Intensity of end-of-life care for gynecologic cancer patients by primary oncologist specialty

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HIGHLIGHTS

⇒ Having a gynecologic rather than a medical oncologist was associated with lower rates of high-intensity end-of-life care.
⇒ Having a gynecologic oncologist rather than a medical oncologist was associated with higher rates of invasive procedures.
⇒ Having a gynecologic oncologist rather than a medical oncologist was associated with higher Medicare spending.

ABSTRACT

Objective The association of primary oncologist specialty, medical oncology versus gynecologic oncology, on intensity of care at the end of life in elderly patients with gynecologic cancer is unclear.

Methods This retrospective cohort study used Surveillance, Epidemiology and End Results-Medicare (SEER-M) data. Subjects were fee-for-service Medicare enrollees aged 65 years and older who died of a gynecologic cancer between January 2006 and December 2015. The primary outcome was a composite score for high-intensity care received in the last month of life. Secondary outcomes included invasive procedures and Medicare spending in the last month of life. Simple and multivariable linear and logistic regression analyses evaluated differences in outcomes by primary oncologist specialty. Linear regressions were repeated after creating a more similar control group through nearest-neighbor propensity score matching.

Results Of 12 189 patients, 7705 (63%) had a medical primary oncologist in the last year of life. In adjusted analyses, patients with a gynecologic versus medical primary oncologist received lower rates of high-intensity end-of-life care (53.9% vs 56.6%; p=0.018). Results were similar for the propensity score-matched cohorts. However, having a gynecologic versus medical primary oncologist was associated with higher rates of invasive procedures in the last month of life (43% vs 41%; p=0.014) and higher Medicare spending ($83 859 vs $74 849; p=0.004).

Conclusions Both specialties engage in overall high levels of intense end-of-life care, with differences by specialty in aspects of aggressive care and spending at the end of life. Physician-level training could be a target for educational or quality improvement initiatives to improve end-of-life cancer care delivery.

INTRODUCTION

Aggressive medical end-of-life care has been associated with worse quality of life in patients with advanced cancer and worse adjustment for their bereaved caregivers.[1] Older women with ovarian cancer increasingly experience high-intensity medical care in the last year of life, despite increasing rates of hospice utilization.[2] These trends are consistent with evidence that healthcare utilization by gynecologic cancer patients increases significantly in the last 2 months of life.[3] Subsequent high healthcare costs are associated with a worse quality of life immediately prior to death, and have been shown to be decreased by end-of-life discussions.[4]

Understanding the role of the primary oncologist at the end of life is imperative because the majority of gynecologic cancer patients are fully managed by their primary oncology provider, with only a minority cared for by palliative care specialists.[5 6] Gynecologic oncology patients may get their care with either a gynecologic oncologist, who can provide both surgical and medical treatments, or a medical oncologist, who provides only medical treatments. In addition to their medical training, medical and gynecologic oncologists differ in their scope of practice, degree of specialization, and practice structures, all of which may influence their approach to end-of-life care. A prior study found that primary oncology provider specialty does not impact cancer survival outcomes, although gynecologic oncologists provide overall less aggressive chemotherapy treatment.[7] A recent study evaluating physician influence on aggressive end-of-life care among women who died of ovarian cancer found that physician specialty was associated with differences in hospice enrollment, chemotherapy, and life-extending procedures.[8] However, the study did not examine other gynecologic cancer sites and did not directly compare medical oncologists with gynecologic oncologists.

A greater understanding of the impact of primary oncologist specialty on end-of-life care is important as gynecologic oncology continues to develop collaborative models of care and works to improve palliative care and end-of-life training.[9 10] The objectives of this study were to examine the association of primary oncologist specialty on intensity of care and Medicare spending with end of life among gynecologic cancer patients.

METHODS

Data

This retrospective cohort study used Surveillance, Epidemiology and End Results-Medicare (SEER-M) data, which are drawn from a nationally representative sample of United States cancer patients and are linked with Medicare claims data.[11] In accordance with the journal's guidelines, we will provide our data for the reproducibility of this study in other centers if such is requested.

