centers and inpatient units at Orlando Regional Medical Center, a community hospital cancer center in Florida. Participants were recruited and enrolled at the first scheduled outpatient chemotherapy treatment appointment. Recruitment and enrollment of participants occurred during a six-month period, from June to December 2012. A power analysis was performed to determine sample size. As-



**FIGURE 1. Conceptual Model of Unplanned Hospital Admissions in Older Adults With Cancer**

suming a power of 0.8 and an alpha of 0.05, a sample of 120 dyads was needed to detect a medium effect size ( $d = 0.5$ ) in analyses addressing the research questions.

Inclusion criteria were older adults who were about to receive first scheduled therapy, were aged 65 years or older, had the ability to speak English, had a diagnosis of cancer or cancer recurrence within the past two to six months, had the ability to identify a caregiver, and were willing to participate. Older adults were excluded if they had a documented life expectancy of less than the duration of the study or had no identified family caregiver. Caregivers were eligible if they were aged 18 years or older, identified by the older adult as a caregiver, and willing to participate.

### Procedure

The study was approved by the institutional review boards at the Orlando Regional Medical Center and the University of Central Florida in Orlando. All patients were screened for inclusion criteria and identified by the principal investigator (PI) from the hospital's electronic scheduling system one week prior to their first planned chemotherapy appointment. Eligible patients were approached in the waiting room and were asked to identify a family caregiver who was present. The older adult and their identified family caregiver were invited to a private area in the hospital's treatment center to learn about the study. After the study was explained, informed consent was obtained from the older adult. Waiver of consent was approved for the family caregiver by the hospital's institutional review board. Data were collected at two time points. At the time of enrollment (time 1), patient demographic data were collected from the electronic medical record. Caregiver demographic data and side effect knowledge was collected by interview using the Nurse Assessment of Family Caregiver

Knowledge and Action Tool (NAFCKAT). At the end of the four-month study period (time 2), data were collected regarding patient side effects (presence and type) and any unplanned hospital admission occurrences by reviewing each patient's electronic medical record.

## Instruments

The PI-developed Patient Medical Record Data Collection Form was used to collect data from the electronic medical record. This included patient demographics (i.e., age, gender, race/ethnicity, education level, and employment status), patient illness characteristics (i.e., cancer diagnosis and stage, number and type of chemotherapy agents, and number of prescrip-

tion medications), number and type of comorbidities, presence of any impaired function (e.g., mobility, incontinence, depression, cognitive difficulties), and unplanned hospital admissions.

The PI obtained comorbidity data from the participant's electronic medical record using the Cumulative Illness Rating Scale–Geriatric (CIRS-G). The 17-item tool evaluates the presence and severity of comorbidities within 13 organ systems. For each organ system, severity is scored as level 0 (no problem) to 4 (severe). The CIRS-G is a well-defined and validated scale for measuring comorbidity in older adults with cancer (Extermann, Overcash, Lyman, Parr, & Balducci, 1998). The CIRS-G has good inter-rater (Kendall's  $W > 0.82$ ) reliability. The intraclass correlation coefficient was 0.78 (95% lower bound estimate [LBE], 0.55) for the total score and 0.81 (95% LBE, 0.61) for subscale scores in outpatients (Miller et al., 1992).

The PI-developed caregiver demographic sheet was used to collect caregiver demographic data (i.e. age, gender, race/ethnicity, education level, employment status, relationship to patient, and previous caregiving experience) and availability to patient. Availability was assessed in terms of living with the patient or separately. If living separately, the distance from the patient (e.g., minutes away) and frequency of contacts per day or week were recorded.

