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Research Article

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Racial Disparities in the Receipt of Guideline Care and Cancer Deaths for Women with Ovarian Cancer

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Abstract

Background: Black women with ovarian cancer experience worse survival than white women. Receipt of guideline care improves survival, yet care may vary by race. We assessed rates of guideline care and role of guideline treatment on survival disparities.

Methods: This retrospective cohort analysis used the NCI's Patterns of Care data for women diagnosed with ovarian cancer, 2002 and 2011 (weighted $n = 3{,}999$), with follow-up through December 12, 2014. Logistic regression included patient characteristics, insurance, and gynecologic oncologist (GO) consultation to produce adjusted standardized percentages of women receiving guideline treatment by race. Cox proportional hazards analysis assessed risk of ovarian cancer death.

Results: Guideline care was significantly lower for black women compared with white women (adjusted 27.5% vs. 34.1%). Increased receipt of guideline care was associated with GO consultation, younger ages, stage, and insurance. Rates of GO consultation were comparable for black and white women, approximately 60%. Black women were more likely to receive no surgery or no chemotherapy if they did not consult a GO. The unadjusted death risk was significantly higher in black women (HR = 1.33). After adjusting for receipt of guideline care and other factors, black and white women had similar risk of death (HR = 1.05).

Conclusions: Race was not associated with risk of death when guideline care was included in multivariate survival models. However, black patients received less guideline care. GO consultation significantly increased receipt of guideline care.

Impact: Research is needed to understand treatment perspectives for black patients and their providers to increase the receipt of guideline care and reduce survival disparities.

Introduction

Epithelial ovarian cancer is the most common gynecologic cancer with 22,000 newly diagnosed ovarian cancer cases expected in 2017 (1). Ovarian cancer is also the leading cause of gynecologic cancer death, accounting for an estimated 14,000 deaths in 2017 (1). Ovarian cancer incidence differs between black and white women. In 2014, the rate of incident ovarian cancer was 9.3 per 100,000 for black women compared with 12.3 per 100,000 for white women (2). During the same period, black women with ovarian cancer had poorer overall 5-year relative survival than did white women, 38.5% versus 46.2%, and poorer survival within each stage group (2). Guideline care has been shown to be associated with improved survival for ovarian cancer patients (3, 4) and several studies have reported that most women with ovarian cancer do not receive guideline care (3–6). This is especially true for black women who receive less guideline care than white women (7–9). Treatment guidelines for ovarian cancer consist of stage-appropriate debulking surgery performed by a gynecologic oncologist (GO) and multiagent chemotherapy including a platinum drug (cisplatin or carboplatin) and a taxane (paclitaxel or docetaxel) for patients with stages II to IV disease (10, 11). Since 2007, guideline care has included the use of intraperitoneal chemotherapy for women with stage III cancer who undergo optimal debulking (12). Although prior studies have shown that black patients are less likely to receive guideline care, there has been little focus on racial differences in treatment by a GO and how this relates to treatment and survival. The purpose of this analysis is twofold; first to understand how patient and provider characteristics influence the receipt of guideline therapy, and second to investigate how much of the observed survival differences between black and white patients can be explained by whether a patient received guideline care adjusting for other patient and provider characteristics.

In this study, we evaluate disparities in guideline treatment between black and white women diagnosed with ovarian cancer in 2002 and 2011 and ovarian cancer deaths for these women followed through 2014. To provide insight into factors that influence treatment, we assess patient and provider characteristics associated with receipt of guideline care, with a focus on care from a GO. Risk of ovarian cancer death is examined by race, adjusting for differences between white and black patients in receipt of guideline care as well as patient and provider characteristics.

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Materials and Methods

Data sources

Data came from the NCI's Patterns of Care (POC) studies that are conducted by the Surveillance Epidemiology and End Results (SEER) registries collaborating with NCI. The SEER registries ascertain all incident cancers occurring in geographic regions that include 28% of the U.S. population. The SEER registries routinely collect population-based data. Information about stage at diagnosis and treatment for each patient comes primarily from hospital records (13).

The SEER registries data do not capture complete information about chemotherapy in the outpatient setting and thus it is underreported (14). To obtain information about chemotherapy, NCI annually conducts POC studies on specific cancer sites. Ovarian cancer was selected as a site for a POC study in 2002 and 2011. The POC studies abstract information about initial cancer treatment from the patient's hospital record and the treating physician.

