Stopping the revolving door: An exploratory analysis of health care super-utilization in gynecologic oncology

Catherine N. Zivanov [a], Annie Apple [a], Alaina J. Brown [b], Marc A. Robinson [b], Lauren S. Prescott [b,*]

[a] *Vanderbilt University School of Medicine, Nashville, TN 37240, USA*
[b] *Department of Obstetrics and Gynecology, Vanderbilt University Medical Center, Nashville, TN 37232, USA*

A B S T R A C T

The objective of this study was to determine the prevalence of and risk factors for health care super-utilization among gynecologic oncology patients at a single academic hospital. A retrospective cohort study of gynecologic oncology patients with an index unplanned encounter between January and December 2018 was performed. Super-utilizers were defined as patients with 3 or more unplanned hospital encounters during a 12-month period starting at the time of the index unplanned encounter. We identified 553 patients with gynecologic cancer. Of those, 37(7%) met inclusion criteria for super-utilizers accounting for 193/310(62%) of unplanned visits. The median number of unplanned visits was 4 (range 3–24). The most common cancers were uterine (N = 15 (41%)) and ovarian (N = 11 (30%)). Nineteen (51%) super-utilizers had advanced stage disease. Phases of oncologic care at index unplanned encounter included primary diagnosis (N = 24 (65%)), recurrence (N = 10 (27%)), and surveillance (N = 2 (5%)). Twelve super-utilizers (32%) had new diagnoses of cancer without prior therapy, 19 (51%) had prior chemotherapy, 17(46%) had prior surgery, and 10(27%) had prior radiation therapy at the time of initial encounter. Fifteen super-utilizers (41%) were in the last year of life. The most common reasons for unplanned encounters were pain (66%) and gastrointestinal symptoms (61%). Multivariable analysis adjusting for key variables demonstrated that Medicaid insurance, ASA classification, and disease status are risk factors for health care super-utilization. The majority of health care utilization occurred during the first year of diagnosis. This exploratory analysis suggests an opportunity to decrease health care utilization, particularly during upfront treatment.

1. Introduction

Cancer is a leading cause of death and major contributor to national health care spending in the United States (US). Over 1.8 million new cancer cases and over 600,000 cancer deaths were projected to occur in 2020 with over $150 billion in spending on oncology care (Siegel et al., 2020; Mariotto et al., 2011). Among Medicare patients with advanced cancer, acute hospitalizations make up the largest proportion of oncology care costs, accounting for nearly 50% of spending. In comparison, chemotherapy accounts for only 16% of spending and hospice care accounts for a mere 5% of spending in this population (Brooks et al., 2014). Oncology patients also have the highest rates of unplanned 30-day readmission when compared to patients with cardiorespiratory and cardiovascular disease as well as patients readmitted to non-oncology services (Horwitz et al., 2014). In addition to high costs, acute care encounters are emotionally distressing and physically draining for both patients and their caretakers, especially in the final days of life (Barbera et al., 2010; Brown et al., 2014).

Following the passage of the Affordable Care Act in 2010, health care quality measures were developed to reduce health care expenditures and promote patient-centered, cost-effective care. Some of these initiatives focused on high-need, high-cost patients who constitute a small percentage of the population yet account for a disproportionately high amount of health care utilization (Jiang et al., 2014; Mann, 2013). These so-called "super-utilizers" account for a significant proportion of emergency department (ED) visits, hospitalizations, and readmissions, some of which may be preventable (Barbera et al., 2010; Jiang et al., 2014; Panattoni et al., 2018; Aprile et al., 2013).

* Corresponding author at: Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Vanderbilt University Medical Center, 1161 21st Ave S. B1100 Medical Center North, Nashville, TN 37232, USA.
E-mail address: lauren.prescott@vumc.org (L.S. Prescott).

Several studies have assessed risk factors for health care super-utilization among cancer patients (Horwitz et al., 2014; Panattoni et al., 2018; Aprile et al., 2013; Manzano et al., 2014; Elsayem et al., 2016; Brooks et al., 2015; Brooks et al., 2015; Hurria et al., 2011; Handley et al., 2018), however few have focused specifically on health care super-utilization among gynecologic oncology patients (Henretta et al., 2011; Clark et al., 2013; Nakayama et al., 2015; Wilbur et al., 2016; Uppal et al., 2016; Hay et al., 2018). A 2011 single center retrospective analysis of gynecologic oncology patients found an all-cause readmission rate of 13.2%, though it did not assess unplanned ED visits or risk factors for readmission (Henretta et al., 2011). Subsequent studies have assessed post-operative readmission rates within the gynecologic oncology population with associated risk factors including surgical modality, medical and psychiatric comorbidities, and social determinants of health such as access to insurance and language barriers (Clark et al., 2013; Nakayama et al., 2015; Wilbur et al., 2016; Uppal et al., 2016). More studies are needed to assess gynecologic oncology super-utilization patterns outside of the immediate post-operative period (Hay et al., 2018).

Given the unique nature of gynecologic oncology care, specifically the provision of both medical and surgical oncology care by a single provider, identifying and understanding the characteristics of gynecologic oncology super-utilizers is essential for developing and implementing quality improvement measures to enhance the care of gynecologic oncology patients. The primary objective of this study was to determine the prevalence of health care super-utilization among gynecologic oncology patients at our institution. The secondary objective was to identify risk factors for health care super-utilization.

2. Methods

We performed a retrospective cohort study of all gynecologic oncology patients who had at least one encounter with gynecologic oncology at our institution between January and December 2018. Institutional Review Board approval was obtained prior to conduction of this study. Study data were collected and managed using HIPAA-compliant interfaces including Box and Research Electronic Data Capture (REDCap) (Harris et al., 2009; Harris et al., 2019). All identifiers stored in REDCap were removed prior to data analysis and publication. Statistical analysis was performed using STATA™ 15.0 for Macintosh (StatCorp LP, College Station Texas).

Gynecologic oncology patients were defined based on International Classification of Diseases, 10th Revision diagnoses of gynecologic cancer (cervical, ovarian/fallopian/peritoneal, uterine, vulvar/vaginal). Patients with diagnoses of peritoneal or retroperitoneal malignancy were reviewed by a physician researcher, and those with a high level of suspicion for gynecologic malignancy were included in this study. Male patients, patients less than 18 years old at the time of index unplanned encounter, and patients with breast cancer or primary peritoneal cancer managed by a medical or surgical oncologist were excluded.