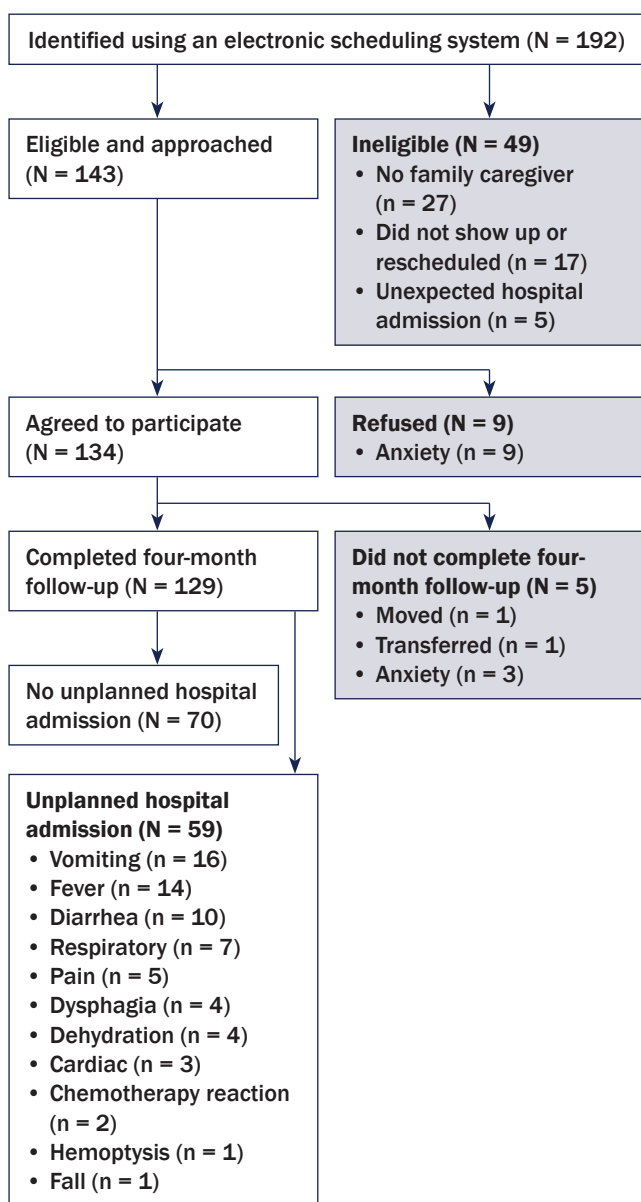
The PI-developed NAFCKAT was used to assess the family caregiver's knowledge of two side effects commonly linked to unplanned hospitalizations: fever and dehydration (Geddie, 2015). It consists of 11 short, open-ended questions that assess caregiver knowledge and a plan of action for fever and dehydration. Responses to each item are scored on a three-point scale (−1 = worst answer, 0 = do not know, 1 = best answer). The measure can be scored by summing item responses for a given individual to create a total score, with a possible range of −11 to 11. Fever and dehydration subscale scores can also be calculated separately from the total score. Initial psychometric testing supports reliability (inter-rater reliability = 97.6%) and validity (Geddie, 2015). The NAFCKAT was designed for administration in a scripted, one-on-one interview with the patient-identified family caregiver. Any postinterview family caregiver questions for additional information were recorded on the back of the form. If the interview stimulated questions about management of fever or dehydration, the PI directed the family caregiver to the patient's oncology healthcare team for answers to their questions to maintain consistency with the usual processes of care and to avoid intervention bias.

## Statistical Analysis

SPSS®, version 21, was used to conduct all analyses. Descriptive statistics (frequencies, means, medians,

**FIGURE 2. Sample Selection and Enrollment Process**

Note. Some patients experienced more than one symptom at hospital admission.



**TABLE 1. Patient and Caregiver Sample Characteristics by Group**

Variable	Unplanned Hospital Admission (N = 59)						No Hospital Admission (N = 70)						Total (N = 129)					
	Patient			Caregiver			Patient			Caregiver			Patient			Caregiver		
	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range	$\bar{X}$	SD	Range
Age (years)	72.56	5.84	65–88	62.07	14.11	18–84	71.01	5.22	65–87	60.59	12.1	27–85	71.72	5.54	65–88	61.26	13.03	18–85
<b>Variable</b>	<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>		<b>n</b>	<b>%</b>	
<b>Gender</b>																		
Male	27	46		21	36		32	46		19	27		59	46		40	31	
Female	32	54		38	64		38	54		51	73		70	54		89	69	
<b>Marital status</b>																		
Married	42	71		35	59		48	69		42	60		90	70		77	60	
Unmarried	17	29		24	41		22	31		28	40		39	30		52	40	
<b>Ethnicity</b>																		
Caucasian	45	76		45	76		53	76		52	74		98	76		97	75	
Hispanic	10	17		9	15		8	11		9	13		18	14		18	14	
African American	3	5		3	5		9	13		8	11		12	8		11	9	
Asian	1	2		2	3		-	-		1	1		1	1		3	2	
<b>Relationship status</b>																		
Spouse or partner	42	71		35	59		48	69		42	60		90	70		77	60	
Other	17	29		24	41		22	31		28	40		39	30		52	40	
<b>Employed</b>																		
Yes	6	10		21	36		7	10		26	37		13	10		47	36	
No	53	90		38	64		63	90		44	63		116	90		82	64	
<b>Living with older adult</b>																		
Yes	-	-		45	76		-	-		55	79		-	-		100	78	
No	-	-		14	24		-	-		15	21		-	-		29	22	