The registries that participated in the POC studies included San Francisco/Oakland, Detroit, Seattle, Atlanta, San Jose/Monterey, Los Angeles County, and the states of Connecticut, Iowa, Louisiana, New Jersey, New Mexico, the remainder of California, Hawaii (2011 only), and Kentucky (2011 only). Institutional review board approval was received as required by the registries. Abstractors underwent centralized training prior to each ovarian cancer POC study. Hospital records for each patient were abstracted to verify cancer characteristics, demographic, and insurance information. Cancer registrars at the central cancer registry reviewed the abstracts and contacted medical providers to obtain additional treatment information. Type of surgery was obtained from routinely collected SEER data. Each patient's physician provided information about the dates and types/route of chemotherapy administration, and the patient's participation in a clinical trial. Hospital bed size and teaching status came from the American Hospital Association data. Specialty of the treating physicians was obtained from the registries. Therapy was verified for 97% of cases in 2002 and 98% of cases in 2011. For quality control, 5% of patients had their records re-abstracted. All data were de-identified before being sent to NCI.

Study sample

The POC study included a sample of SEER patients diagnosed with stage II to IV ovarian cancer (ICD-O-3 Site code C56.9). Patients with stage I ovarian cancer were excluded from this study as not all stage I patients are recommended to receive adjuvant chemotherapy. Patients were excluded if their cancer was identified from autopsy or death certificate. Patients were ineligible if they were diagnosed under age 20, had a previous cancer diagnosis or had nonepithelial ovarian cancer. Eligible patients were stratified by stage, registry, racial/ethnic group, and age (2011 only) and randomly sampled within strata. Sampling fractions were used to calculate weighted percentages which reflect SEER populations from which the data were obtained. Sampling weights varied based on the stratification variables. Non-Hispanic blacks and women with stage II disease were oversampled to obtain more stable estimates.

Measures

Patient date of diagnosis, cancer site and stage, and type of cancer surgery were obtained from routinely collected SEER registry data as were age, race/ethnicity, and marital status. Stage was determined using the SEER modified American Joint Committee on Cancer (AJCC) definition at the time of diagnosis, AJCC 3rd edition in 2002 and AJCC 6th edition in 2011 (15, 16). Patient comorbidities and type of health insurance were abstracted from the medical record. Comorbidity was coded centrally by a single Certified Tumor Registrar and assessed using the Charlson comorbidity index (17). Insurance was classified into mutually exclusive groups based on a hierarchy of any Medicaid, private insurance, Medicare only (no supplemental coverage), or no health insurance. Provider characteristics included whether the patient had consulted a GO and the type of hospital where the patient was treated. The type of hospital reflects a composite measure of bed size and whether the hospital had an approved residency training program, except for small/very small hospitals where teaching was not assessed. Bed size was categorized as large (400+ beds), medium (200–399 beds), small (100–199 beds), and very small (1–99 beds).

Guideline care was defined using National Comprehensive Cancer Network (NCCN) guidelines for ovarian cancer (10, 11). Guideline care for women with stages II to IV cancer included debulking and receipt of multiagent chemotherapy—a platinum drug (cisplatin or carboplatin) and a taxane (paclitaxel or docetaxel). Debulking is defined by the SEER program as surgical removal of as much macroscopic ovarian tumor as possible in the pelvis and abdomen with partial or complete omentectomy. Treatment by a GO was determined from specialty information collected by the registrars. We assessed the use of intraperitoneal chemotherapy for women for whom it is indicated—stage III cancer who had undergone debulking.

Underlying cause of death (COD) was ascertained by SEER cancer registries from death certificates. To correct for known errors with COD attribution, the SEER program uses a special COD variable that maps underlying CODs to the primary cancer diagnosis (18). We used this variable to capture deaths due to ovarian cancer among women with an incident ovarian cancer diagnosis (19).

Statistical analyses

The number of cases was weighted using sample weights to obtain estimates that are representative of all eligible patients from which the sample was drawn. Weights were calculated as the inverse of the sampling proportion for each sampling stratum. We used SUDAAN software (RTI International) to perform the weighted analysis. To increase sample size, cases from 2002 and 2011 were combined for the analysis. Bivariate comparison between white and black patients were analyzed using chi-square tests and were considered significant at $P < 0.05$.

