Oncology Nurse Navigator Effect on Emergency Department Visits and Hospital Admissions of Adults With Cancer Post–Outpatient Chemotherapy

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OBJECTIVES: To examine the effect of oncology nurse navigators (ONNs) on the number of emergency department (ED) visits and hospital admissions (HAs) of adults with cancer post–outpatient chemotherapy.

SAMPLE & SETTING: 1,370 patients with cancer between January 1, 2018, and December 31, 2019, in a comprehensive community cancer center in southern California.

METHODS & VARIABLES: A descriptive cross-sectional study was conducted using retrospective electronic health records. Primary analysis included bivariate and multiple linear regression to identify correlates of ED visits and HAs in terms of ONN involvement.

RESULTS: About 35% of patients had an ED visit or HA. Anemia, dehydration, and pain were common diagnoses. No significant differences were found in ED visits and HAs by ONN group. Medicare and chemotherapy administration location contributed to the likelihood of ED visits; nausea, pain, and pneumonia contributed to the likelihood of HAs.

IMPLICATIONS FOR NURSING: ED visits and HAs are not appropriate clinical outcomes to measure ONNs' efficacy. Further research is needed to understand the long-term fiscal and operational outcomes of ONNs.

KEYWORDS oncology nurse navigator; emergency department visits; hospital admissions

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Cancer is the second leading cause of death in the United States, with nearly 1.9 million new cancer cases diagnosed in 2022 (American Cancer Society [ACS], 2022). National direct costs for cancer-related health care were estimated to be $190.2 billion in 2015 and $208.9 billion in 2020 (adjusted for inflation), representing an increase of 10% because of the aging and growth of the U.S. population (National Cancer Institute, 2021). By 2030, it is projected that this cost will grow to $246 billion, an increase of 34% (ACS Cancer Action Network, 2020). The healthcare utilization of people with cancer is greater than that of the U.S. general population. People with cancer use more emergency department (ED) resources and have higher hospital admission rates than the general population (Yang et al., 2018). Inpatient hospitalizations, surgical procedures, and oral prescription drugs drive most of the direct costs for cancer-related health care, with nearly 43% paid by government programs (i.e., Medicare and Medicaid) (ACS Cancer Action Network, 2020).

In 2016, with the shift toward minimizing preventable hospitalizations and ED visits because of chemotherapy-related side effects, the Centers for Medicare and Medicaid Services (CMS, 2022a) introduced the Admissions and Emergency Department Visits for Patients Receiving Outpatient Chemotherapy measure (OP-35) to encourage institutions to improve the quality of outpatient cancer care, increase transparency, and provide information to the public. An ED visit or a hospitalization within 30 days of any outpatient chemotherapy treatment with any of the 10 potentially preventable diagnoses (anemia, dehydration, diarrhea,

emesis, fever, nausea, neutropenia, pain, pneumonia, or sepsis) and a cancer diagnosis qualifies for the reporting and prompting of CMS review and potential payment reduction (CMS, 2022a, 2022b).

Nurses perform a vital role in the coordination of complex care of individuals with cancer. Relatively new to the cancer care workforce, the oncology nurse navigator (ONN) role has been focused on delivering quality cancer care since its inception. Although many studies have supported the benefits of ONNs in cancer care—such as patient and staff experiences, financial navigation, education, and empowerment—a paucity of research exists to adequately identify standardized metrics for measuring ONN programs and effectiveness (Battaglia et al., 2011; Christensen & Cantril, 2020; Guadagnolo et al., 2011). As a result, the Academy of Oncology Nurse and Patient Navigators (2020) developed the Navigation Metrics Toolkit in collaboration with ACS. In addition, the effect of ONNs on prevention of ED visits and hospital admissions post–outpatient chemotherapy is unknown.

The purpose of this article is to examine the contribution of ONNs to healthcare utilization in the number of ED visits and hospital admissions of adults with cancer post–outpatient chemotherapy. Meleis et al.'s (2000) transition model informed the research questions and design. The model was used to identify variables of interest and to synthesize the conceptual framework, which guided the research process and analysis. In this conceptual framework, experiencing outpatient chemotherapy to treat cancer is the transition event. Conditions in this transition are influenced by the patient's sociodemographic characteristics and further shaped by the care site characteristics that can act as facilitators and inhibitors. The healthy transition experience can be observed through process and outcome indicators, such as unplanned ED visits and hospital admissions. A visualization of the research conceptual model is presented in Figure 1.