Note. Because of rounding, percentages may not total 100.

and percentage) were used to examine older adult and family caregiver demographic characteristics. Skew and kurtosis indexes suggested that all continuous variables were normally distributed except for family caregiver subcategories of availability (distance and contacts). Transformation did not correct the skew, so the availability variable was changed to a categorical/discrete variable of "lives with" (yes or no).

Prior to multivariate analysis, some of the nominal variables were combined or had response categories collapsed to accommodate low-frequency response categories. For example, older adult physical and psychological impaired functioning were condensed to "impaired function," the side effects of fever and infection were combined to create the variable "fever and infection," and vomiting and diarrhea were combined to create the variable "vomiting and diarrhea."

A series of t tests for independent groups for continuous variables and chi-square tests for categorical variables were used to determine whether any differences existed between the unplanned hospital admission group versus the no admission group. Pearson correlations were used to examine the relationship between patient variables (impaired function, fever and infection, vomiting and diarrhea), family caregiver variables (NAFCKAT

score, availability), and unplanned hospital admissions. Then, univariate analyses (chi-square likelihood ratio tests) were used to identify variables for multivariate logistic regression. Finally, a series of multivariate logistic regressions were conducted with unplanned hospital admission as the dependent variable. Multicollinearity was controlled with mean centering of continuous variables involved in interaction terms and only entering respective tolerance levels when greater than 0.4. All statistical tests were two-sided and considered statistically significant if *p* values were less than 0.05.

## Results

### Sample Characteristics

A total of 143 dyads of patients and their family caregivers were approached to participate in the study from June to December 2012. Nine dyads declined because of fatigue or pain, and five were lost to follow-up, resulting in a study sample of 129 older adults with cancer and their family caregivers (see Figure 2). The average age of the older adult was 71.72 years (*SD* = 5.54). Gender was well distributed between males and females. Most older adults were married, Caucasian, and retired (see Table 1). Fifty-nine (46%) older adults experienced an unplanned hospital admission. Most admissions occurred in the first month after their initial chemotherapy treatment (*n* = 28, 48%). No significant differences were found between groups (no admission versus admission) of older adults for demographic characteristics.

The majority of family caregivers were female and Caucasian, with a mean age of 61.26 years (*SD* = 13.03). The typical caregiver was college educated (61%), unemployed or retired (64%), lived with the older adult (78%), and identified him- or herself as a spouse or partner (58%). Many had general caregiving experience (57%) and demonstrated adequate knowledge and a plan of action to address symptoms of fever and dehydration, as indicated by an overall NAFCKAT mean score of 9.22 (*SD* = 2.13). The mean NAFCKAT score for the unplanned hospital admission group was 9.58 (*SD* = 1.8), and the mean score for the no hospital admission group was 8.93 (*SD* = 2.34). No significant differences were found between family caregivers with respect to a family member experiencing or not experiencing an unplanned hospital admission (*p* ≥ 0.2).

Table 2 outlines the older adult cancer and illness characteristics for the whole sample and by group (no admission versus admission). The majority of participants had no functional impairments; however, participants reported having three or more comorbidities and using five or more prescriptions. The cancer diagnosis included solid tumors and lym-

phoma, with staging for all cancer diagnoses ranging from I–IV. Most participants received two or more chemotherapy drugs, and alkylating agents were most prescribed. Those who experienced an unplanned hospital admission had more functional impairments and endocrine comorbidities than those who were not admitted. Overall, CIRS-G scores were a mean of 3.55 (*SD* = 2.32). Patients with unplanned hospital admission had a mean score of 3.75 (*SD* = 2.31), and patients with no hospital admission had a mean score of 3.39 (*SD* = 2.34) (*p* = 0.371).

### Correlates of Impaired Function, Side Effects, and Unplanned Hospital Admissions

Table 3 lists the side effects of the older adults for the whole sample and by group (no admission versus admission). Side effects were more common in participants in the unplanned hospital admission group compared to the no admission group.