Study Population

Our cohort included female patients who died of a gynecologic cancer (ovary, uterus, cervix, vagina, vulva, or other female genital site) between January 2006 to December 2015, were enrolled in Medicare Parts A and B for the last 12 months of life, and did not have end-stage renal disease. We excluded patients who had more than one gynecologic cancer, a cancer that was diagnosed on autopsy, inconsistent SEER and Medicare dates of death, or zero outpatient visits with a gynecologic or medical oncologist in the last year of life (Online supplemental figure 1). In addition to this full cohort sample, we created a smaller sample of propensity score-matched patients (Online supplemental file).

Exposure

Medical and gynecologic oncologists were identified using the specialty listed in physician claims. Gynecologic oncologists were defined as any providers who had any specialty codes of "Gynecological/Oncology" (specialty code 98). Medical oncologists were defined as any providers who had any specialty codes of "Medical Oncology" (specialty code 90) or "Hematology/Oncology" (specialty code 83). This variable has been shown to accurately identify physician specialty in over 80% of oncologists.[12 13]

Each patient was assigned to a primary medical oncologist or a primary gynecologic oncologist based on the specialty of their primary oncologist, defined as the provider with the plurality of outpatient oncology visits in the last year of life. A similar algorithm was found to correctly attribute approximately 85% of patients to their anti-cancer treatment-prescribing oncologist.[14] Outpatient visits were identified based on Healthcare Common Procedure Coding System (HCPCS) codes (Online supplemental table 4). Ties were broken by assigning the patient to the last outpatient provider seen before death. See Online supplemental file for details on additional sensitivity analyses.

Primary Outcome

The primary outcome, high-intensity end-of-life care, was a binary composite score of intense care in the last 30 days of life. The score has been used in prior literature examining end-of-life care in patients with cancer.[15 16] The composite score was defined by any of the following: receipt of chemotherapy in the last 14 days of life,[17 18] death in the hospital,[17–19] enrollment in hospice for less than 3 days,[17 18] more than one emergency department visit in the last 30 days of life,[17–20] more than one hospital admission in the last 30 days of life,[17 18 20] spending more than 14 days in the hospital in the last 30 days of life,[3 17] or any intensive care unit (ICU) admission in the last 30 days of life.[17–20] We also examined each individual component of the composite score.

Secondary Outcomes

The secondary outcomes included invasive procedures in the last 30 days of life[3] and Medicare spending in the last 30 days of life. Invasive procedures were defined as any invasive procedure, test, or part of care that involved some amount of pain or discomfort. Over 1200 HCPCS and International Classification of Diseases (ICD) codes were manually selected. Invasive procedure categories included surgery, biopsies, cardiac catheterization and procedures, central lines, cardiopulmonary resuscitation, dialysis, drain insertion or exchange, upper and lower endoscopy, gastrostomy tube placement or exchange, incision and drainage, intubation, interventional radiology procedures, total parenteral nutrition, tracheostomy, indwelling bladder catheterization, mechanical ventilation, and wound care. Non-invasive tests, venipuncture, injections, and medications were excluded.

Medicare spending was defined as the total allowed Medicare payment amount, a sum of Medicare spending in the last 30 days of life for inpatient and outpatient, physician/suppliers, home health agency, hospice, durable medical equipment, and Medicare Part D claims. Suppliers includes non-physician providers including advanced practice providers, social workers, some laboratories, emergency medical services providers, and some ambulatory surgical centers. Claims within 30 days after the date of death were included to allow for a lagged claims submission.

Statistical Analysis

We used linear regression models to estimate the association between primary oncologist specialty and the intense end-of-life binary composite score. Simple (bivariate) and multivariable linear regressions were conducted for each of the three cohorts: (1) entire study population; (2) propensity score-matched with replacement; and (3) propensity score-matched without replacement. The multivariable linear regression for the entire study population included covariates for age at death, race, ethnicity, marital status, median income of residential zip code, percent of people with less than a high school education in the residential zip code, SEER registry source, residential urban status, year of diagnosis, year of death, cancer site, cause of death, stage at diagnosis, Medicare/Medicaid dual eligibility, and Charlson Comorbidity Index (CCI) at death. The multivariable linear regression for the propensity score-matched cohorts included only unbalanced covariates. We repeated these analyses with logistic rather than linear regressions.