Demographic data (age, race, ethnicity, insurance status, education, marital status, health literacy, BMI, smoking history) were automatically extracted from the electronic medical record (EMR). Health literacy screening for all admitted patients is completed by inpatient nursing staff using standard questions in our EMR. Patient zip codes were automatically extracted and manually correlated with median income based on 2018 Community Assessment Survey Census data as an indicator of area-based socioeconomic status (Census Bureau and Survey, 2018). Research team members then manually abstracted additional clinical characteristics: American Society of Anesthesiologists (ASA) physical classification status, comorbidities, Charlson comorbidity index (CCI) (Charlson et al., 1994), primary cancer site, cancer stage, phase of oncologic care, and prior oncologic treatments (surgery, systemic therapy, radiation therapy).

Index unplanned encounters were defined as the first unplanned hospital encounter between January 2018 and December 2018.

Unplanned hospital encounters included unplanned ED visits with or without admission (including patients who were only seen in ED triage), unplanned direct admissions, and transfers from outside hospitals. Scheduled admissions for same-day procedures (e.g., surgery, chemotherapy, radiation, etc.) were excluded.

The total number of unplanned encounters for each gynecologic oncology patient was manually extracted from the EMR, and gynecologic oncology patients were divided into super-utilizer and non-super-utilizer databases. Super-utilizers were defined as patients with 3 or more unplanned hospital encounters at our institution within a 12-month period starting at the time of the index unplanned encounter, as previously defined by Hay et al. (2018) Non-super-utilizers were defined as gynecologic oncology patients with less than 3 unplanned hospital encounters at our institution within a 12-month period starting at the time of the index unplanned encounter. For non-super-utilizers with no unplanned hospital encounters, the date of the first gynecologic oncology encounter in 2018 was used to determine the starting point of the 12-month period.

For super-utilizers only, the date and time of unplanned encounters, presenting symptoms, dates of last oncologic treatment, ED and admission diagnoses, length of admissions, discharge diagnoses, and discharge dispositions were also manually abstracted from the EMR. Presenting symptoms for each unplanned encounter were subdivided into the following categories: pain, gastrointestinal, cardiovascular, respiratory, infection, hematologic, gynecologic, genitourinary/renal, neurologic/psychiatric, fatigue, equipment malfunction, chemotherapy-associated toxicity, radiation-associated toxicity, complication related to surgery (Aprile et al., 2013; Henretta et al., 2011; Hay et al., 2018).

Descriptive statistics were used to summarize patient demographics, clinical and oncologic characteristics, features of unplanned hospital encounters, and outcomes. Chi-squared and Fisher's exact tests were used to test for differences between super-utilizers and non-super-utilizers for categorical variables, and Wilcoxon rank-sum tests were used to compare medians between groups for continuous variables. Univariable logistic regression was used to model the logit of the probability of health care super-utilization as a function of patient demographics and clinical characteristics to determine risk factors for super-utilization. A saturated model including all factors with a $P < 0.2$ was built, and backward elimination was used in a multivariable analysis to construct a parsimonious model, removing factors individually until all remaining factors remained statistically significant. Adjusted odds ratios and corresponding 95% confidence intervals for each factor remaining in the model are reported. By standard convention, $P < 0.05$ was considered statistically significant.

3. Results

We identified 553 unique patients with a diagnosis of gynecologic malignancy who met inclusion criteria for this study. Of these, 37 patients (7%) met inclusion criteria for super-utilizers.

3.1. Demographics and clinical characteristics

Patient demographics and clinical characteristics are displayed in Table 1. Super-utilizers tended to be younger, more commonly reported non-white race, and were more likely to have Medicaid insurance than non-super-utilizers. Among patients with known education levels, super-utilizers less commonly reported an advanced degree or at least some college education. Super-utilizers were also more likely to have high ASA class (III or IV) and higher CCI scores. The total number of chronic comorbidities were not significantly different between groups, but super-utilizers were more likely to have anemia and anxiety than non-super-utilizers. The distribution of ethnicity, level of income, marital status, body mass index, median income and smoking history were not significantly different between groups. Super-utilizers also had lower levels of self-reported health literacy and indicated lower levels of

Table 1
Patient Demographics and Clinical Characteristics.

	Super-Utilizers (N = 37) N (%)	Non-Super-Utilizers (N = 516) N (%)	P
Age in Years, Median (IQR)	58 (44–66)	63 (55–70)	0.043
Race*			0.002
White	23 (62%)	424 (85%)	
Black	11 (30%)	46 (9%)	
Asian	1 (3%)	9 (2%)	
Other/Unknown	2 (5%)	19 (4%)	
Ethnicity**			0.504
Non-Hispanic	36 (97%)	452 (98%)	
Hispanic	1 (3%)	8 (2%)	
Insurance Status			< 0.001
Private	11 (30%)	227 (43%)	
Medicare	13 (35%)	255 (48%)	
Medicaid	6 (16%)	13 (2%)	
Uninsured	4 (11%)	2 (<1%)	
Other Governmental	3 (8%)	19 (4%)	
Education**			0.122
Advanced Degree	1 (3%)	26 (11%)	
Completed or Some College	17 (47%)	122 (53%)	
Completed or Some High School	16 (44%)	78 (34%)	
Less Than or Equal to 8th grade	2 (6%)	4 (2%)	
Marital Status			0.075
Single	11 (30%)	74 (14%)	
Married	18 (49%)	301 (58%)	
Significant Other	1 (3%)	4 (1%)	
Divorced	3 (8%)	58 (11%)	
Widowed	3 (8%)	61 (12%)	
Legally Separated	1 (3%)	3 (1%)	
Unknown	0 (0%)	15 (3%)	
Annual Income, Median	$49,155	$53,201	0.154
BMI, Median (IQR)	27 (24–34)	31 (25–37)	0.094
Smoking History			0.820
Never	24 (65%)	341 (66%)	
Current	4 (11%)	41 (8%)	
Former	9 (24%)	134 (26%)	
ASA Classification***			0.008
I or II	3 (9%)	78 (29%)	
III or IV	32 (91%)	193 (71%)	
Number of Chronic Comorbidities			0.758
None	1 (3%)	25 (5%)	
One	3 (8%)	76 (15%)	
Two	7 (19%)	91 (18%)	
Three or more	26 (70%)	324 (63%)	
Charlson Comorbidity Index, Median (IQR)	8 (2–10)	4 (0–13)	< 0.001

Abbreviations: ASA: American Society of Anesthesiologists, IQR: interquartile range.