A multivariate logistic regression model was used to assess the association between patient and provider characteristics and receipt of guideline treatment, with a binary dependent variable (yes vs. no) for receipt of guideline care. Separate models were fit for guideline surgery, guideline chemotherapy, and the receipt of both guideline surgery and chemotherapy. Independent variables in the model included race, age, marital status, insurance, comorbidity, stage at diagnosis, GO consultation, and treatment in a large teaching hospital. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were used to assess the association between the independent variables and receipt of guideline treatment. We also report the standardized percentages (predictive margins), representing the average percent of patients (marginal probability of) receiving guideline treatment based on patient groups (20).

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A Cox proportional hazards model was used to evaluate factors that were associated with ovarian cancer deaths. Deaths due to ovarian cancer were treated as the event and other causes of death as the censoring indicator. Survival times were censored at loss to follow-up, death from causes other than ovarian cancer for the SEER special COD variable (18) or December 31, 2014, whichever occurred first. This allowed a maximum of 155 months of follow-up time for our cohort. The median follow-up time for the cohort was 33 months. We used the Proc PHREG for Cox proportional hazard model with the *weight* statement to incorporate the sampling weights in SAS 9.3 (SAS Institute) to perform the survival analysis.

Results

The study included weighted sample size of 3,999 patients, 3,614 white patients and 385 black patients (Table 1) [unweighted sample was 1,738, 1,422 non-Hispanic (NH) white women and 316 NH black]. A similar percent of black and white women consulted a GO, 62.0% versus 58.1%, respectively, although black women were significantly more likely to be treated in a large teaching hospital (48.8%) than were white women (40.0%). Black women were more likely to have a comorbidity score of 1+ than white women, 34.5% compared with 20.0%. Black women were significantly more likely to have a stage IV diagnosis, 46.8% compared with 31.7% of white women. Compared with white women, black women were significantly more likely to be unmarried (66.1% black patients vs. 42.2% white patients) and have Medicaid (25.2% black patients vs. 7.4% white patients).

Table 1. Characteristics of ovarian cancer patients included in the SEER POCs, 2002 and 2011

	Non-Hispanic black		Non-Hispanic white		
	Wt *N*	Wt Col%	Wt *N*	Wt Col%	*P* value
Age group					
<50	72	18.7	484	13.4	0.033
50–64	137	35.6	1303	36.0	
65–74	89	23.1	813	22.5	
75+	87	22.6	1014	28.1	
Year of diagnoses					
2002	178	46.2	2118	58.6	<0.001
2011	207	53.8	1497	41.4	
Marital status					
Married/partnered	113	29.4	1984	54.9	<0.001
Not married	255	66.1	1525	42.2	
Unknown	17	4.5	105	2.9	
Type of insurance					
Private	211	54.9	2842	78.6	<0.001
Any Medicaid	97	25.2	268	7.4	
Medicare only	55	14.3	389	10.8	
None	21	5.6	115	3.2	
Charlson comorbidity score					
0	252	65.5	2893	80.0	<0.001
1+	133	34.5	721	20.0	
Stage[a]					
II	31	8.1	421	11.7	<0.001
III	174	45.1	2049	56.7	
IV	180	46.8	1145	31.7	
GO consultation					
Consulted GO	239	62.0	2101	58.1	ns
Did not consult GO	146	38.0	1514	49.1	
Type of hospital					
Large teaching	188	48.8	1446	40.0	0.005
Large community	19	5.0	315	8.7	
Medium teaching	69	18.0	515	14.3	
Medium community	53	13.8	694	19.2	
Small/very small	55	14.4	644	17.8	

Abbreviations: ns, not significant; wt, weighted, all numbers and percents are unadjusted.

[a]Stage, AJCC 3rd edition used in 2002; 6th edition used in 2011.

Receipt of guideline surgery varied by race, stage, and consultation with a GO (Table 2). For all stages, women who consulted GOs received more guideline surgery than those who did not have GO care. Even when consulting with a GO, black women were less likely to receive guideline care than white women for stage IV cancer. Among women who did not see a GO, black women were less likely to receive guideline care than white women for stage III and stage IV cancer.

Women were more likely to receive guideline chemotherapy when they had a GO consultation; 74% of NH black women and 77% of NH white women who had a GO consultation received guideline chemotherapy as compared with 49% of NH black women and 62% of NH white women who did not have a GO consultation (Table 3). The difference in chemotherapy use between NH black and NH white women was significant only in the group that did not have a GO consultation. Intraperitoneal and neoadjuvant chemotherapy was predominantly among women who had a GO consultation. Among women with stage III cancer who underwent debulking surgery, black women who had a GO consultation were more likely to receive intraperitoneal chemotherapy than white women, 25.1% of black women compared with 17.3% of white women. Neoadjuvant chemotherapy was only collected for cases in 2011, there was no significant difference between black and white women in the percent who received neoadjuvant therapy, 17.6% for black women compared with 10.4% for white women.