Similar linear regression models tested the association between specialty of the primary oncologist and other outcomes: each component of the composite score, the secondary outcomes listed earlier, and the composite score by cancer site. Standard errors for all models were clustered at the primary oncologist level. All statistical tests were considered significant at $p<0.05$. All analyses were performed with Stata 15.0.[21] This study was reviewed by the University of Pennsylvania institutional review board and was determined to be exempt.

RESULTS

Cohort

A total of 22 554 women who met the following initial criteria were assessed for eligibility. The final cohort included 12 189 women. Overall, most of the cohort was aged less than 80 years (61%), White (>80%), and died of ovarian cancer (55%). Medical oncologists served as the primary oncologist for the majority of patients

Table 1 Patient characteristics

Covariate	Total (n=12 189)	Patients of medical oncologists (n=7705)	Patients of gynecologic oncologists (n=4484)	P value
Age at death, years (%)				<0.001
66–70	20.5	20.2	21.0	
71–74	19.0	19.2	18.6	
75–79	21.7	22.4	20.5	
80–84	19.4	20.1	18.2	
≥85	19.5	18.1	21.7	
Race (%)				<0.001
White	>80	>80	>80	
Black	8.4	7.0	10.8	
Asian or Pacific Islander	4.1	3.8	4.5	
Other or Unknown	<1	<1	<1	
Hispanic	5.9	6.1	5.6	0.22
Married	43.8	45.5	41.0	<0.001
Charlson Comorbidity Index, year prior to death (%)				0.007
0	54.3	54.0	54.8	
1	24.5	24.9	24.0	
2	10.0	10.4	9.2	
≥3	8.3	8.2	8.5	
Unknown	2.9	2.6	3.5	
Cause of death, cancer site (%)				<0.001
Ovary	55.1	60.8	45.4	
Uterus	31.4	28.5	36.4	
Cervix	6.9	6.2	8.1	
Vulva	3.7	2.1	6.4	
Vagina	1.3	1.0	1.7	
Other	1.7	1.5	2.0	
Stage at diagnosis (%)				<0.001
I	11.3	10.0	13.5	
II	6.8	6.3	7.4	
III	36.0	35.6	36.6	
IV	32.3	34.7	28.2	
Unknown	13.7	13.3	14.3	
Urban/rural location (%)				<0.001
Big metropolitan	>50	>50	>50	
Metropolitan	30.4	32.0	27.7	
Urban	5.6	6.5	4.0	
Less urban	7.1	6.9	7.5	
Rural	2.0	2.2	2.2	
Unknown	<1	<1	<1	
Medicare/Medicaid dual eligible (%)	16.3	15.5	17.5	0.005

Continued

Table 1 Continued

Covariate	Total (n=12 189)	Patients of medical oncologists (n=7705)	Patients of gynecologic oncologists (n=4484)	P value
Zip code percent less than high school education (%)				<0.001
<5	15.7	15.1	16.6	
5–9.9	29.8	30.9	28.1	
10–19.9	32.7	31.9	34.2	
20–29.9	14.2	14.0	14.5	
≥30	6	6.5	5.1	
Unknown	1.6	1.6	1.4	
Zip code median income (%)				0.26
<$20 000	<1	<1	<1	
$20 000–$44 999	25.6	24.9	26.8	
$45 000–$139 999	70.7	71.3	69.6	
$140 000-$149 999	0.7	0.7	0.6	
≥$150 000	1	1	0.9	
Unknown	<2	<2	<2	
Registry, year of death (%)				<0.001
San Francisco	3.3	3.9	2.3	
Connecticut	6.5	6.0	7.2	
Detroit	5.5	3.7	8.7	
Hawaii	0.8	0.5	1.4	
Iowa	6.5	5.9	7.4	
New Mexico	2.2	1.4	3.5	
Seattle	6.0	6.7	4.9	
Utah	2.3	2.9	1.2	
Atlanta	2.9	2.2	4.2	
San Jose	2.1	2.3	1.7	
Los Angeles	7.1	7.7	6.2	
Rural Georgia	<1	<1	<1	
Greater California	17.3	19.8	12.8	
Kentucky	5.8	4.2	8.7	
Louisiana	5.4	5.2	5.7	
New Jersey	16.9	18.7	13.8	
Greater Georgia	7.9	7.6	8.5	
Unknown	<2	<2	<2	