* Missing race for 18 non-super-utilizers (% out of N = 498).
** Missing ethnicity for 56 non-super-utilizers (% out of N = 460).
*** Missing education for 1 super-utilizer and 286 non-super-utilizers (% out of N = 36 and N = 230, respectively).
**** Missing ASA classification for 2 super-utilizers and 245 non-super-utilizers (% out of N = 35 and N = 271, respectively).

confidence filling out medical forms independently, more frequent need for assistance reading hospital materials, and more problems learning about medical conditions because of difficulty understanding written information (Table 2).

3.2. Oncologic characteristics

Patient oncologic characteristics are displayed in Table 3. The most common primary cancer sites among super-utilizers were uterine and ovarian/fallopian/peritoneal. Super-utilizers were more likely to have advanced stage cancer relative to non-super-utilizers. The distribution of phases of care at initial encounter was significantly different between groups, with super-utilizers being more likely to present with primary

Table 2
Patient Health Literacy.

	Super-Utilizers (N = 37) N (%)	Non-Super-Utilizers (N = 516) N (%)	P
How confident are you filling out medical forms by yourself?*			0.001
Extremely	11 (32%)	152 (68%)	
Somewhat	6 (18%)	18 (8%)	
Quite a bit	16 (47%)	49 (22%)	
Not at all	1 (3%)	2 (1%)	
A little of the time	0 (0%)	3 (1%)	
How often do you have someone help you read hospital materials?*			0.009
All of the time	1 (3%)	6 (3%)	
Most of the time	2 (6%)	4 (2%)	
None of the time	23 (68%)	176 (79%)	
Some of the time	8 (24%)	18 (8%)	
A little of the time	0 (0%)	20 (9%)	
How often do you have problems learning about your medical conditions because of difficulty understanding written information?**			0.01
All of the time	1 (3%)	6 (3%)	
Most of the time	2 (6%)	3 (1%)	
None of the time	23 (68%)	175 (78%)	
Some of the time	8 (24%)	20 (9%)	
A little of the time	0 (0%)	21 (9%)	

* Missing data for 3 super-utilizers and 292 non-super-utilizers (% out of N = 34 and N = 224, respectively).
** Missing data for 3 super-utilizers and 293 non-super-utilizers (% out of N = 34 and N = 225, respectively).

Table 3
Patient Oncologic Characteristics.

	Super-Utilizers (N = 37) N (%)	Non-Super-Utilizers (N = 516) N (%)	P
Primary Cancer Site*			
Vulva/Vaginal	2 (5%)	40 (8%)	1.000
Uterine	15 (41%)	232 (45%)	0.733
Ovarian/Fallopian/Peritoneal	11 (30%)	176 (34%)	0.720
Cervical	9 (24%)	79 (15%)	0.162
Unknown	0 (0%)	3 (1%)	1.000
Cancer Stage			0.224
I/II	17 (46%)	302 (59%)	
III/IV	19 (51%)	190 (37%)	
Unknown	1 (3%)	24 (5%)	
Phase of Care at Initial Encounter			< 0.001
Survivorship/Surveillance	2 (5%)	224 (43%)	
Primary Disease	23 (62%)	211 (41%)	
Recurrence	4 (11%)	73 (14%)	
Recurrence, Last Year of Life	7 (19%)	7 (1%)	
Unknown	1 (3%)	1 (<1%)	
Oncologic Treatment(s) Received Prior to Index Encounter			
New Diagnosis (No Prior Treatment)	12 (32%)	121 (23%)	0.233
Chemotherapy	19 (51%)	229 (44%)	0.494
Hormones	1 (3%)	33 (7%)	0.719
Surgery	17 (46%)	335 (65%)	0.032
Radiation	10 (27%)	141 (27%)	1.000
Prior Lines of Chemotherapy**			0.677
One	10 (56%)	121 (55%)	
Two	5 (28%)	45 (20%)	
Three or More	3 (17%)	54 (25%)	

* Dual primaries were included in both disease sites: Cervix and Endometrial (N = 1), Cervix and Vulva/Vaginal (N = 4), Uterine and Ovarian (N = 8), Uterine and Vulva/Vaginal (N = 1).
** Missing prior lines of chemotherapy for 1 super-utilizer and 9 non-super-utilizers (% out of N = 18 and N = 220, respectively).

disease or recurrence in last year of life than non-super-utilizers. Non-super-utilizers were also more likely to have had oncologic surgery prior to their initial encounter than super-utilizers. There were no significant differences in receipt of prior systemic therapy or radiation between groups.

A univariable logistic regression was completed with a dependent variable of super-utilization and covariates of sociodemographic characteristics, disease phase of care, medical comorbidities, and surgical intervention for cancer management. The regression demonstrated that Black race (OR 4.4, P < 0.001), single marital status (OR 2.5, P = 0.024), Medicaid insurance (OR 9.5, P < 0.001), lack of insurance (OR 41.3, P < 0.001), ASA class III or IV (OR 4.3, P = 0.018), and any phase of care other than surveillance/survivorship were associated with increased odds of super-utilization (Table 4). Surgical intervention for cancer management (OR 0.46, P = 0.023) and age (OR 0.71, P = 0.006) were associated with decreased odds of super-utilization. An exploratory regression was performed using backward stepwise approach given the small number of patients in our cohort. After adjusting for key clinical and demographic variables including age, BMI, race, cancer stage, marital status, insurance, education, ASA classification, disease status, CCI, and prior surgery in our multivariable analysis, Medicaid insurance (OR 17.7, P < 0.001), ASA III or IV (OR 4.5, P = 0.047), and recurrence in last year of life (OR 286.3, P < 0.001) were associated with increased risk of super-utilization.

3.3. Summary of unplanned encounters

The distribution of unplanned encounters of all 553 gynecologic oncology patients are summarized in Fig. 1. Super-utilizers accounted for 193/310 (62%) unplanned hospital encounters with a median of 4 unplanned encounters per super-utilizer (IQR 3–9, range 3–24). Most unplanned super-utilizer encounters resulted in inpatient admissions (140/193, 72.5%), over half of which were 30-day readmissions (78/140, 55.7%). The median number of days from previous discharge to readmission was 9 (IQR 5–18). Characteristics and outcomes of super-utilizer index unplanned encounters and subsequent unplanned encounters are summarized in Table 5. The most common admitting services were Gynecologic Oncology and Internal Medicine. The median number of days admitted was 17 (IQR 6–49) per super-utilizer and 4 (IQR 1–19) per admission, with super-utilizers spending a combined total of 881 days admitted during the study period. Over half (127/193, 66%) of unplanned super-utilizer encounters occurred outside of standard work hours (defined as 8 am to 4 pm Monday through Friday) (Hay et al., 2018).