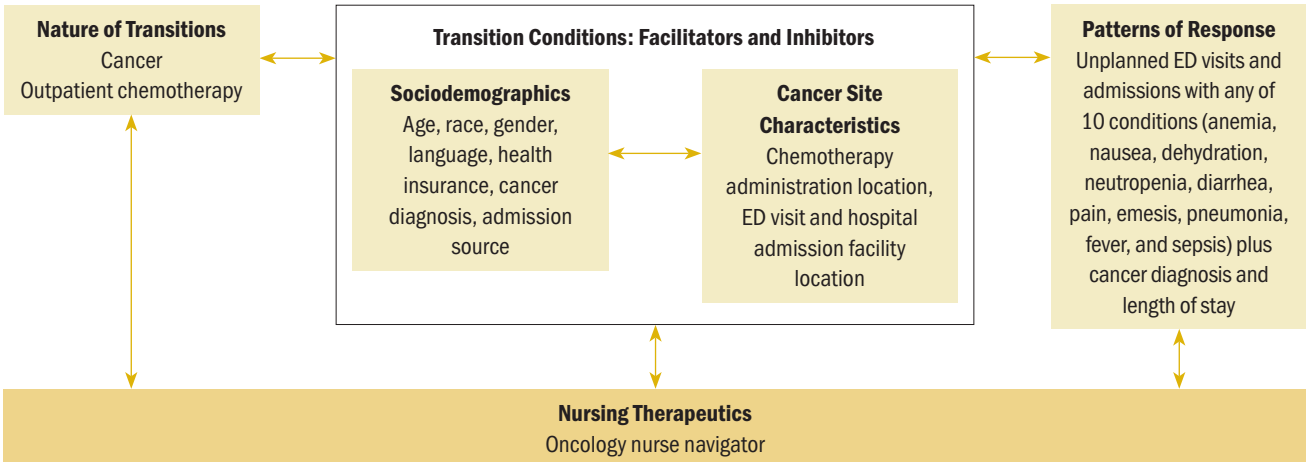
Methods

A retrospective descriptive cross-sectional study was conducted to examine the contribution of ONNs on healthcare utilization in the number of ED visits and hospital admissions of patients with cancer post–outpatient chemotherapy.

Sample and Setting

Data were obtained from the electronic health records of patients with cancer who received outpatient chemotherapy between January 1, 2018, and December 31, 2019, in a not-for-profit comprehensive community cancer center in an integrated healthcare system, Sharp HealthCare, in southern California. A convenience sample of 1,370 patients with a cancer diagnosis receiving chemotherapy in one of three participating outpatient infusion centers were included in the study. Patients with a diagnosis of leukemia, with a planned hospital admission (e.g., transplantation, maintenance chemotherapy), receiving chemotherapy to treat conditions other

FIGURE 1. Conceptual Framework: The Effect of the Oncology Nurse Navigator on ED Visits and Hospital Admissions of Adult Patients With Cancer Post–Outpatient Chemotherapy



ED—emergency department

TABLE 1. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population During the 2-Year Study Period

	Total (N = 1,370)		ONN (N = 867)		No ONN (N = 503)			
Characteristic	$\bar{X}$	**SD**	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**t**	**p**
Age (years)	62.55	13.35	61.35	13.13	64.61	13.49	4.39	< 0.001
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Gender							12.01	< 0.001
Female	818	60	548	67	270	33		
Male	552	40	319	58	233	42		
Race							27.6	< 0.001
American Indian or Alaska Native	5	1	4	80	1	20		
Asian	154	12	111	72	43	28		
Black or African American	63	5	37	59	26	41		
Hawaiian or Pacific Islander	14	1	13	93	1	7		
White	760	59	502	66	258	34		
Another race	288	22	152	53	136	47		
Primary language							42.36	< 0.001
English	1,190	88	790	66	400	34		
Spanish	82	6	25	31	57	69		
English and other[a]	70	5	40	57	30	43		
Another language[b]	15	1	9	60	6	40		
Medical insurance							60.49	< 0.001
Private	684	50	493	72	191	28		
Medicare	625	46	355	57	270	43		
Medi-Cal	61	4	19	31	42	69		
Cancer diagnosis							168.27	< 0.001
Breast	357	26	282	79	75	21		
Lymphoma	168	12	63	38	105	62		
Lung	154	11	91	59	63	41		
Colorectal	142	10	101	71	41	29		
Urologic	134	10	73	55	61	45		
Gynecologic	111	8	74	67	37	33		
Gastrointestinal (noncolorectal)	87	6	53	61	34	39		
Hematologic	66	5	12	18	54	82		
Other	151	12	118	78	33	22		
Visit type							4.04	0.132
Neither ED visit nor hospital admission	892	65	577	65	315	35		
Hospital admission	287	21	172	59	115	41		
ED visit	123	9	81	66	42	34		
Both ED visit and hospital admission	68	5	37	33	31	67		
Chemotherapy location							213.2	< 0.001
1	314	23	130	41	184	59		
2	161	12	48	30	113	70		
3	895	65	689	77	206	23		

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TABLE 1. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population During the 2-Year Study Period *(Continued)*

	Total (N = 1,370)		ONN (N = 867)		No ONN (N = 503)			
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
ED visit location (N = 191)							0.66	0.988
1	38	20	23	61	15	39		
2	77	41	48	62	29	38		
3	74	39	45	61	29	39		
4	1	1	1	100	–	–		
Hospital admission location (N = 355)[c]							18.47	< 0.001
1	58	16	26	49	32	52		
2	47	13	18	38	29	62		
3	248	70	164	66	84	34		
4	2	1	1	50	1	50		
Condition: anemia							7.62	0.007
No	1,117	82	726	65	391	35		
Yes	253	18	141	56	112	44		
Condition: dehydration							0.07	0.808
No	1,181	86	749	63	432	37		
Yes	189	14	118	62	71	38		
Condition: diarrhea							0.11	0.865
No	1,332	97	842	63	490	37		
Yes	38	3	25	66	13	34		
Condition: emesis							0.02	0.879
No	1,365	99	864	63	501	99		
Yes	5	1	3	60	2	40		
Condition: fever							0.94	0.348
No	1,288	94	811	63	477	37		
Yes	82	6	56	68	26	32		
Condition: nausea							< 0.01	0.998
No	1,321	96	836	63	485	37		
Yes	49	4	31	63	18	37		
Condition: neutropenia							0.07	0.816
No	1,286	94	815	63	471	37		
Yes	84	6	52	62	32	38		
Condition: pain							1.72	0.213
No	1,190	87	761	64	429	36		
Yes	180	13	106	59	74	41		
Condition: pneumonia							3.24	0.089
No	1,280	93	818	64	462	36		
Yes	90	7	49	54	41	46		
Condition: sepsis							1.36	0.266
No	1,255	92	800	64	455	36		

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TABLE 1. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population During the 2-Year Study Period *(Continued)*