(n=7705, 63%) in the last year of life. Table 1 lists the patient characteristics.

High-Intensity End-of-Life Care

Overall, the majority of women in the cohort received high-intensity end-of-life care (n=6778, 56%). In unadjusted analyses, patients with a primary medical oncologist were slightly more likely to receive high-intensity end-of-life care (n=4354, 57%) compared with patients with a primary gynecologic oncologist (n=2424, 54%; p=0.028). A similar difference was seen in adjusted analyses (57% vs 54%; p=0.018) with gynecologic oncologists' patients having lower odds of receiving high-intensity end-of-life care (odds ratio (OR) 0.90, p=0.018). Similar results were seen in the propensity score-matched cohorts (Table 2).

Most patients who received high-intensity end-of-life care received only one measure of high-intensity care (Online supplemental figure 2). Figure 1 and Online supplemental table 5 show the components of the high-intensity end-of-life care composite score. Overall, 7% (n=855) received chemotherapy in the last 14 days of life, 15% (n=1879) died in the hospital, 11% (n=1313) were enrolled in hospice for less than 3 days, 14% (n=1748) had more than one emergency department visit, 13% (n=1545) had more than one hospital admission, 24% (n=2877) spent more than 14 days in the hospital, and 11% (n=1379) had an ICU admission in the last 30 days of life. In adjusted analyses, patients with a primary medical oncologist were more likely to receive chemotherapy in the last 14 days of life (8% vs 6%; p<0.001) and have more than

Table 2 Difference in composite rate of high-intensity end-of-life care by primary outpatient oncologist type

		Model 1: Simple			Model 2: Multivariable linear			Model 3: Multivariable logistic		
Cohort	n	Percent of intense end-of-life care (%)	95% CI	P value	Percent of intense end-of-life care (%)	95% CI	P value	OR	95% CI	P value
Entire cohort*										
Medical oncologist	7705	56.51	55.35 to 57.66	0.028	56.56	55.4 to 57.73	0.018	1	Ref.	0.018
Gynecologic oncologist	4484	54.06	52.2 to 55.92		53.97	52.21 to 55.72		0.90	0.82 to 0.98	
Propensity score-matched cohort, with replacement†										
Medical oncologist	2768	57.51	55.59 to 59.44	0.012	57.46	55.52 to 59.39	0.011	1	Ref.	0.011
Gynecologic oncologist	4484	54.06	52.2 to 55.92		54.1	52.38 to 55.81		0.87	0.78 to 0.97	
Propensity score-matched cohort, without replacement‡										
Medical oncologist	4484	56.91	55.40 to 58.42	0.020	56.78	55.27 to 58.29	0.027	1	Ref.	0.027
Gynecologic oncologist	4484	54.06	52.2 to 55.92		54.19	52.46 to 55.92		0.90	0.82 to 0.99	

*Covariates included in the multivariable regression models: age at death, race, ethnicity, marital status, median income of residential zip code at death, percent of people with less than a high school education in the residential zip code at death, SEER registry at death, residential urban status at death, year of diagnosis, year of death, cancer site, cause of death, stage at diagnosis, Medicare/Medicaid dual eligibility at death, and CCI at death.
†Covariates included in the multivariable regression models: SEER registry at death, cause of death, and CCI at death.
‡Covariates included in the multivariable regression models: SEER registry at death, cause of death, and year of death.
CCI, Charlson Comorbidity Index; CI, confidence interval; OR, odds ratio; Ref., reference; SEER, Surveillance, Epidemiology and End Results .