Presenting symptoms were similar between index and subsequent unplanned encounters. The most common presenting symptoms for index unplanned encounters were gastrointestinal (N = 23 (62%)), pain (N = 21 (57%)) and hematologic (N = 17 (46%)). The most common gastrointestinal symptoms were nausea, anorexia, and emesis. The most common pain location was abdominal/pelvic pain. Of 19 super-utilizers who received chemotherapy prior to their index unplanned encounter, 10 (27%) received chemotherapy within the 30-days prior to their index encounter and 5 (14%) presented with a chemotherapy-associated toxicity. Chemotherapy complications most commonly included nausea, emesis, dehydration, diarrhea, anemia, and fatigue. Of 17 super-utilizers who had surgery prior to their index unplanned encounter, 4 (11%) had surgery within the 30-days prior to their index encounter and presented with acute infectious or gastrointestinal complications related to their surgery. An additional 3 (8%) super-utilizers presented with chronic post-surgical complications (e.g., fistulas, strictures). Of 10 super-utilizers who received radiation prior to their index unplanned encounter, 2 (5%) presented with chronic radiation-associated complications. Four super-utilizers (11%) experienced unplanned encounters related to non-oncologic chronic comorbidities, and 2 (5%) presented with multiple episodes of vaginal bleeding in the setting of conservative management of endometrial cancer for fertility preservation. Most

Table 4

Regression Analyses Comparing Super-Utilizers and Non-Super-Utilizers.

	Univariable Regression		Multivariable Regression	
	OR	P	OR	P
Age	0.71	0.006		
Race[*]				
White	Reference			
Black	4.41	< 0.001		
Asian	2.05	0.505		
Other/Unknown	1.94	0.391		
Ethnicity[**]				
Non-Hispanic	Reference			
Hispanic	1.57	0.675		
Insurance Status				
Private	Reference		Reference	
Medicare	1.05	0.904	0.95	0.920
Medicaid	9.52	< 0.001	17.68	0.001
Uninsured	41.27	< 0.001	1.00	None
Other Governmental	3.26	0.089	1.60	0.586
Education[***]				
Advanced Degree	Reference		Reference	
Completed or Some College	3.62	0.221	6.24	0.210
Completed or Some High School	5.33	0.113	4.78	0.284
Less Than or Equal to 8th grade	13.00	0.055	42.64	0.031
Marital Status				
Married	Reference			
Single	2.49	0.024		
Significant Other	4.18	0.211		
Divorced	0.87	0.821		
Widowed	0.82	0.76		
Legally Separated	5.57	0.145		
BMI				
< 30	Reference			
30–40	0.49	0.076		
> 40	0.73	0.509		
Smoking History				
Never	Reference			
Current	1.39	0.563		
Former	0.95	0.908		
ASA Classification[****]				
I or II	Reference		Reference	
III or IV	4.31	0.018	4.48	0.047
Number of Chronic Comorbidities				
None	Reference			
One	0.99	0.991		
Two	1.92	0.550		
Three or more	2.01	0.503		
Charlson Comorbidity Index	4.24	0.008		
Primary Cancer Site[*****]				
Vulva/Vaginal	Reference			
Uterine	0.95	0.936		
Ovarian/Fallopian/Peritoneal	0.92	0.899		
Cervical	1.68	0.449		
Cancer Stage				
I/II	Reference			
III/IV	1.78	0.097		
Phase of Care at Initial Encounter				
Survivorship/Surveillance	Reference		Reference	
Primary Disease	12.21	0.001	4.07	0.080
Recurrence	6.14	0.038	2.57	0.407
Recurrence, Last Year of Life	112.00	< 0.001	286.31	< 0.001
Unknown	112.00	0.003		
Surgery Prior to Index Encounter	0.46	0.023		

Abbreviations: ASA: American Society of Anesthesiologists

[*] Missing race for 18 non-super-utilizers (N = 498).

[**] Missing ethnicity for 56 non-super-utilizers (N = 460).

[***] Missing education for 1 super-utilizer and 286 non-super-utilizers (N = 36 and N = 230, respectively).

super-utilizers were discharged home with self-care and few were discharged with home health or transferred to a nonhospital facility. One super-utilizer also left the ED without being seen.

Twenty-five super-utilizers (68%) were seen by a palliative care provider in either the inpatient or outpatient setting. Four super-utilizers (11%) were seen by palliative care providers prior to their index unplanned encounter, 2 (5%) received inpatient palliative care consultations during their index unplanned encounter, and 19 (51%) were seen by a palliative care provider after their index unplanned encounter. Of the 25 patients seen by a palliative care provider, 21/25 (84%) had their initial consultation in the inpatient setting, and only 4/25 (16%) had initial consultation in the outpatient setting.

Eighteen super-utilizers (49%) had aggressive disease, 14 (38%) received end of life care, and 6 (16%) rapidly progressed from diagnosis to death during the 12 months following their index visit. Unfortunately, 17 of 37 super-utilizers (46%) have passed away since their index unplanned encounter, including 10 who died within 30 days of discharge from an unplanned encounter. Among the 17 deceased super-utilizers, 8/17 (47%) initially presented with primary disease, 8/17 (47%) with recurrence, and 1/17 (6%) with unknown phase of disease. The median number of days from index unplanned encounter to death was 208 (IQR 134–299).

4. Discussion

Unplanned acute care is a major contributor to growing US health care costs particularly among patients with cancer (Mariotto et al., 2011; Brooks et al., 2014). Our study found that 7% of gynecologic oncology patients at our institution accounted for 62% of unplanned hospital encounters, 63% of ED visits, 61% of admissions, and 82% of readmissions, resulting in 881 days admitted during the study period.

Over half (66%) of unplanned super-utilizer encounters occurred outside of standard work hours. Pain, gastrointestinal, and hematologic symptoms were the most common presenting symptoms. When compared to non-super-utilizers at our institution, super-utilizers tended to be younger, present in the primary phase of disease, have more aggressive and advanced disease, and have higher ASA and CCI scores. Additionally, several social determinants of health were found to increase likelihood of super-utilization, including non-white race, Medicaid insurance, lack of insurance, lower levels of education, and lower levels of self-reported health literacy.