	Total (N = 1,370)		ONN (N = 867)		No ONN (N = 503)			
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	χ^2	**p**
Condition: sepsis *(continued)*							1.36	0.266
Yes	115	8	67	58	48	42		

[a] Other included Arabic, Cambodian, Mandarin, Cantonese, Japanese, Korean, Laotian, Russian, Spanish, Tagalog, and Vietnamese.
[b] Another language included Arabic, Cantonese, Chinese, Hungarian, Persian, Polish, Russian, Spanish, and Tagalog.
[c] Hospital admission source includes acute care, inpatient, or ambulatory surgery.
ED—emergency department; ONN—oncology nurse navigator
Note. Fisher's exact test significance (2-sided) unless otherwise specified
Note. Missing data values were omitted from the table. Because of missing data, variable frequencies do not add up to the total sample size (N = 1,370) for every characteristic. Percentages represent valid percent values and exclude missing data.
Note. Because of rounding, percentages may not total 100.

than cancer, or receiving only oral chemotherapy were excluded from the study. Inclusion and exclusion criteria were rooted in OP-35 methodology. The study was developed using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies (von Elm et al., 2008).

Procedures and Measures

Data were extracted from the community cancer center's electronic health record. The CMS (2019) Chemotherapy Measure Data Dictionary was used to identify qualifying cancer diagnoses and exclusion criteria. Although the OP-35 only targets Medicare beneficiaries, this study included all insurance types.

Sociodemographic and clinical characteristics included age, gender, race, primary language, medical insurance status, medical insurance type (private, Medicare, or Medi-Cal), and cancer diagnosis (breast, lymphoma, lung, colorectal, urologic, gynecologic, gastrointestinal [noncolorectal], hematologic, and other). Care site characteristics included chemotherapy location, admission source, visit type (ED visit, hospital admission, neither, or both), facility locations, ONN involvement in care (yes or no), and OP-35–qualifying diagnoses (anemia, dehydration, diarrhea, emesis, fever, nausea, neutropenia, pain, pneumonia, and sepsis). Outcome variables included the number of ED visits and hospital admissions combined, the number of ED visits, the number of hospital admissions, and their respective length of stay (LOS). ED visits and hospital admissions were defined as one visit or more or admission within 30 days of any outpatient chemotherapy treatment with an OP-35–qualifying diagnosis either in the principal diagnosis or as a secondary diagnosis with a cancer diagnosis (Mathematica Policy Research, 2019).

Data Analysis

A priori sample size calculation projected a minimum sample size of 234 participants to detect a moderate effect size ($f^2 = 0.15$) using a two-tailed significance test with a power of 0.8, a significance level of 0.05, and as many as 23 independent variables (Cohen, 1988; Tabachnick & Fidell, 2013). A final sample size of 1,370 was considered sufficient to address study aims (Dunn, 1961). All statistical analyses were performed using IBM SPSS Statistics, version 26.0.

Descriptive statistics were calculated for all study variables, and data were examined for normality, missing values, and outliers. Bivariate associations were examined using the chi-square test of independence for categorical variables, and independent samples t test and correlations for continuous variables; test assumptions were evaluated. Nonparametric statistics were used when appropriate. Variables that were important in the literature review and those significant at $p < 0.05$ in the bivariate analysis were considered for entry into multiple linear regression analyses to identify factors that increase the odds of ED visits and hospital admissions within 30 days of any outpatient chemotherapy treatment for patients receiving care in one of three acute care hospitals in southern California. Factors evaluated included participants' sociodemographic and clinical characteristics and care site characteristics.

Each patient may have received more than one chemotherapy infusion and may have had multiple ED visits and hospital admissions during the study

period. The current analysis used the first chemotherapy visit, ED visit, and hospital admission to describe the sample. In addition, the average number of ED visits and hospital admissions was calculated for the two-year study period; presence or absence of OP-35–related conditions was evaluated for the entirety of the study period.

Ethical Considerations

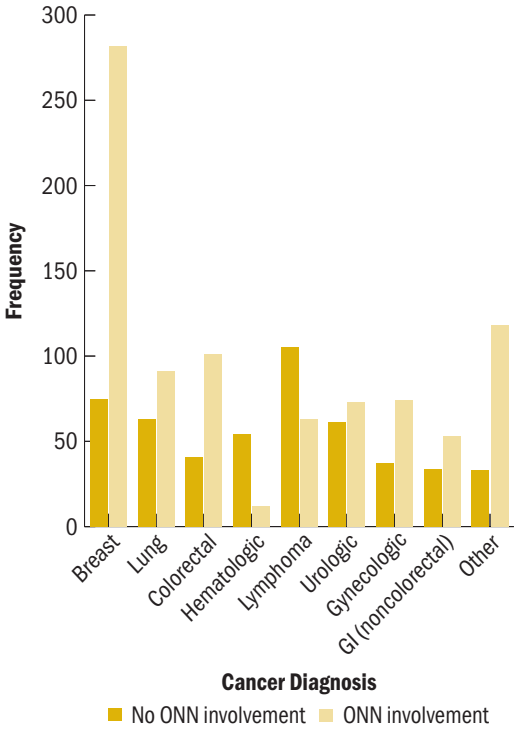
Prior to study initiation, in accordance with the U.S. Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46 and 21 CFR 50 and 56), all study procedures were reviewed and approved by the appropriate administrative and university institutional review boards.