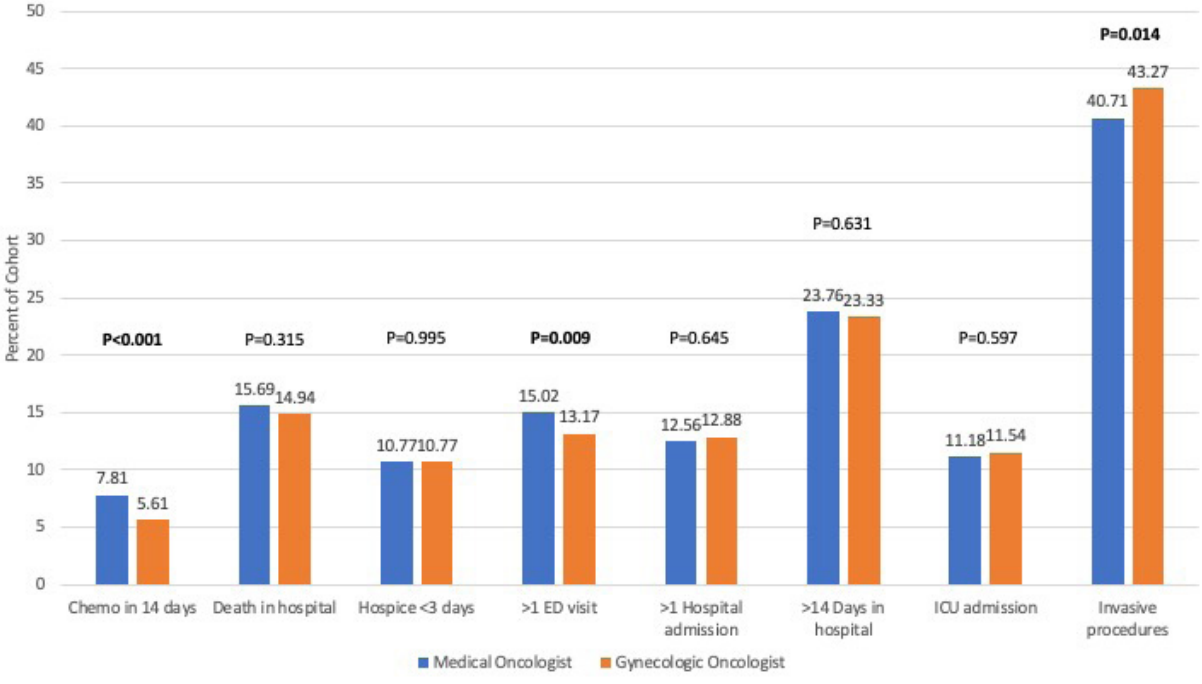

Figure 1 End-of-life care outcomes by primary oncologist specialty. ED, emergency department; ICU intensive care unit.

Table 3 Difference in overall Medicare spending in the last 30 days of life by primary outpatient oncologist type

Cohort	Model 1: Simple				Model 2: Multivariable		
	n	Medicare spending ($)	95% CI	P value	Medicare spending ($)	95% CI	P value
Entire cohort*							
Medical oncologist	7705	76 776	73 652 to 79 900	0.263	74 849	72 227 to 77 471	0.004
Gynecologic oncologist	4484	80 548	74 727 to 86 370		83 859	78 673 to 89 045	
Propensity score-matched cohort, with replacement†							
Medical oncologist	2768	75 769	70 650 to 80 888	0.227	73 192	68 451 to 77 933	0.013
Gynecologic oncologist	4484	80 548	74 725 to 86 371		82 139	77 246 to 87 032	
Propensity score-matched cohort, without replacement‡							
Medical oncologist	4484	75 678	71 675 to 79 681	0.177	73 629	70 184 to 77 074	0.003
Gynecologic oncologist	4484	80 548	74 726 to 86 370		82 597	77 867 to 87 327	