Initially, family caregiver knowledge (NAFCKAT score); family caregiver availability (lives with); older adult impaired function; older adult fever and infection; and older adult vomiting and diarrhea were to be used in the regression analysis as predictors and moderators. However, family caregiver knowledge and availability were not significantly correlated with unplanned hospital admissions (*r* = 0.152, *p* > 0.05 and *r* = -0.027, *p* > 0.05, respectively) and, as such, were not included in the final logistic regression analysis. Impaired function and side effects of fever and infection and vomiting and diarrhea were significantly correlated with unplanned hospital admissions (*r* = 0.212, *p* < 0.05; *r* = 0.219, *p* < 0.05; and *r* = 0.263, *p* < 0.01, respectively).

### Impaired Function and Side Effects as Predictors of Unplanned Hospital Admissions

A logistic regression analysis was conducted to explain unplanned hospital admissions using the variables of impaired function, fever and infection, and vomiting and diarrhea as predictors. No evidence of multicollinearity (tolerance > 0.4) was found for any predictor variables, and model fit was supported by model chi square, Hosmer-Lemeshow, and -2loglikelihood statistics. Results indicated that an unplanned hospital admission was greater than two times more likely to occur in older adults with impaired function (odds ratio [OR] = 2.416, 95% confidence interval [CI] [1.216, 5.738]), greater than three times more likely in older adults with fever and infection (OR = 3.705, 95% CI [1.387, 9.893]), and greater than four times more likely in older adults with vomiting and diarrhea (OR = 4.237, 95% CI [1.487, 12.073]) (see Table 4).

A logistic regression model was tested to investigate whether the impact of each side effect (fever and infection and vomiting and diarrhea) and unplanned

hospital admission was moderated by impaired function or family caregiver knowledge (NAFCKAT score). However, no evidence of moderation existed for impaired function or family caregiver knowledge ( $p > 0.4$ ) (see Table 5).

## Discussion

Forty-seven percent of older adults in this study experienced an unplanned hospital admission. Although this number is high, it falls within the range (8%–59%) reported for older adults in the post-cancer treatment phase (Bowles et al., 2008; Manzano et al., 2014; Weaver et al., 2006). Functional impairment and two key chemotherapy side effects (fever and infection and vomiting and diarrhea) predicted unplanned hospital admissions during chemotherapy treatment. Contrary to current literature and the conceptual model, other demographic and illness characteristics and family caregiver factors were not significant predictors. For example, other studies have shown that being older, non-Caucasian, and having less family support predicted unplanned hospital admissions (Bowles et al., 2008; Manzano et al., 2014; Weaver et al., 2006). However, the current study sample was predominantly Caucasian and focused on patients with support. Therefore, this sample represents a “best case” group of older adults with respect to vulnerability, but about half of the patients still experienced an unplanned hospital admission.

More advanced stage cancer, cardiac and/or respiratory comorbidity, and a higher CIRS-G score were not more likely to exist in the older adults in this sample who experienced an unplanned hospital admission. Although additional research is needed to replicate these findings