Racial and socioeconomic disparities in health care outcomes and quality measures such as 30-day readmission rates are well documented and must be addressed to provide equitable, high-value care for all patients (Joynt et al., 2011; Tsai et al., 2014). A 2014 study of Medicare beneficiaries found that Black patients were more likely to be readmitted following surgery than white patients (OR 1.19); this was compounded if the patients were seen at a "minority-serving" hospital (OR 1.34) (Tsai et al., 2014). A 2016 study of gynecologic oncology readmission rates found that race was significantly different between readmitted and not readmitted groups in univariable analysis, but this did not hold in multivariable analysis due to the small number of non-white patients within their sample (Uppal et al., 2016). Similarly, our hospital is not a predominantly minority-serving hospital, and although we determined a significantly higher rate of health care super-utilization among non-white patients in univariable analysis, this did not hold in multivariable analysis.

Super-utilizers at our institution were also more likely to have Medicaid or other governmental insurance. Addressing disparities in access to health insurance and health care is necessary to reduce the risk of health care super-utilization among underinsured, minority patients. Improvements in gynecologic oncology screening and diagnostic practices, particularly among racial minorities and patients with lower socioeconomic status, may also lead to earlier detection and treatment, which may in turn decrease the need for acute care services among these patients. Improving racial disparities in pain management may also reduce rates of unplanned acute care (Badreldin et al., 2019; Stein et al., 2016). Super-utilizers in our study also reported lower levels of
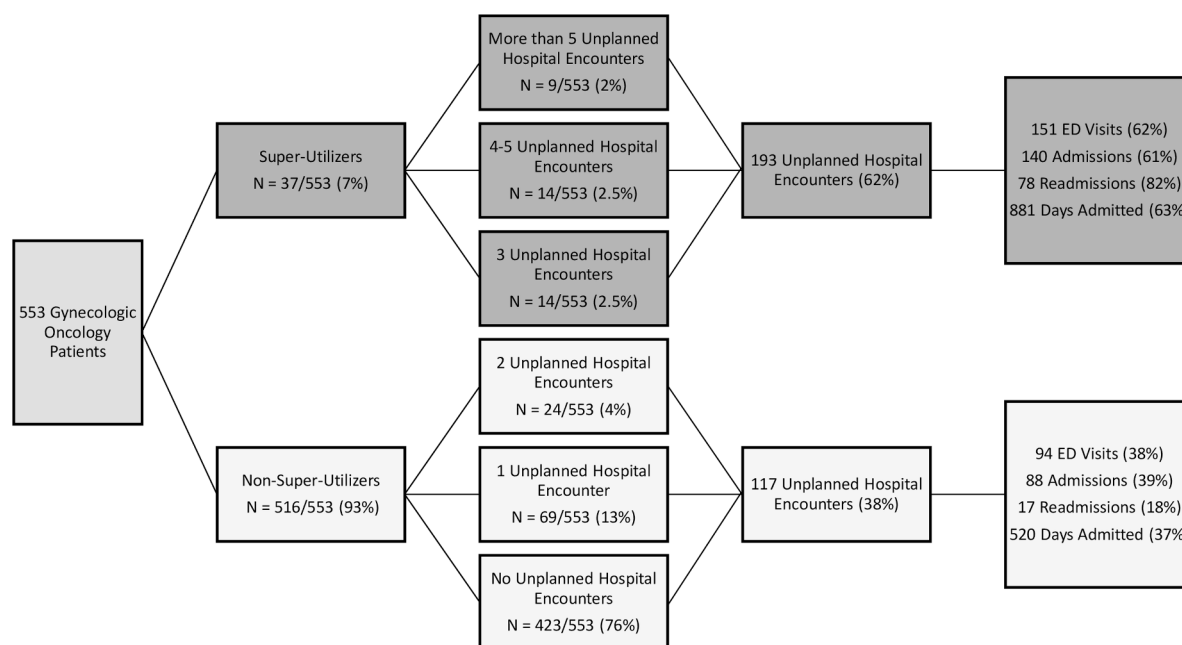

Fig. 1. Summary of Gynecologic Oncology Health Care Utilization Among Super- and Non-Super-Utilizers. We identified 553 unique gynecologic oncology patients who met inclusion criteria for this study. Of those, 37 (7%) met super-utilizer criteria, accounting for 193/310 (62%) unplanned hospital encounters during the study period for a combined total of 151/245 (62%) visits to the emergency department, 140/228 (61%) inpatient admissions, 78/95 (82%) readmissions, and 881/1401 (63%) days admitted. Non-super-utilizer unplanned encounters were also reviewed and are summarized for comparison.

Table 5

Super-Utilizer Unplanned Hospital Encounter Characteristics and Outcomes.

	Index Visits (N = 37) N (%)	All Unplanned Encounters (N = 193) N (%)
Total ED visits	25 (68%)	151 (78%)
ED visit with admission	13 (35%)	99 (51%)
ED visit without admission	12 (32%)	52 (27%)
Direct admission from clinic/provider	7 (19%)	29 (15%)
Total transfers from OSH	5 (14%)	12 (6%)
Transfer from OSH with admission	4 (11%)	11 (6%)
Transfer from OSH without admission	1 (3%)	1 (1%)
Other Unplanned Encounters*	0 (0%)	1 (1%)
Total Admissions	24 (65%)	140 (73%)
Readmissions	4 (11%)	78 (40%)
Admitting Service		
Gynecologic Oncology	17 (71%)	94 (67%)
Internal Medicine	4 (17%)	30 (21%)
General Gynecology	2 (8%)	2 (1%)
Other**	1 (4%)	14 (10%)
Days from last oncologic treatment tounplanned encounter, Median (IQR)	26 (1–277)	25 (0–685)
Presenting Symptoms		
Gastrointestinal	23 (62%)	118 (61%)
Pain	21 (57%)	128 (66%)
Hematologic	17 (46%)	99 (51%)
Genitourinary/Renal	14 (38%)	80 (41%)
Cardiovascular	13 (35%)	61 (32%)
Infection	12 (32%)	55 (28%)
Fatigue	10 (27%)	56 (29%)
Neurologic/Psychiatric	10 (27%)	43 (22%)
Gynecologic	8 (22%)	29 (15%)
Respiratory	7 (19%)	38 (20%)
Chemotherapy-associated toxicity	5 (14%)	28 (15%)
Complication related to surgery	4 (11%)	9 (5%)
Radiation-associated toxicity	2 (5%)	13 (7%)
Equipment Malfunction	1 (3%)	17 (9%)
Pain Location		
Abdomen/pelvis	16 (43%)	93 (48%)
Back/flank	5 (14%)	28 (15%)
Other	6 (16%)	56 (29%)
GI Symptoms		
Nausea	16 (43%)	89 (46%)
Emesis	11 (30%)	61 (32%)
Diarrhea	5 (14%)	22 (11%)
Constipation	5 (14%)	18 (9%)
Abdominal pain	8 (22%)	50 (26%)
Anorexia	14 (38%)	52 (27%)
Abdominal distention	3 (8%)	15 (8%)
Ascites	2 (5%)	10 (5%)
Dysphagia	1 (3%)	3 (2%)
Other	0 (0%)	9 (5%)
Disposition		
Home with self-care	33 (89%)	146 (76%)
Home with home health	2 (5%)	14 (7%)
Transferred to nonhospital facility	1 (3%)	8 (4%)
Left ED without being seen	1 (3%)	5 (3%)
Left against medical advice	0 (0%)	4 (2%)
In hospital mortality	0 (0%)	3 (2%)
Hospice/home palliative care	0 (0%)	13 (7%)