*Covariates included in the multivariable regression models: age at death, race, ethnicity, marital status, median income of residential zip code at death, percent of people with less than a high school education in the residential zip code at death, SEER registry at death, residential urban status at death, year of diagnosis, year of death, cancer site, cause of death, stage at diagnosis, Medicare/Medicaid dual eligibility at death, and CCI at death.
†Covariates included in the multivariable regression models: SEER registry at death, cause of death, and CCI at death.
‡Covariates included in the multivariable regression models: SEER registry at death, cause of death, and year of death.
CCI, Charlson Comorbidity Index; CI, confidence interval; SEER, Surveillance, Epidemiology and End Results .

one emergency department visit (15% vs 13%; p=0.009). Ovarian cancer was the only cancer site associated with a statistically significant difference in high-intensity end-of-life care by primary oncologist type (56% vs 53%; p=0.038), with gynecologic oncologists' patients having lower odds of receiving high-intensity end-of-life care (OR 0.89, p=0.044; Online supplemental table 6).

Invasive Procedures

Overall, 42% (n=5077) of women in the cohort received an invasive procedure in the last 30 days of life. In unadjusted analyses, there was not a significant difference in rates of invasive procedures between medical oncologists' patients (n=3155, 41%) compared with gynecologic oncologists' patients (n=1922, 43%; p=0.068). However, in adjusted analyses (Figure 1 and Online supplemental table 5), gynecologic oncologists' patients were more likely to undergo an invasive procedure (43%) compared with medical oncologists' patients (41%; p=0.014). The 25 most common procedure codes in the last 30 days of life are presented in Online supplemental table 7.

Medicare Spending

The mean Medicare spending in the last 30 days of life for the entire cohort was $76 776. In unadjusted analyses, there was not a significant difference in Medicare spending in the last 30 days of life between medical oncologists' patients ($76 776) compared with gynecologic oncologists' patients ($80 548; p=0.263). However, in adjusted analyses, care with gynecologic oncologists was associated with significantly higher spending compared with care with medical oncologists ($83 859 vs $74 849; p=0.004). Similar results were seen in the propensity score-matched cohorts (Table 3).

Table 4 shows Medicare spending in the last 30 days of life by claim type. In adjusted analyses, care from gynecologic oncologists was associated with higher Medicare spending for short stay, long stay, and skilled nursing facilities ($52 154 vs $44 203; p=0.010) compared with care from medical oncologists. Care from medical oncologists was associated with higher Medicare spending for physician/suppliers ($2643 vs $2350; p<0.001) and home health agencies ($1262 vs $1107; p=0.023) compared with care from gynecologic oncologists. There was no significant difference in Medicare spending for the following claim types by primary oncologist specialty: institutional outpatient providers (p=0.482), hospice (p=0.158), durable medical equipment (p=0.116), and Part D (p=0.475).

DISCUSSION

Summary of Main Results

Compared with patients who receive the majority of their cancer care from a medical oncologist, those who receive the majority of their cancer care from a gynecologic oncologist are less likely to receive high-intensity care, but more likely to undergo invasive procedures at the end of life. Overall, both specialties engage in high levels of intense end-of-life care, with rates consistent with those previously reported.[22–24] Similar to prior literature,[16] most patients who experienced high-intensity end-of-life care experienced only one measure of aggressive care. In addition, we found that patients with a primary gynecologic oncologist have higher Medicare spending in the last month of life compared with patients with a primary medical oncologist. Overall, these findings indicate that gynecologic oncology patients receive a high amount of aggressive medical end-of-life care, which may have implications for their quality of life at the end of life. Given the differences in end-of-life care between patients with a primary gynecologic oncologist versus a medical oncologist, physician-level training could be a target for educational or quality improvement initiatives to improve end-of-life cancer care delivery.