**TABLE 2. Preexisting Illness Characteristics in Patients by Group**

Characteristic	Unplanned Hospital Admission				Overall (N = 129)		p
	Yes (N = 59)		No (N = 70)		n	%	
	n	%	n	%	n	%	
<b>Cancer diagnosis</b>							
Lung	16	27	17	24	33	26	0.71
Gastrointestinal	9	15	14	20	23	18	0.44
Head and neck	12	20	5	7	17	13	0.09
Lymphoma	6	10	8	11	14	11	0.82
Gynecologic	2	3	8	11	10	8	0.09
Breast	4	7	6	9	10	8	0.51
Other	10	17	12	17	22	17	0.4
<b>Cancer stage</b>							0.18
I	3	5	10	14	13	10	0.14
II	11	19	11	16	22	17	0.66
III	15	25	14	20	29	22	0.46
IV	24	41	33	47	57	44	0.46
Unknown	6	10	2	3	8	6	
<b>Number of chemotherapy drugs</b>							0.033
1	24	41	15	21	39	30	
2	22	37	43	61	65	50	
3	9	15	10	14	19	15	
4	4	7	2	3	6	5	
<b>Type of chemotherapy<sup>a</sup></b>							
Antitumor antibiotics	1	2	–	–	1	1	0.457
Anthracyclines	6	10	6	9	12	9	0.975
Antimetabolites	19	32	18	26	37	29	0.545
Alkylating	37	63	55	79	92	71	0.047
Vinca alkaloid	11	19	11	16	22	17	0.659
Taxane	21	36	25	36	46	36	0.989
Miscellaneous	2	3	2	3	4	3	1
Monoclonal antibody	15	25	22	31	37	29	0.453
<b>Impaired function</b>							0.016
Yes	29	49	21	30	51	40	
No	30	51	49	70	78	60	
<b>Comorbidity</b>							0.43
Yes	56	95	63	90	119	92	
No	3	5	7	10	10	8	
<b>Type of comorbidity<sup>a</sup></b>							
Cardiac	48	81	58	83	106	82	0.824
Respiratory	11	19	14	20	25	19	0.846
Gastrointestinal	18	31	14	20	32	25	0.169
Musculoskeletal	18	31	17	24	35	27	0.428
Endocrine	26	44	19	27	45	35	0.045
Other	25	42	19	27	44	34	0.069
<b>Side effects or symptoms<sup>a</sup></b>							
None	–	–	29	23	29	23	0.000
Fever and infection	17	29	8	11	25	19	0.013
Vomiting and diarrhea	17	29	6	9	23	18	0.003
Nausea	8	14	4	6	12	9	0.142
Dysphagia	7	12	1	1	8	6	0.023
Dehydration	13	10	–	–	13	10	0.000
Pain	5	9	13	19	18	14	0.099
Cardiac	6	10	1	1	7	5	0.047
Respiratory	9	15	8	11	17	13	0.522
Miscellaneous	8	14	15	21	23	18	0.245

<sup>a</sup> Patients could choose more than one option.

Note. Because of rounding, percentages may not total 100.

**TABLE 3. Correlations of Predictors With UHAs**

Variable	UHAs	Impaired Function	Fever and Infection	Vomiting and Diarrhea	NAFCKAT Score	Availability (Lives With Caregiver)
UHAs	-	0.212* 0.016	0.219* 0.013	0.263** 0.003	0.152 0.085	-0.027 0.757
Impaired function	-	-	-0.076 0.395	0.079 0.374	0.146 0.098	0.056 0.531
Fever and infection	-	-	-	0.028 0.754	0.105 0.235	0.076 0.391
Vomiting and diarrhea	-	-	-	-	0.171 0.053	-0.137 0.121
NAFCKAT score	-	-	-	-	-	0.066 0.458

\*  $p < 0.05$ ; \*\*  $p < 0.01$

NAFCKAT—Nurse Assessment of Family Caregiver Knowledge and Action Tool; UHA—unplanned hospital admission

in similar and different samples of older adults with cancer, this pattern of results suggests that cancer stage and comorbidity may not be good indicators for tolerance to cancer treatment–related side effects in older adults.

### Impaired Function

Twenty-nine older adults in this study who experienced an unplanned hospital admission had one or more documented preexisting functional impairments. This is similar to findings by Bowles et al. (2008), who reported mobility impairment (59%) as a predictor for older adults with cancer who experienced poor discharge outcomes after cancer surgery (i.e., unplanned hospital admission). In general, functional impairments have been reported to be as high as 42% in older adults in the general population (Federal Interagency Forum on Agency-Related Statistics, 2012) and 48% in older adults with cancer (Flood et al., 2006; Koroukian, Murray, & Madigan, 2006). With an expected growth of cancer incidence and an aging population of patients with cancer (Siegel et al., 2014), impaired function and other health-related concerns need to be identified during cancer treatment planning and follow-up to provide additional self-management support. Planning care to support this population during cancer treatment will be critical for reducing and/or preventing unwanted outcomes, such as unplanned hospital admissions.

### Side Effects

The presence of fever and infection or vomiting and diarrhea also predicted unplanned hospital admissions in this study. Other studies of unplanned hospital admissions in older adults with cancer have found

similar symptoms as predictors (Manzano et al., 2014; Weaver et al., 2006). However, the older adults in these prior studies were examined after cancer surgery and were one to two years postdiagnosis. None or only a small portion of their samples (7%–22%) had received chemotherapy at some time during the study period. The symptoms reported in prior studies may have been related to other causes, such as complications from the cancer diagnosis (e.g., intestinal obstruction from tumor could cause nausea or vomiting), comorbid conditions, and other medications. The proportion of those experiencing an unplanned hospital admission in these studies were less than or similar to the current study, but the most frequent symptoms were related to infection (e.g., pneumonia) or gastrointestinal effects (e.g., nausea, dehydration). The current study argues for the generalizability of the findings that chemotherapy side effects of fever and infection and vomiting and diarrhea put older adults with cancer at risk for an unplanned hospital admission because previous studies had similar overall sample demographics and symptoms with unplanned hospital admissions.