Results

Sociodemographic and Clinical Characteristics

A total of 1,370 patients were included in the study, with an average age of 62.55 years (SD = 13.35). Most participants (n = 818, 60%) were female and self-identified as White (n = 760, 59%). During a two-year period, a total of 12,317 chemotherapy infusion visits, 230 ED visits, and 449 hospital admissions were reported. Half (n = 684, 50%) of the study sample had private insurance, and 625 (46%) were covered by Medicare. Nearly two-thirds (n = 867, 63%) had experienced at least one ONN assessment, and the most common types of cancer were breast cancer (n = 357, 26%), followed by lymphoma (n = 168, 12%) and lung cancer (n = 154, 11%) (see Table 1).

FIGURE 2. ONN Involvement in Patient Care Per Cancer Diagnosis



GI—gastrointestinal; ONN—oncology nurse navigator

Emergency Department Visits and Hospital Admissions Combined

About 65% (n = 892) of participants did not have an ED visit or a hospital admission during the two-year study period, 9% (n = 123) had an ED visit, 21% (n = 287) had a hospital admission, and 5% (n = 68) had both. Of the 35% (n = 478) of participants who had an ED visit or a hospital admission, 26% (n = 123) were admitted to the ED and discharged, and 74% (n = 355) were hospitalized at least once. Most patients did not experience OP-35–related conditions during the two-year study period (n = 891, 65%). Among participants who experienced at least one OP-35–related condition, anemia was the most common condition (n = 253, 18%) present during the study period, followed by dehydration (n = 189, 14%) and pain (n = 180, 13%). Participants had an average of 0.17 ED visits (SD = 0.46) and 0.33 hospital admissions (SD = 0.64) during the two-year study period.

Oncology Nurse Navigator Involvement

Chi-square test results showed that ONN involvement (having an ONN versus not having an ONN) was significantly associated with gender (Fisher's $\chi^2 = 12.01$, $p < 0.001$, phi = –0.094), race (Fisher's $\chi^2 = 27.6$, $p < 0.001$, Cramer's V = 0.147), primary language (Fisher's $\chi^2 = 42.36$, $p < 0.001$, Cramer's V = 0.18), Medical insurance (Fisher's $\chi^2 = 60.49$, $p < 0.001$, Cramer's V = 0.211), private versus public insurance (Fisher's $\chi^2 = 60.49$, $p < 0.001$, Cramer's V = –0.123), the location of hospital admission (Fisher's $\chi^2 = 18.47$, $p < 0.001$, Cramer's V = 0.228), and the OP-35–related condition of anemia (Fisher's $\chi^2 = 7.62$, $p = 0.007$, Cramer's V = –0.075); all associations had a small effect size (Cohen, 1988). By contrast, the type of cancer diagnosis (Fisher's $\chi^2 = 168.27$, $p < 0.001$, Cramer's V = 0.35) and the chemotherapy location (Fisher's $\chi^2 = 213.2$, $p < 0.001$, Cramer's V = 0.396) were significantly associated with ONN involvement, with a moderate effect size. The frequencies of participants' ONN involvement by cancer diagnosis are presented in Figure 2. Most participants with breast

TABLE 2. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of ED Visits During the 2-Year Study Period (N = 191)

Characteristic	n	$\bar{X}$ Rank	H	df	p
Race			1.58	3	0.663
Asian	13	80.65			
Black or African American	13	95.38			
White	103	91.4			
Another race	50	88.15			
Primary language			0.86	3	0.836
English	162	94.7			
Spanish	16	90.28			
English and other[a]	6	93.08			
Another language[b]	3	78			
Medical insurance			3.95	2	0.139
Private	93	90.94			
Medicare	91	101.38			
Medi-Cal	7	93.21			
Cancer diagnosis			4.48	5	0.483
Breast	39	90.28			
Lung	30	102.1			
Lymphoma	26	87.12			
Colorectal	20	98.5			
Urologic	16	104.09			
Other	60	97.53			
Chemotherapy location			7	2	0.03
1	43	99.72			
2	34	108.57			
3	114	90.85			
Visit type			9.51	1	0.002
ED and discharged	123	90.05			
Hospital (after ED or trauma, or direct admission)	68	106.76			
ED visit source			1.51	2	0.471
Home, physician referral	154	91.24			
Hospital[c]	26	90.77			
Skilled nursing facility, assisted living, home health	2	120.75			
ED visit location			1.19	3	0.756
1	38	99.68			
2	77	92.84			
3	74	96.33			
4	1	79.5			
Hospital admission source			1.34	2	0.512
ED	60	34.01			
Home, physician referral	7	40.07			
Hospital[c]	1	25			
Skilled nursing facility, assisted living, home health	1	20			

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TABLE 2. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of ED Visits During the 2-Year Study Period (N = 191) *(Continued)*

Characteristic	n	$\bar{X}$ Rank	H	df	p
Hospital admission location			2.13	2	0.345
1	10	38.75			
2	10	38.75			
3	48	32.73			
4	–	–			

Characteristic	n	$\bar{X}$ Rank	U	p
Gender			4,568.5	0.367
Female	116	94.12		
Male	75	98.91		
Medicare insurance			5,040	0.048
No	100	91.1		
Yes	91	101.38		
Oncology nurse navigator			4,053.5	0.292
Yes	118	93.85		
No	73	99.47		
Condition: anemia			4,898	0.16
No	100	92.52		
Yes	91	99.82		
Condition: dehydration			4,515	0.011
No	131	91.53		
Yes	60	105.75		
Condition: diarrhea			1,796	0.025
No	174	94.18		
Yes	17	114.65		
Condition: emesis			587.5	0.003
No	187	94.86		
Yes	4	149.38		
Condition: fever			2,895.5	0.057
No	159	93.79		
Yes	32	106.98		
Condition: nausea			2,153	0.171
No	168	94.68		
Yes	23	105.61		
Condition: neutropenia			2,538.5	0.006
No	166	93.21		
Yes	25	114.54		
Condition: pain			4,999.5	0.058
Yes	103	100.54		
No	88	90.69		