Results in the Context of Published Literature

We found higher rates of invasive procedures at the end-of-life than what has previously been reported. Lower rates of invasive procedures in other literature may be due to variation in inclusion

Table 4 Difference in Medicare spending in the last 30 days of life by primary outpatient oncologist type

		Model 1: Simple			Model 2: Multivariable*		
Parameter	**N**	**Spending ($)**	**95% CI**	**P value**	**Spending ($)**	**95% CI**	**P value**
Short stay, long stay, and skilled nursing facilities							
Medical oncologist	7705	46388	43 592 to 49185	0.528	44203	41 734 to 46672	0.010
Gynecologic oncologist	4484	48400	42 816 to 53983		52154	47 053 to 57255	
Physician/suppliers†(Medicare Part B)							
Medical oncologist	7705	2648	2551 to 2744	<0.001	2643	2560 to 2727	<0.001
Gynecologic oncologist	4484	2343	2202 to 2483		2350	2235 to 2466	
Institutional outpatient providers							
Medical oncologist	7705	9398	8727 to 10069	0.416	9427	8771 to 10083	0.482
Gynecologic oncologist	4484	9906	8882 to 10930		9856	8892 to 10821	
Hospice							
Medical oncologist	7705	15743	14 981 to 16504	0.035	16024	15 306 to 16743	0.158
Gynecologic oncologist	4484	17622	16 050 to 19194		17138	15 836 to 18439	
Home health agency							
Medical oncologist	7705	1277	1194 to 1360	0.005	1262	1180 to 1345	0.023
Gynecologic oncologist	4484	1082	974 to 1190		1107	1007 to 1207	
Durable medical equipment							
Medical oncologist	7705	194	164 to 224	0.827	177	149 to 204	0.116
Gynecologic oncologist	4484	188	148 to 229		218	174 to 262	
Part D							
Medical oncologist	7705	1128	974 to 1283	0.238	1112	960 to 1264	0.475
Gynecologic oncologist	4484	1007	879 to 1136		1035	901 to 1169	

*Covariates included in the multivariable regression models: age at death, race, ethnicity, marital status, median income of residential zip code at death, percent of people with less than a high school education in the residential zip code at death, SEER registry at death, residential urban status at death, year of diagnosis, year of death, cancer site, cause of death, stage at diagnosis, Medicare/Medicaid dual eligibility at death, and CCI at death.
†Suppliers includes non-physician providers including advanced practice providers, social workers, some laboratories, emergency medical services providers, and some ambulatory surgical centers.
CCI, Charlson Ccomorbidity lindex ; CI, confidence interval; SEER, Surveillance, Epidemiology and End Results .

criteria, as there is no validated standard definition.[7 23] Silber *et al* found no differences in operative procedures in the 5 years after the initial staging procedure by oncologist specialty.[7] Our finding that patients with a primary gynecologic oncologist are more likely to undergo invasive procedures in the last month of life may indicate that the timing of procedures over a patient's cancer course differs by primary oncologist specialty, and that gynecologic oncologists are more likely to offer invasive procedures, even in patients with a very poor prognosis. Many of these invasive procedures may be performed with palliative intent, but we were not able to determine the intent of the procedure in our data. Furthermore, our analysis assumed that the primary oncologist would be determining the appropriateness of a procedure, and we did not assess the specialty of the provider directly performing the procedure.

Differences in Medicare spending at the end of life by oncology specialty have not been previously reported. It has been established that cancer care spending increases at the end-of-life, driven mainly by inpatient spending.[25 26] Similarly, the majority of our observed differences in Medicare spending at the end of life are due to differences in inpatient spending, with gynecologic oncologist patients having significantly higher Medicare spending. While we do not find specialty differences in hospitalizations or ICU admissions in the last month of life to explain

spending differences, other studies have suggested that gynecologic cancer patients with high-cost admissions were more likely to undergo invasive procedures.[27] Therefore, it is possible that the higher rate of invasive procedures among gynecologic oncologist patients are contributing to higher Medicare spending.