A surprising finding in the current study was that older adults in the unplanned hospital admission group, who experienced more chemotherapy-related side effects, had fewer multichemotherapy drug treatments and fewer alkylating-type chemotherapy drugs than older adults in the group who were not admitted. Treatment with single-drug chemotherapy should be more well tolerated than multidrug treatment because the side effect profiles are less varied and overlapping (De Vita, Lawrence, Rosenberg, & DePinho, 2011). Myelosuppressive and gastrointestinal chemotherapy-related side effects are also expected to be less pronounced in those who



received fewer alkylating agents (Chabner & Longo, 2011). Older adults in this study who received multi-chemotherapy drug treatments and alkylating agents may have been less at risk for unplanned hospital admissions because their doses were reduced or stopped because of a lack of tolerance. However, this finding argues for the importance of the side effects of fever and infection and vomiting and diarrhea over the particular chemotherapy regimen. It suggests that older adults with cancer may experience chemotherapy-related side effects regardless of the number and type of chemotherapy drugs received.

### Strengths and Limitations

This study had several strengths and limitations. The study was conducted at one cancer center, which is considered a limitation. However, the findings from this study may be generalizable to other settings and parts of the country. The demographic, illness characteristics, and functional impairments found in this sample from the southeastern part of the United States were similar to those in other studies of older adults with cancer located in other parts of the country, particularly the northeastern and southwestern United States (Bowles et al., 2008; Manzano et al., 2014; Weaver et al., 2006). In addition, patient data collected for this study were obtained from the hospital's electronic medical record. No data were missing, and all data were easily located in the standard documentation, which is a strength of the study.

In terms of limitations, the presence of functional impairment was limited to mobility (use of assistive devices) and patients' report of incontinence, depressive symptoms, and memory problems. Other types or severity of impaired function (i.e., IADLs and ADLs) were not included or measured in this study. Therefore, the effect of functional impairment may have been underestimated in the analyses. Regardless, this study demonstrated that functional impairments identified as part of standard documentation in the medical record were predictive of unplanned hospital admissions.

In addition, the number of unplanned hospital admissions was recorded only if documented in the medical record. However, it is unlikely that unplanned hospital admissions in this study occurred at other hospital facilities. Patients with cancer tend to seek oncology care services, including emergent care, at the facility where their oncology team is located. Of the 59 older adults who experienced an unplanned hospital admission in this study, only five patients were admitted to other hospital sites outside of this research site setting, which was documented in the medical record.

Lastly, the NAFCKAT is a newly developed tool and only measured knowledge and plan of action for specific chemotherapy side effects associated with unplanned hospital admissions. The impact of other factors, such as family caregiver self-efficacy, cognitive impairment, depression, stress, and burden, on unplanned hospital admissions is not known. Future studies could investigate those factors.

### Implications for Practice and Research

The findings in this study have significant implications for oncology nursing practice and research. Oncology nurses can use information already collected as part of routine care to identify older adults receiving chemotherapy who are at high risk for unplanned admission. Innovative, cost-saving nursing interventions that can enhance quality of life can be developed and targeted to this patient cohort.

A significant number of older adults in this study experienced an unplanned hospital admission in the first and second month of chemotherapy treatment. Nurses should consider scheduling weekly follow-up telephone calls for older adults and/or their family caregivers after the start of treatment to assess for side effects and reinforce self-management strategies to reduce or prevent the risk for an unplanned hospital admission.

**TABLE 4. Logistic Regression: Basic Model of Predictors**

Factor	$\beta$	Wald	p	OR	95% CI
Impaired function	0.971	6.02	0.014	2.641	[1.216, 5.738]
Fever and infection	1.31	6.829	0.009	3.705	[1.387, 9.893]
Vomiting and diarrhea	1.444	7.303	0.007	4.237	[1.487, 12.073]
Impaired function	1.014	6.953	0.008	2.757	[1.297, 5.857]
Fever and infection	1.303	0.704	0.008	3.68	[1.406, 9.637]
Impaired function	0.855	5.032	0.025	2.351	[1.114, 4.961]
Vomiting and diarrhea	1.436	7.51	0.006	4.202	[1.505, 11.734]