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TABLE 2. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of ED Visits During the 2-Year Study Period (N = 191) *(Continued)*

Characteristic	n	$\bar{X}$ Rank	U	p
Condition: pneumonia			2,283	0.089
No	167	94.33		
Yes	24	107.63		
Condition: sepsis			1,885	0.091
No	172	94.54		
Yes	19	109.21		

[a] Other included Arabic, Cambodian, Mandarin, Cantonese, Japanese, Korean, Laotian, Russian, Spanish, Tagalog, and Vietnamese.
[b] Another language included Arabic, Cantonese, Chinese, Hungarian, Persian, Polish, Russian, Spanish, and Tagalog.
[c] Hospital admission source includes acute care, inpatient, or ambulatory surgery.
df—degrees of freedom; ED—emergency department
Note. Missing data values were omitted from the table. Variable frequencies may not add up to the total sample size (N = 191) because of missing data.

cancer had an ONN, and most participants with hematologic cancer or lymphoma did not.

Independent samples t-test results also showed that age was significantly associated with ONN involvement ($t[1,368] = 4.39$, $p < 0.001$). Participants who had an ONN involved in their care were younger ($\bar{X}$ age = 61.35 years, SD = 13.13) than those who did not ($\bar{X}$ age = 64.61 years, SD = 13.49).

Emergency Department Visits

Nonparametric Kruskal–Wallis H tests, used because of the not-normally-distributed data, outliers, and unbalanced and small sample sizes, revealed that the mean ranks for the number of ED visits were significantly different for participants depending on the chemotherapy location ($\chi^2[2] = 7$, $p = 0.03$, $\varepsilon^2 = 0.037$), representing a small effect size. Pairwise comparisons were performed using the Dunn procedure with a Bonferroni correction for multiple comparisons (Dunn, 1961). The post-hoc analysis indicated statistically significant differences in the number of ED visits between chemotherapy location 2 ($\bar{X}$ rank = 108.57) and 3 ($\bar{X}$ rank = 90.85) (adjusted $p = 0.03$) (see Table 2). Nonparametric Mann–Whitney U tests also identified significant differences in the number of ED visits by participants, in terms of Medicare insurance ($U = 5{,}040$, $z = 1.98$, $p = 0.048$, $r = 0.143$) and the OP-35–related conditions of dehydration ($U = 4{,}515$, $z = 2.544$, $p = 0.011$, $r = 0.184$), diarrhea ($U = 1{,}796$, $z = 2.247$, $p = 0.025$, $r = 0.163$), emesis ($U = 587.5$, $z = 3.009$, $p = 0.003$, $r = 0.218$), and neutropenia ($U = 2{,}538.5$, $z = 2.774$, $p = 0.006$, $r = 0.201$); all differences had a small effect size. Distributions for the other study variables evaluated were not significantly different.

Hospital Admissions

Kruskal–Wallis H tests indicated that the mean ranks for the number of hospital admissions were significantly different for participants' OP-35–related conditions combined ($\chi^2[5] = 31.48$, $p < 0.001$, $\varepsilon^2 = 0.089$), representing a moderate effect size (see Table 3). The post-hoc analysis identified statistically significant differences in the number of hospital admissions between anemia ($\bar{X}$ rank = 145.93) and other combinations of conditions ($\bar{X}$ rank = 193.82) (adjusted $p = 0.003$) and between pain ($\bar{X}$ rank = 154.07) and other combinations of conditions ($\bar{X}$ rank = 193.82) (adjusted $p = 0.02$). Mann–Whitney U tests identified significant differences in the participants' number of hospital admissions during the two-year study period by gender and the following OP-35–related conditions: anemia, dehydration, fever, nausea, neutropenia, pain, pneumonia, and sepsis. Distribution scores were as follows: gender ($U = 17{,}073.5$, $z = 2.043$, $p = 0.041$, $r = 0.108$), anemia ($U = 16{,}955.5$, $z = 2.807$, $p = 0.005$, $r = 0.149$), dehydration ($U = 17{,}733.5$, $z = 3.034$, $p = 0.002$, $r = 0.161$), fever ($U = 10{,}994.5$, $z = 2.53$, $p = 0.011$, $r = 0.134$), nausea ($U = 7{,}110$, $z = 2.952$, $p = 0.003$, $r = 0.157$), neutropenia ($U = 12{,}377$, $z = 2.794$, $p = 0.005$, $r = 0.148$), pain ($U = 16{,}345$, $z = 3.586$, $p < 0.001$, $r = 0.19$), pneumonia ($U = 13{,}318.5$, $z = 3.527$, $p < 0.001$, $r = 0.187$), and sepsis ($U = 16{,}008.5$, $z = 3.469$, $p = 0.001$, $r = 0.184$); all differences had a small effect size. Distributions for the other study variables evaluated were not significantly different.