This study captures new dimensions of specialty differences in cancer care compared with descriptions in previous work. A previous study that examined the role of the oncologist specialty in gynecologic cancer care was conducted by Silber *et al* (2007), who examined differences in care provided in the first 5 years of treatment. While the study found no differences in survival, it did find that gynecologic oncologist patients received less chemotherapy with fewer weeks of chemotherapy-associated toxicity than medical oncologist patients.[7] Our findings suggest that specialty differences in chemotherapy treatment may persist throughout a patient's cancer course, with medical oncologists being more likely to prescribe chemotherapy, even in the last weeks of life.

In a recently published study, Mullins *et al* (2021) found that physician characteristics did influence end-of-life care, although physician specialty was not meaningfully associated with variations in end-of-life care.[8] Similar to our study, they also used SEER-M data and found a similar distribution of patients to gynecologic oncologists versus medical oncologists at the end of life. However, they defined physician specialty differently, assigning physicians to gynecologic oncology, OB/GYN, oncology, or other. Their analyses also did not compare outcomes among patients with gynecologic oncologists versus those with medical oncologists directly. Furthermore, their study did not evaluate healthcare spending outcomes.

Strengths and Weaknesses

Our study provides a unique perspective on how oncologist specialty may be associated with differences in treatment course even in the last weeks of life. Strengths of the study include our large cohort from a national sample. Our careful definitions of the medical specialties allowed us to directly compare patients of only medical versus gynecologic oncologists. This comparison more accurately reflects how gynecologic cancer care is delivered in the United States compared with other literature. Our analyses by Medicare claim type provide a detailed examination of Medicare spending at the end of life. Finally, we performed several sensitivity analyses to evaluate the robustness of our findings.

Our study has several limitations. First, our cohort was limited to older patients who aged into Medicare and were enrolled in both Parts A and B. Practice patterns may be different for younger patients or those with commercial insurance or Medicare Advantage, which is an alternate insurance plan where Medicare services are subcontracted and overseen by commercial (private) insurers. Studies have found that end-of-life spending[25] and palliative care specialist care[28] are higher for younger patients and that patients with Medicare Advantage tend to use hospice more and hospital services less at the end of life compared with patients with fee-for-service Medicare.[29 30] However, there are data that beneficiaries enrolled in Medicare Advantage do not differ significantly in characteristics compared with those in traditional Medicare.[31] Second, it is possible that we misclassified a physician's specialty because the specialty codes could be incorrect. In addition, it is not uncommon in gynecologic oncology for patients to receive care from both gynecologic and medical oncologists in a team-based collaborative care model. We therefore could also have misclassified primary oncologist because the assignment was based on a plurality of visits, assuming that the physician who sees a patient most frequently is the most involved with clinical decision-making. We would expect measurement errors like these to bias our results toward the null. Furthermore, our results remained consistent in our sensitivity analyses. Third, high-intensity end-of-life care may represent goal-concordant care for an individual patient. We were unable to assess goal-concordance in our data. Fourth, while clinical practice may change over time, we did not find changes in aggressive end-of-life care over time in our prior work.[32] Finally, we were not able to accurately assess palliative care referrals or consultations.

Implications for Practice and Future Research

This is the first study to examine differences in end-of-life care by primary oncologist specialty. Overall, the majority of gynecologic cancer patients experience high-intensity end-of-life care. Differences in high-intensity end-of-life care, invasive procedures, and Medicare spending by primary oncologist specialty indicate that training background and scope of practice have a measurable impact on the care that patients receive. Interventions to address high rates of high-intensity end-of-life care and differences by primary oncologist specialty may include additional training,[33] support for earlier end-of-life discussions,[34] increased and more consistent referral to palliative care specialists,[15 35] and clear documentation of advance directives,[36] allowing patients to make deliberate decisions about their cancer care at the end of life.[37]

CONCLUSIONS

End-of-life care with a gynecologic versus medical oncologist was associated with lower rates of high-intensity end-of-life care, higher rates of invasive procedures, and higher Medicare spending in the last month of life.

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