In the multivariate regression model (Table 4), women who had Medicare insurance were less likely to receive guideline surgery and women with stage III and stage IV disease were more likely to receive guideline surgery than women with stage II disease. Black women, older women, uninsured women, and women with stage IV disease were less likely to receive guideline chemotherapy. Women diagnosed in 2011 were more likely to receive guideline chemotherapy than women diagnosed in 2002. The standardized percent of patients who received both guideline surgery and chemotherapy was significantly lower for black women, 27.5% versus 34.1% of white patients. Women who did not see a GO were significantly less likely to receives guideline care, as were older women and women with Medicare insurance only. Women with stage III cancer were more likely to receive guideline care than women with either stage II or stage IV disease after adjusting for other factors. As with guideline chemotherapy, women diagnosed in 2011 were more likely to receive both guideline surgery and guideline chemotherapy than women diagnosed in 2002.

The unadjusted HR for ovarian cancer death in black women, 1.33, was significantly higher than for white women (Table 5). Yet after adjusting for receipt of guideline care and patient and provider factors in a multivariate Cox hazard analysis, black women did not have a significantly higher risk of ovarian cancer death than white women (adjusted HR = 1.05). Women who did not consult with a GO were at significantly increased risk for ovarian cancer death (adjusted HR = 1.25) as were women who did not receive guideline care (adjusted HR = 1.24). The risk of ovarian cancer death was also higher for women in older age groups, women who did not have private insurance, had

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Table 2. Type of surgery for ovarian cancer by stage, race, and consultation with GO (SEER POCs, 2002 and 2011)

		Had a GO consultation					Did not have a GO consultation				
		NH black		NH white			NH black		NH white		
	Type of surgery	Wt *N*	Col Wt%	Wt *N*	Col Wt%	*P* value	Wt *N*	Col Wt%	Wt *N*	Col Wt%	*P* value
Stage II	Guideline	8	34.3	60	27.6	ns	2	24.0	38	18.5	ns
	Other	14	61.3	147	68.0		5	62.0	135	65.9	
	None	1	4.4	10	4.4		1	14.0	32	15.5	
Stage III	Guideline	70	52.2	772	58.0	ns	9	23.0	303	42.2	0.003
	Other	52	39.1	475	35.7		10	25.6	274	38.2	
	None	12	8.7	84	6.3		21	51.4	141	19.6	
Stage IV	Guideline	25	30.5	269	48.5	0.023	15	15.5	149	25.2	0.048
	Other	27	32.4	141	25.5		11	11.1	119	20.1	
	None	31	37.1	144	25.9		72	73.4	323	54.6	

Abbreviation: ns, not significant.

comorbidities and those who were unmarried. Women with Medicaid had a higher hazard ratio than women with Medicare or no insurance. Women who were diagnosed in 2011 had a significantly lower risk of ovarian cancer death than women diagnosed in 2002.

Discussion

This analysis used population-based data to show that for patients with stages II to IV ovarian cancer, black women were significantly less likely to receive guideline surgery and chemotherapy compared with white women. Our findings are consistent with prior studies that have also reported racial disparities in ovarian cancer treatment (7–9, 21, 22). After adjusting for receipt of care, patient and provider characteristics, and whether a patient saw a GO, there was no longer a survival difference between black and white women. Our findings are similar to other population-based studies that have reported disparities in ovarian cancer survival are no longer significant after adjusting for patient and provider factors and receipt of guideline care (9, 23). Our analysis adds to previous research of disparities in ovarian cancer by including information about which women consulted a GO.

In our analysis, the majority of patients consulted a GO and there was no significant difference between black and white patients in the percent seeing a GO. We also found that women who consulted a GO were more likely to receive guideline care, consistent with what has been reported in other studies (24, 25). For women who did not have a GO consultation, a sizeable percent of women with stages III and IV did not have any surgery for their cancer. This was especially true for black women who did not see a GO where over half of stage III and 73% of stage IV women had no surgery. For women who had a GO consultation, there was no significant difference between black and white with stage II and stage III cancer in the percent receiving guideline surgery. Yet for women with stage IV cancer who saw GOs, there was a significant difference in the percent of women who had guideline surgery, with over one-third of black women having no type of surgery. Like surgery, there was no significant difference in the receipt of chemotherapy among women who saw GOs, but black women were less likely to receive chemotherapy among women who did not see a GO. Even when adjusting for other factors such as stage, GO, age, and comorbidities, black women were less likely to receive guideline chemotherapy and guideline care defined as receiving both guideline chemotherapy and surgery. The reason for the disparity is unclear. Regardless of the reason, the fact that black women are less likely to have surgery and chemotherapy is a contributing factor to survival differences that have been reported for black and white ovarian cancer patients.