TABLE 3. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of Hospital Admissions During the 2-Year Study Period (N = 355)

Characteristic	n	$\bar{X}$ Rank	H	df	p
Race			5.07	5	0.407
American Indian or Alaska Native	1	14.5			
Asian	32	170.44			
Black or African American	16	220.22			
Hawaiian Native or Pacific Islander	5	205.5			
White	200	168.37			
Another race	88	170			
Primary language			0.96	3	0.81
English	308	178.31			
Spanish	23	173.28			
English and other[a]	20	171.9			
Another language[b]	3	163.67			
Medical insurance			0.4	2	0.819
Medicare	195	178.07			
Private	142	178.52			
Medi-Cal	18	173.14			
Cancer diagnosis			3.62	5	0.605
Lung	53	167.37			
Breast	52	166.95			
Urologic	45	183.76			
Colorectal	37	194.82			
Lymphoma	35	152.03			
Other	133	186.76			
Chemotherapy location			0.22	2	0.894
1	80	165.78			
2	59	183.81			
3	216	180.94			
ED visit source			–	–	–
Home	60	30.5			
Hospital[c]	–	–			
Skilled nursing facility, assisted living, home health	–	–			
ED visit location			2.95	2	0.229
1	11	34.86			
2	10	21.9			
3	46	36.42			
4	–	–			
Hospital admission source			2.88	3	0.41
ED	295	179.43			
Home, physician referral	49	172.72			
Hospital[c]	6	181.92			
Skilled nursing facility, assisted living, home health	5	140.5			

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TABLE 3. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of Hospital Admissions During the 2-Year Study Period (N = 355) *(Continued)*

Characteristic	n	$\bar{X}$ Rank	H	df	p
Hospital admission location			1.93	3	0.587
1	58	171.03			
2	47	185.48			
3	248	178.77			
4	2	109			
Conditions combined			31.48	5	< 0.001
Anemia	38	145.93			
Pain	43	154.07			
Dehydration	19	141.5			
Anemia and pain	11	141.5			
Anemia and dehydration	17	163.38			
Other combinations of conditions	227	193.82			

Characteristic	n	$\bar{X}$ Rank	U	p
Gender			17,073.5	0.041
Female	189	170.66		
Male	166	186.35		
Medicare insurance			15,421	0.791
Yes	195	177.08		
No	160	179.12		
Oncology nurse navigator			15,472.5	0.747
Yes	209	179.03		
No	146	176.52		
Condition: anemia			16,955.5	0.005
No	190	167.17		
Yes	165	190.48		
Condition: dehydration			17,733.5	0.002
No	190	167.17		
Yes	165	190.48		
Condition: diarrhea			5,095	0.323
No	326	176.87		
Yes	29	190.69		
Condition: emesis			448.5	0.348
No	353	177.73		
Yes	2	225.75		
Condition: fever			10,994.5	0.011
No	288	173.32		
Yes	67	198.1		
Condition: nausea			7,110	0.003
No	318	174.14		
Yes	37	211.16		

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TABLE 3. Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population by the Number of Hospital Admissions During the 2-Year Study Period (N = 355) *(Continued)*

Characteristic	n	$\bar{X}$ Rank	U	p
Condition: neutropenia			12,377	0.005
No	277	172.32		
Yes	78	198.18		
Condition: pain			16,345	< 0.001
No	236	168.24		
Yes	119	197.35		
Condition: pneumonia			13,318.5	< 0.001
No	272	170.53		
Yes	83	202.46		
Condition: sepsis			16,008.5	0.001
No	240	168.2		
Yes	115	197.2		

[a] Other included Arabic, Cambodian, Mandarin, Cantonese, Japanese, Korean, Laotian, Russian, Spanish, Tagalog, and Vietnamese.
[b] Another language included Arabic, Cantonese, Chinese, Hungarian, Persian, Polish, Russian, Spanish, and Tagalog.
[c] Hospital admission source includes acute care, inpatient, or ambulatory surgery.
df—degrees of freedom; ED—emergency department
Note. Missing data values were omitted from the table. Because of missing data, variable frequencies may not add up to the total sample size (N = 355).

Emergency Department Visits and Hospital Admissions by Oncology Nurse Navigator Involvement

The study's primary outcome was to examine the contribution of ONNs on healthcare utilization in the number of ED visits and hospital admissions of adults with cancer post–outpatient chemotherapy. Nonparametric Kruskal–Wallis H tests identified the mean ranks for the number of ED visits (U = 4,053.5, z = −1.053, p = 0.292), average LOS at the ED (U = 4,449.5, z = 0.529, p = 0.597), number of hospital admissions (U = 15,472.5, z = 0.322, p = 0.747), and LOS at the hospital (U = 15,385, z = 0.135, p = 0.892); these were not significantly different for participants in terms of ONN involvement, using an asymptotic sampling distribution for U (see Table 4).

Odds of Emergency Department Visits and Hospital Admissions

Multiple linear regression analyses were run to identify factors that increased the odds of participants' ED visits and hospital admissions within 30 days of any outpatient chemotherapy treatment. Test assumptions, including linearity, independence of residuals, homoscedasticity, multilinearity, normality of residuals, or leverage points, were evaluated. Factors identified in the literature as significant, as well as those significant ($p < 0.05$) in the bivariate analysis, were considered for entry in the regression models. A multiple regression analysis established that participants' age, gender, Medicare insurance status, chemotherapy location, and 10 different OP-35–related conditions could significantly predict the number of ED visits ($F[15, 175] = 2.53$, $p = 0.002$, adjusted $R^2 = 0.148$). Two parameters, Medicare insurance status ($p = 0.028$) and chemotherapy location 3 ($p = 0.012$), contributed significantly to the prediction, with the OP-35–related condition of diarrhea ($p = 0.059$) approaching significance. Regression coefficients and standard errors can be found in Table 5.

A second multiple linear regression analysis established that participants' age, gender, and nine different OP-35–related conditions could significantly predict the number of hospital admissions ($F[12, 34] = 4.31$, $p < 0.001$, adjusted $R^2 = 0.101$). A summary of the regression coefficients and standard errors can be found in Table 6. Three parameters, the OP-35–related conditions of nausea ($p = 0.021$), pain ($p = 0.006$), and pneumonia ($p = 0.034$), contributed significantly to the prediction. Given that the study's

primary outcome was to examine the contribution of ONNs, this factor was included in subsequent regression models, with ONNs not improving the model fit or the percent variability explained by the model.