CI—confidence interval; OR—odds ratio

**TABLE 5. Logistic Regression: Moderation Model of Main Effects and Interaction Effects**

Factor	$\beta$	Wald	p	OR	95% CI
Impaired function	1.104	7.046	0.008	3.018	[1.335, 6.82]
Fever and infection	1.477	6.485	0.001	4.38	[1.405, 13.65]
Impaired function on fever and infection	-0.612	0.341	0.559	0.542	[0.07, 4.226]
Impaired function	1.034	6.184	0.013	2.811	[1.245, 6.348]
Vomiting and diarrhea	1.932	7.228	0.007	6.9	[1.688, 28.21]
Impaired function on vomiting and diarrhea	-1.151	1.233	0.267	0.316	[0.041, 2.414]
NAFCKAT score	0.183	3.345	0.067	1.2	[0.987, 1.46]
Fever and infection	1.227	5.879	0.015	3.411	[1.265, 9.195]
NAFKCAT on fever and infection	-0.334	1.494	0.222	0.716	[0.419, 1.223]
NAFCKAT score	0.091	0.094	0.332	1.096	[0.911, 1.318]
Vomiting and diarrhea	1.272	0.545	0.02	3.568	[1.227, 10.375]
NAFKCAT on vomiting and diarrhea	0.2	0.284	0.48	1.222	[0.7, 2.132]

CI—confidence interval; NAFCKAT—Nurse Assessment of Family Caregiver Knowledge and Action Tool; OR—odds ratio

Several areas are recommended for future research. The findings from the current study show that pre-existing impaired functioning may be a risk factor, but impaired functioning can also develop in older adults as a function of treatment or changes in other comorbidities. Future studies should assess for the presence of impaired function at intervals during the entire treatment time period to understand its effects over time with respect to unplanned hospital admissions and as a function of chemotherapy treatment in this vulnerable population.

Future research using established geriatric tools and instruments should be considered to measure other types of impaired function, such as performance of IADLs and ADLs, to determine if they are predictive of unplanned hospital admissions during chemotherapy treatment. A sensitivity analysis could then be conducted to determine whether the cost in nursing staff time to complete these measures can be justified based on improved detection of individuals at risk for an unplanned admission as compared to the quality of

detection provided by the use of data collected as part of routine care, such as what was used in this study.

This study did not examine the use of urgent care or emergency departments by the study population. Future research could use periodic contact with the study participants during active treatment to identify the use of urgent care or emergency departments and their efficacy in preventing unplanned admissions.

The cost and benefit of providing additional support in the home setting during the cancer treatment phase is not known. Strategies that incorporate technology (e.g., telemedicine) and home visits by nurses and/or other healthcare personnel to monitor for side effects and effectiveness of self-management strategies should be explored.

Future research is needed to understand and measure how family caregivers manage chemotherapy-related side effects at home. Findings from this study highlight the need for teaching older adults and their caregivers strategies to manage treatment-related side effects of fever and infection and vomiting and diarrhea, so they can remain home during active cancer treatment.

More studies are needed to examine how psychosocial factors, such as self-efficacy, cognitive impairment, depression, and burden and stress of family caregivers, are associated with unplanned hospital admissions. Both qualitative and quantitative research approaches should be used for future studies to capture the older adults' and family members' perceptions and experiences, which may also influence self-care management of side effects.

## Conclusion

This study identified impaired function and the side effects of fever and infection and vomiting and

## Knowledge Translation

- Identification of risk factors before and during cancer treatment is important to reduce unplanned hospital admissions in older adults with cancer.
- Early and ongoing nurse monitoring for treatment-related side effects may improve self-management during treatment.
- Predictive factors associated with unplanned hospital admissions in older adults with cancer include functional impairment, infection and fever, and dehydration from vomiting and diarrhea.

diarrhea as predictors of unplanned hospital admissions in older adults with cancer. These findings show a need for future research regarding the further exploration of these and other factors that may predict unplanned hospital admissions in older adults with cancer. Quantitative and qualitative research approaches are needed to understand older adults' and family caregivers' experiences regarding side effect self-management during treatment. Findings from this study may assist with future development of effective strategies to identify older adults with cancer who need additional support to remain home during active cancer treatment. Oncology nurses can advocate for more targeted assessments of older adults' baseline and ongoing function, proactive monitoring, and providing ongoing and purposeful support in the home setting to reduce the occurrence of unplanned hospital admissions.

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