Abbreviations: ED: emergency department; OSH: outside hospital.
* Other unplanned encounters included an unplanned admission following an aborted surgical procedure.
** Other Admitting Services included Palliative Care, Emergency General Surgery, Cardiology, Geriatrics, MICU, Pediatric Oncology, and Psychiatry.

education and health literacy. Understanding of health information is crucial for patient activation and engagement in their care (Miller, 2016; Hibbard, 2017). Educational materials and patient-provider communication platforms can further increase patient activation and should be intentionally developed for patients with socioeconomic risk factors for health care super-utilization (Hay et al., 2016; Schnock et al., 2019;

Jansen et al., 2018).

Clinical characteristics that were associated with higher rates of health care super-utilization included higher ASA and CCI scores, suggesting that these scores could be used as indicators for the implementation of educational or other care coordination initiatives aimed at reducing preventable unplanned acute care encounters. Similar to prior studies, gastrointestinal symptoms and pain were the most common presenting symptoms for unplanned hospital encounters (Aprile et al., 2013; Hay et al., 2018). Hematologic symptoms (anemia 38%, active bleeding 17%) were more common among our super-utilizers than previously reported by Hay and colleagues (anemia 4%) (Hay et al., 2018). Prior studies assessing post-operative readmission rates found that 30–45% of readmissions were due to infectious symptoms (Nakayama et al., 2015; Wilbur et al., 2016; Uppal et al., 2016). Infectious symptoms were identified in 28% of all unplanned encounters and 32% of index unplanned encounters among super-utilizers in our study. Only 4 patients had surgery within 30-days prior to their index unplanned encounter, however, 75% (3/4) of these patients experienced post-surgical infectious complications. Optimal pain and symptom management and maintenance of best practices for prevention of surgical site infections and post-operative infections could reduce rates of unplanned hospital encounters. Additionally, similar to rates reported by Hay and colleagues, over half of unplanned super-utilizer encounters occurred outside of standard work hours suggesting that improved patient-provider communication platforms (e.g., telemedicine, patient portals), extended hours, or education about outpatient urgent care services may reduce unplanned hospital encounters (Hay et al., 2018).

Super-utilizers also tended to have more advanced cancer stage. Interestingly, however, most of the super-utilizers at our institution presented in the primary phase of their disease, and nearly one third presented at the time of new diagnosis of gynecologic malignancy. This is higher than was previously reported by Hay and colleagues, which found that only 8% of super-utilizers presented at the time of new diagnosis (Hay et al., 2018). Additionally, prior studies suggested that patients with ovarian cancer have the highest rates of readmission and super-utilization among gynecologic oncology patients (Henretta et al., 2011; Hay et al., 2018). However, the most common primary cancer site among our super-utilizers was uterine/endometrial cancer, and we found no significant difference in primary cancer sites between super-utilizers and non-super-utilizers at our institution. In addition to addressing anticipated super-utilization among patients with aggressive cancers nearing the end of life, high rates of unplanned acute care utilization among patients with newly diagnosed malignancies may be related to a lack of understanding of their disease, symptoms, and management strategies. Early patient education about expected symptoms, management strategies, and indications for seeking additional care could potentially minimize unplanned hospital encounters and better meet patients' oncologic needs at the time of their new diagnoses.

Improved understanding of risk factors and common presenting symptoms among gynecologic oncology patients with high rates of unplanned acute care can inform strategies for improving patient activation, understanding, and management of their symptoms. Although most unplanned encounters in our study resulted in inpatient admissions, the unplanned encounters that did not require admission represent potentially preventable encounters that could be managed with outpatient care strategies. In addition to developing education materials and communication platforms for patients with high rates of health care super-utilization, a potential strategy for reducing unnecessary acute care among super-utilizers could be the development of web-based, self-assessment tools and treatment algorithms similar to those popularized for used as screening tools during the COVID-19 pandemic (Mehring et al., 2020). Additionally, unplanned encounters for pain control and palliative care could also have been mitigated with earlier referrals and increased use of outpatient palliative care services.

Patient reported outcomes (PROs) represent another strategy for reducing super-utilization. A recent study showed that use of electronic

PROs for symptom monitoring among patients with metastatic solid tumors was not only associated with increased survival and prolonged toleration of chemotherapy but also decreased rates of admission to an emergency department (Basch et al., 2016; Basch et al., 2017). Since then, use of PROs has been successfully integrated into the care of patients with ovarian cancer who are enrolled in clinical trials (Wilson et al., 2018; Hilpert and Du Bois, 2018). While these studies focused on the common symptoms experienced during chemotherapy, use of electronic PROs in the routine care of gynecologic oncology patients with high risk for health care super-utilization with an emphasis on common presenting symptoms (gastrointestinal symptoms, pain) may reduce the number of unplanned hospital encounters among these patients. Preventing unnecessary hospital encounters can minimize financial and emotional burdens for both patients and providers and would allow patients to interact with familiar providers who can help them learn how to anticipate and manage symptoms that may not require emergent care.

4.1. Limitations

Our study has several limitations. First, this study was conducted at a single academic institution with a limited sample size and may not be generalizable to patients at other institutions. Given our small sample size of super-utilizers, our study may be underpowered to detect true differences in the cohorts. Additionally, data collection for this study was retrospective and involved manual data extraction from electronic medical records. This introduces subjectivity of data extraction by the research team and relies on accuracy of documentation in medical records. There may also be unmeasured confounding variables that were not accounted for in our analysis. Furthermore, except for transfers from outside hospitals, we were not able to track unplanned hospital encounters outside of our institution. Thus, health care utilization among both super-utilizers and non-super-utilizers may have actually been greater than what we were able to discern from review of our institution's medical records. It was also difficult to determine the health status of patients who were discharged with home hospice or palliative care who have not returned to our institution for care. Thus, a greater proportion of super-utilizers may have passed away than are reflected in the EMR. Finally, symptoms were manually extracted from the EMR by research team members and not directly reported by patients.