Discussion

About 35% of patients receiving outpatient chemotherapy had at least one ED visit or hospital admission during the two-year study period related to OP-35 conditions. This finding is similar to Kolodziej et al. (2011), who reported that chemotherapy-related admissions accounted for 40% of hospitalizations of patients with cancer receiving chemotherapy. Among the 10 conditions evaluated, anemia was the most common condition, followed by dehydration and pain for ED visits and hospital admissions combined. When evaluating ED visits and hospital admissions separately, anemia is the second most common condition for ED visits, and the most common condition for hospital admissions. Although many previous studies recognized that anemia was one of the reasons for ED visits and hospital admissions, it had not been identified as the most common condition for ED visits and hospital admissions combined (Aprile et al., 2013; Foltran et al., 2014; Hassett et al., 2006; Mayer et al., 2011; McKenzie et al., 2011). This may be attributed to the studies not using the OP-35 criteria (Office of the Assistant Secretary for Planning and Evaluation, 2021).

The number of ED visits that participants had during the two-year study period was significantly different in terms of their Medicare insurance status, chemotherapy location, and the OP-35–related conditions of dehydration, diarrhea, emesis, and neutropenia. By contrast, the number of hospital admissions that participants had during the two-year study period was significantly different in terms of their gender and the OP-35–related conditions of anemia, dehydration, fever, nausea, neutropenia, pain, pneumonia, and sepsis. Although CMS does not specify which 10 conditions are likely to result in ED visits and hospital admissions, the current study results indicated that different sets of OP-35–related conditions were significantly associated with these outcomes.

The multiple linear regression models presented significantly predict the number of ED visits and

TABLE 4. Oncology Nurse Navigator Involvement of the Study Population by Number of ED Visits (N = 191) and Hospital Admissions (N = 355) During the 2-Year Study Period

Characteristic	n	$\bar{X}$ Rank	U	p
Number of ED visits				
Oncology nurse navigator			4,053.5	0.292
Yes	118	93.85		
No	73	99.47		
Average length of stay at the ED				
Oncology nurse navigator			4,449.5	0.597
Yes	118	97.21		
No	73	94.05		
Number of hospital admissions				
Oncology nurse navigator			15,472.5	0.747
Yes	209	179.03		
No	146	176.52		
Average length of stay at the hospital				
Oncology nurse navigator			15,385	0.892
Yes	209	178.61		
No	146	177.12		

ED—emergency department

TABLE 5. Regression Analysis Summary for Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population Predicting the Number of Emergency Department Visits During the 2-Year Study Period (N = 191)

Variable	B	95% CI for B	β	t	p
Age at discharge	–	[–0.01, 0]	–0.11	–1.16	0.246
Gender: male	0.03	[–0.11, 0.17]	0.03	0.46	0.649
Medicare	0.22	[0.02, 0.41]	0.22	2.21	0.028
Chemotherapy location 1	–0.19	[–0.43, 0.06]	–0.16	–1.49	0.138
Chemotherapy location 3	–0.28	[–0.5, –0.06]	–0.27	–2.53	0.012
Anemia	–0.11	[–0.3, 0.09]	–0.08	–1.05	0.295
Dehydration	0.15	[–0.07, 0.38]	0.11	1.33	0.184
Diarrhea	0.43	[–0.02, 0.87]	0.14	1.9	0.059
Emesis	0.98	[–0.17, 2.13]	0.12	1.68	0.095
Fever	0.12	[–0.21, 0.45]	0.06	0.71	0.481
Nausea	0.17	[–0.22, 0.56]	0.06	0.86	0.389
Neutropenia	0.23	[–0.1, 0.57]	0.11	1.37	0.172
Pain	0.09	[–0.12, 0.3]	0.06	0.85	0.397
Pneumonia	0.08	[–0.23, 0.38]	0.04	0.51	0.611
Sepsis	–0.08	[–0.36, 0.21]	–0.04	–0.52	0.606

B—unstandardized regression coefficient; β—standardized coefficient; CI—confidence interval
Note. Reference categories: Medicare insurance, no Medicare; gender, female; chemotherapy location, location 2; anemia, no; dehydration, no; diarrhea, no; emesis, no; fever, no; nausea, no; neutropenia, no; pain, no; pneumonia, no; and sepsis, no

hospital admissions for these participants. The OP-35–related conditions of nausea, pain, and pneumonia added significantly to the prediction of the number of hospital admissions for these participants. Although gender was significantly associated with the number of hospital admissions in the bivariate analysis, only select OP-35–related conditions (nausea, pain, and pneumonia) contributed to the number of hospital admissions. Of note, both models only explained about 10% of the variation in the number of ED visits and 11% of the variation in the number of hospital admissions. It is challenging to identify significant predictors of ED use from the literature because limited research has been done on population-based estimation predictors of ED use among patients with cancer (Office of the Assistant Secretary for Planning and Evaluation, 2021). However, the results of this study add to the understanding of which factors may result in a return to the ED or hospital within 30 days of any outpatient chemotherapy treatment.

The study results showed that there was no difference in the number of ED visits and hospital admissions for patients with cancer post–outpatient chemotherapy regardless of their ONN involvement; of note, ONN involvement did not significantly contribute to the prediction of the number of ED visits or hospital admissions for these participants. Factors associated with ED visits and hospital admissions are complex, and some opportunities for prevention are likely outside of the ONN's control. The lack of standard national metrics and ONN financial reimbursement further complicates measurement of impact and could jeopardize the efficacy and sustainability of ONN programs in organizations if patient clinical outcomes were the sole evaluation metric.

Interpreting these findings that there was no difference in ED visits and hospital admissions

regardless of ONN involvement as evidence, or lack thereof, of ONNs' value may be inappropriate, and may not reflect the range of ONN direct and indirect activities on behalf of the patient. These findings are not a surprise given the scope of the ONN role and work patterns. The primary role of the ONN is reducing barriers to care in a complex healthcare delivery system; in contrast, close symptom management post–outpatient chemotherapy is coordinated by providers (Cook et al., 2013; McMullen et al., 2017; Oncology Nursing Society, 2015; Pautasso et al., 2018). In the current study, the ONNs did not work for specific oncology providers and the institution does not have an oncology urgent care service. Consequently, ONNs were not providing interventions involving provider orders or on-demand symptom management, even if they identified the patient's need. The literature suggests that oncology urgent care would be more directly related to preventing ED visits and hospital admissions for this population (Eskander et al., 2018; Foltran et al., 2014; Geddie et al., 2016; Handley et al., 2018; Whitney et al., 2018).

OP-35 metrics of ED visits and hospital admissions are not exclusive clinical outcomes to measure ONNs' efficacy, and other process measures need to be considered. Other process measures would be more appropriate to capture the impact of the ONN program. Examples include adhering to institutional treatment pathways, reducing delays from cancer diagnosis to initial oncology consultation or first treatment, and navigating patients with abnormal cancer screening (Johnston et al., 2017). In conclusion, the study findings broaden the understanding of how the ONN may affect the number of

KNOWLEDGE TRANSLATION

- Organizations should analyze patients receiving outpatient chemotherapy who are at risk for emergency department visits or hospital admissions and develop support plans.
- Standardizing the oncology nurse navigator (ONN) role and identifying appropriate ONN metrics will enable organizations to measure ONN impact and productivity.
- ONNs should collaborate with cancer program leaders to create clear pathways of communication when intervention for symptom control or an unanticipated situation is necessary.

TABLE 6. Regression Analysis Summary for Sociodemographic and Clinical Characteristics, Care Site Characteristics, and Chemotherapy-Related Conditions of the Study Population Predicting the Number of Hospital Admissions During the 2-Year Study Period (N = 355)

Variable	B	95% CI for B	β	t	p
Age at discharge	–	[–0.01, 0]	–0.07	–1.39	0.166
Gender: male	0.13	[0, 0.26]	0.1	1.94	0.053
Anemia	–	[–0.19, 0.18]	–	–0.01	0.991
Dehydration	–0.03	[–0.24, 0.18]	–0.02	–0.3	0.768
Diarrhea	–0.09	[–0.5, 0.33]	–0.02	–0.4	0.686
Emesis	0.24	[–0.83, 1.31]	0.02	0.44	0.661
Fever	–0.01	[–0.31, 0.3]	–	–0.05	0.958
Nausea	0.43	[0.07, 0.79]	0.13	2.33	0.021
Neutropenia	0.3	[–0.02, 0.61]	0.11	1.87	0.062
Pain	0.28	[0.08, 0.48]	0.15	2.79	0.006
Pneumonia	0.31	[0.02, 0.59]	0.12	2.13	0.034
Sepsis	0.24	[–0.03, 0.51]	0.11	1.78	0.076

B—unstandardized regression coefficient; β—standardized coefficient; CI—confidence interval
Note. Reference categories: gender, female; anemia, no; dehydration, no; diarrhea, no; emesis, no; fever, no; nausea, no; neutropenia, no; pain, no; pneumonia, no; and sepsis, no

ED visits and hospital admissions post–outpatient chemotherapy.

Limitations

Study findings must be placed in the context of study limitations, including study design or variables not evaluated. The study was a retrospective descriptive cross-sectional research study; therefore, the findings cannot establish causal relationships and are not generalizable across organizations. ONN involvement and interventions were nonstandardized, and specific activities regarding ONN interventions were not included in this study. For example, one infusion location is near the largest oncology offices in the region and had the greatest number of ONNs with a robust breast cancer navigation program, in contrast to the other two locations. Most patients with lymphoma did not receive ONN involvement in their care, and most people with breast cancer did. The number, timing, and content of ONN interventions were not evaluated in this study.

Despite these limitations, the study findings provide new knowledge in the understanding of the contribution of ONNs in the number of ED visits and hospital admissions for patients with cancer post–outpatient chemotherapy.

Implications for Nursing Research

ONNs play an integral role in complex cancer care. OP-35 metrics of ED visits and hospital admissions are not exclusive clinical outcomes to measure ONNs' efficacy, and other process measures need to be considered. There is a clear opportunity for healthcare organizational leadership to understand the importance in choosing the appropriate metrics to evaluate the impact of ONNs.

Future studies should employ a methodologically stronger design, such as randomized controlled trial or stepped wedge cluster trial, particularly because the literature repeatedly points to design as a weakness of ONN studies (Baik et al., 2016; Bernardo et al., 2019; Johnson, 2015; Paskett et al., 2011). A longitudinal study design is also recommended for future studies to reflect the full cancer journey, which usually takes several months to years from diagnosis and on to survivorship (Bernardo et al., 2019; Johnson, 2015; McMullen et al., 2017; Paskett et al., 2011).

Conclusion

This study examined the effect of ONNs on the number of ED visits and hospital admissions of adults with cancer post-outpatient chemotherapy. A variety of complex factors were associated with ED visits and hospital admissions for this population, with some opportunities for prevention likely outside of the ONN's control. In analysis, adding the ONN factor did not improve predictive model fits for ED visits or hospital admissions. This result does not preclude the benefit of ONNs. Instead, it emphasizes the ONN scope of responsibilities and related outcome measures. Collaboration and dissemination of best practices and evidence will likely decrease confusion and facilitate outcome reporting.

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