5. Conclusion

Institutional and national initiatives are necessary for reducing health care expenditures and promoting patient-centered, cost-effective among high-need, high-cost patients who constitute a small percentage of the population yet account for a disproportionately high amount of health care utilization. This study offers new information about the prevalence of and risk factors for health care super-utilization among gynecologic oncology patients that can be used to inform strategies for reducing preventable unplanned encounters. In addition to maintaining appropriate palliative care strategies for patients with aggressive cancers and advanced disease, improved patient education at the time of cancer diagnosis with symptom monitoring and mechanisms for patient-reported outcomes may reduce unplanned encounters among newly diagnosed patients in the primary phase of disease.

CRediT authorship contribution statement

Catherine N. Zivanov: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Visualization. **Annie Apple:** Investigation, Writing - review & editing. **Alaina J. Brown:** Conceptualization, Methodology, Writing - review & editing. **Marc A. Robinson:** Software, Data curation, Writing - review & editing. **Lauren S. Prescott:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Formal analysis, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Aprile, G., Pisa, F.E., Follador, A., et al., 2013. Unplanned presentations of cancer outpatients: a retrospective cohort study. Support. Care Cancer 21 (2), 397–404. https://doi.org/10.1007/s00520-012-1524-6.

Badreldin, N., Grobman, W.A., Yee, L.M., 2019. Racial Disparities in Postpartum Pain Management. Obstet. Gynecol. 134 (6), 1147–1153. https://doi.org/10.1097/AOG.0000000000003561.

Barbera, L., Taylor, C., Dudgeon, D., 2010. Why do patients with cancer visit the emergency department near the end of life? CMAJ 182 (6), 563–568. https://doi.org/10.1503/cmaj.091187.

Basch, E., Deal, A.M., Dueck, A.C., et al., 2017. Overall Survival Results of a Trial Assessing Patient-Reported Outcomes for Symptom Monitoring During Routine Cancer Treatment. JAMA 318 (2), 197–198. https://doi.org/10.1001/jama.2017.7156.

Basch, E., Deal, A.M., Kris, M.G., et al., 2016. Symptom Monitoring With Patient-Reported Outcomes During Routine Cancer Treatment: A Randomized Controlled Trial [published correction appears in J Clin Oncol. 2016 Jun 20;34(18):2198] [published correction appears in J Clin Oncol. 2019 Feb 20;37(6):528]. J. Clin. Oncol. 34(6), 557–565. http://dx.doi.org/10.1200/JCO.2015.63.0830.

Brooks, G.A., Li, L., Uno, H., Hassett, M.J., Landon, B.E., Schrag, D., 2014. Acute hospital care is the chief driver of regional spending variation in Medicare patients with advanced cancer. Health Aff (Millwood). 33 (10), 1793–1800. https://doi.org/10.1377/hlthaff.2014.0280.

Brooks, G.A., Kansagra, A.J., Rao, S.R., Weitzman, J.I., Linden, E.A., Jacobson, J.O., 2015. A Clinical Prediction Model to Assess Risk for Chemotherapy-Related Hospitalization in Patients Initiating Palliative Chemotherapy. JAMA Oncol. 1 (4), 441–447. https://doi.org/10.1001/jamaoncol.2015.0828.

Brooks, G.A., Jacobson, J.O., Schrag, D., 2015. Clinician perspectives on potentially avoidable hospitalizations in patients with cancer. JAMA Oncol. 1 (1), 109–110. https://doi.org/10.1001/jamaoncol.2014.155.

Brown, A.J., Sun, C.C., Prescott, L.S., Taylor, J.S., Ramondetta, L.M., Bodurka, D.C., 2014. Missed opportunities: Patterns of medical care and hospice utilization among ovarian cancer patients. Gynecol. Oncol. 135 (2), 244–248. https://doi.org/10.1016/j.ygyno.2014.08.039.

U.S. Census Bureau; American Community Survey, 2018. American Community Survey 1-Year Estimates, Tables B19001, B19013, B19301, S1902, B19049; generated using data.census.gov; <https://data.census.gov/cedsci/>; (19 December 2019).

Charlson, M., Szatrowski, T.P., Peterson, J., Gold, J., 1994. Validation of a combined comorbidity index. J. Clin. Epidemiol. 47 (11), 1245–1251. https://doi.org/10.1016/0895-4356(94)90129-5.

Clark, R.M., Growdon, W.B., Wiechert, A., et al., 2013. Patient, treatment and discharge factors associated with hospital readmission within 30 days after surgical cytoreduction for epithelial ovarian carcinoma. Gynecol. Oncol. 130 (3), 407–410. https://doi.org/10.1016/j.ygyno.2013.05.034.

Elsayem, A.F., Merriman, K.W., Gonzalez, C.E., et al., 2016. Presenting Symptoms in the Emergency Department as Predictors of Intensive Care Unit Admissions and Hospital Mortality in a Comprehensive Cancer Center. J. Oncol. Pract. 12 (5), e554–e563. https://doi.org/10.1200/JOP.2015.009019.

Handley, N.R., Schuchter, L.M., Bekelman, J.E., 2018. Best Practices for Reducing Unplanned Acute Care for Patients with Cancer. J Oncol Pract. 14 (5), 306–313. https://doi.org/10.1200/JOP.17.00081.

Harris, P.A., Taylor, R., Thielke, R., et al., 2009. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. J. Biomed. Inform. 42 (2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010.

Harris, P.A., Taylor, R., Minor, B.L., et al., 2019. The REDCap consortium: Building an international community of software platform partners. J. Biomed. Inform. 95, 103208 https://doi.org/10.1016/j.jbi.2019.103208.

Hay, C.M., Kelley 3rd, J.L., Edwards, R.P., Pombier, K.M., Comerci Jr., J.T., 2018. Super-Utilization of Health Care Resources Among Gynecologic Oncology Patients. Am. J. Med. Qual. 33 (5), 509–513. https://doi.org/10.1177/1062860618757343.

Hay, J.L., Zabor, E.C., Kumar, J., Brennessel, D., Kemeny, M.M., Lubetkin, E.I., 2016. Cancer beliefs and patient activation in a diverse, multilingual primary care sample. Psychooncology. 25 (9), 1071–1078. https://doi.org/10.1002/pon.4196.

Henretta, M.S., Scalici, J.M., Engelhard, C.L., Duska, L.R., 2011. The revolving door: hospital readmissions of gynecologic oncology patients. Gynecol. Oncol. 122 (3), 479–483. https://doi.org/10.1016/j.ygyno.2011.05.011.

Hibbard, J., 2017. Patient Activation and Health Literacy: What's the Difference? How Do Each Contribute to Health Outcomes. Stud. Health Technol. Inform. 240, 251–262.

Hilpert, F., Du Bois, A., 2018. Patient-reported outcomes in ovarian cancer: are they key factors for decision making? Expert Rev. Anticancer Ther. 18 (sup1), 3–7. https://doi.org/10.1080/14737140.2018.1516146.

Horwitz, L.I., Partovian, C., Lin, Z., et al., 2014. Development and use of an administrative claims measure for profiling hospital-wide performance on 30-day unplanned readmission. Ann. Intern. Med. 161 (10 Suppl), S66–S75. https://doi.org/10.7326/M13-3000.

Hurria, A., Togawa, K., Mohile, S.G., et al., 2011. Predicting chemotherapy toxicity in older adults with cancer: a prospective multicenter study. J. Clin. Oncol. 29 (25), 3457–3465. https://doi.org/10.1200/JCO.2011.34.7625.

Jansen, F., Coupé, V.M.H., Eerenstein, S.E.J., Leemans, C.R., Verdonck-de Leeuw, I.M., 2018. Costs from a healthcare and societal perspective among cancer patients after total laryngectomy: are they related to patient activation? Support. Care Cancer 26 (4), 1221–1231. https://doi.org/10.1007/s00520-017-3945-8.

Jiang, H.J., Weiss, A.J., Barrett, M.L., 2017. Characteristics of Emergency Department Visits for Super-Utilizers by Payer, 2014: Statistical Brief #221. 2017 Feb. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]. Agency for Healthcare Research and Quality (US), Rockville (MD).

Joynt, K.E., Orav, E.J., Jha, A.K., 2011. Thirty-day readmission rates for Medicare beneficiaries by race and site of care. JAMA 305 (7), 675–681. https://doi.org/10.1001/jama.2011.123.

Mann, C., 2013. Department of Health and Human Services; Center for Medicaid and CHIP Services. Targeting Medicaid Super-Utilizers to Decrease Costs and Improve Quality. https://www.medicaid.gov/federal-policy-guidance/downloads/cib-07-24-2013.pdf (Published July 24, 2013).

Manzano, J.G., Luo, R., Elting, L.S., George, M., Suarez-Almazor, M.E., 2014. Patterns and predictors of unplanned hospitalization in a population-based cohort of elderly patients with GI cancer. J. Clin. Oncol. 32 (31), 3527–3533. https://doi.org/10.1200/JCO.2014.55.3131.

Mariotto, A.B., Yabroff, K.R., Shao, Y., Feuer, E.J., Brown, M.L., 2011. Projections of the cost of cancer care in the United States: 2010–2020 [published correction appears in J Natl Cancer Inst. 2011 Apr 20;103(8):699]. J. Natl Cancer Inst. 103 (2), 117–128. https://doi.org/10.1093/jnci/djq495.

Mehring, W.M., Poksay, A., Kriege, J., et al., 2020. Initial Experience with a COVID-19 Web-Based Patient Self-assessment Tool [published online ahead of print, 2020 Jun 15]. J. Gen. Intern. Med. 1–2 https://doi.org/10.1007/s11606-020-05893-0.

Miller, K.L., 2016. Patient centered care: A path to better health outcomes through engagement and activation. NeuroRehabilitation. 39 (4), 465–470. https://doi.org/10.3233/NRE-161378.

Nakayama, J.M., Ou, J.P., Friedman, C., Smolkin, M.E., Duska, L.R., 2015. The Risk Factors of Readmission in Postoperative Gynecologic Oncology Patients at a Single Institution. Int. J. Gynecol. Cancer. 25 (9), 1697–1703. https://doi.org/10.1097/IGC.0000000000000535.

Panattoni, L., Fedorenko, C., Greenwood-Hickman, M.A., et al., 2018. Characterizing Potentially Preventable Cancer- and Chronic Disease-Related Emergency Department Use in the Year After Treatment Initiation: A Regional Study. J. Oncol. Pract. 14 (3), e176–e185. https://doi.org/10.1200/JOP.2017.028191.

Schnock, K.O., Snyder, J.E., Fuller, T.E., et al., 2019. Acute Care Patient Portal Intervention: Portal Use and Patient Activation. J. Med. Internet Res. 21(7), e13336. Published 2019 Jul 18. http://dx.doi.10.2196/13336.

Siegel, R.L., Miller, K.D., Jemal, A., 2020. Cancer statistics, 2020. CA Cancer J. Clin. 70 (1), 7–30.

Stein, K.D., Alcaraz, K.I., Kamson, C., Fallon, E.A., Smith, T.G., 2016. Sociodemographic inequalities in barriers to cancer pain management: a report from the American Cancer Society's Study of Cancer Survivors-II (SCS-II). Psychooncology. 25 (10), 1212–1221. https://doi.org/10.1002/pon.4218.

Tsai, T.C., Orav, E.J., Joynt, K.E., 2014. Disparities in surgical 30-day readmission rates for Medicare beneficiaries by race and site of care. Ann. Surg. 259 (6), 1086–1090. https://doi.org/10.1097/SLA.0000000000000326.

Uppal, S., Penn, C., Del Carmen, M.G., Rauh-Hain, J.A., Reynolds, R.K., Rice, L.W., 2016. Readmissions after major gynecologic oncology surgery. Gynecol. Oncol. 141 (2), 287–292. https://doi.org/10.1016/j.ygyno.2016.02.031.

Wilbur, M.B., Mannschreck, D.B., Angarita, A.M., et al., 2016. Unplanned 30-day hospital readmission as a quality measure in gynecologic oncology. Gynecol. Oncol. 143 (3), 604–610. https://doi.org/10.1016/j.ygyno.2016.09.020.

Wilson, M.K., Mercieca-Bebber, R., Friedlander, M., 2018. A practical guide to understanding, using and including patient reported outcomes in clinical trials in ovarian cancer. J. Gynecol. Oncol. 29 (5), e81 https://doi.org/10.3802/jgo.2018.29.e81.