Earlier research has reported that patient socioeconomic status (SES) is a significant factor in receipt of guideline care (21, 22). In our preliminary analyses, an SES variable was included in the models, but it was later excluded as it was not significantly associated with guideline care. We did not find that treatment in a large teaching hospital was associated with receipt of guideline care, differing from published studies (5, 26). Unlike earlier studies, our analysis included information about both hospital type and GO consultation. Published studies that have had information about the hospital and the surgeon treating women with ovarian cancer have reported that hospital volume was not significantly associated with survival after adjusting for surgeon volume (27, 28).

Table 3. Use of adjuvant chemotherapy by race and consultation with GO (SEER POCs, 2002 and 2011)

	Had a GO consultation					Did not have a GO consultation				
	NH black		NH white			NH black		NH white		
	Wt *N*	Col Wt%	Wt *N*	Col Wt%	*P* value	Wt *N*	Col Wt%	Wt *N*	Col Wt%	*P* value
Chemotherapy agent										
Guideline (platinum and taxane)	176	73.7	1618	77	ns	58	39.9	939	62	0.002
Other chemotherapy	13	5.7	129	6.1		13	8.9	116	7.7	
No chemotherapy	49	20.7	354	16.8		75	51.2	459	30.3	
Type of administration										
Intraperitoneal chemotherapy[a]	12	17.6	80	10.4	ns	[b]		[b]		
Neoadjuvant chemotherapy[c]	38	25.1	200	17.3	0.047	[b]		48	14.3	

Abbreviation: ns, not significant.

[a]Includes only stage III cancer patients who underwent debulking.

[b]Data suppressed due to small number.

[c]Collected in 2011 only.

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Table 4. Logistic regression for the receipt of guideline surgery, chemotherapy, and both surgery and chemotherapy (SEER POCs, 2002 and 2011)

	Received guideline surgery				Received guideline chemotherapy				Received guideline surgery and chemotherapy			
	Standardized percent[a]	Adjusted OR	95% CI lower	95% CI upper	Standardized percent[a]	Adjusted OR	95% CI lower	95% CI upper	Standardized percent[a]	Adjusted OR	95% CI lower	95% CI upper
Race												
NH white[b]	43.9	1.00			70.6	1.00			34.1	1.00		
NH black	34.8	0.66	0.32	1.04	***62.7***	***0.66***	***0.47***	***0.92***	***27.3***	***0.69***	***0.50***	***0.97***
Age group												
<50[b]	42.3	1.00			78.0	1.00			32.9	1.00		
50–64	44.8	1.12	0.72	1.74	78.0	1.00	0.56	1.77	38	1.28	0.82	1.99
65–74	49.9	1.41	0.88	2.26	74.4	0.80	0.45	1.45	41.6	1.51	0.93	2.46
75+	35.0	0.71	0.42	1.20	***52.2***	***0.28***	***0.15***	***0.51***	***20***	***0.48***	***0.26***	***0.87***
Year of diagnosis												
2002[b]	43.2	1.00			64.8	1.00			30.2	1.00		
2011	42.7	0.97	0.72	1.33	***76.7***	***1.94***	***1.38***	***2.73***	***37.56***	***1.45***	***1.03***	***2.04***
Marital status												
Married/partnered[b]	46.0	1.00			74.1	1.00			36.4	1.00		
Not married	39.6	0.75	0.54	1.04	65.7	0.63	0.43	0.92	30.1	0.73	0.52	1.02
Unknown	38.2	0.70	0.32	1.49	60.7	0.49	0.23	1.06	25.4	0.56	0.23	1.33
Type of insurance												
Private[b]	44.5	1.00			70.7	1.00			35.4	1.00		
Any Medicaid	47.8	1.16	0.72	1.88	69.3	0.93	0.54	1.57	36	1.03	0.61	1.74
Medicare only	***32.3***	***0.57***	***0.34***	***0.94***	66.3	0.79	0.45	1.37	***19.3***	***0.40***	***0.24***	***0.67***
None	30.6	0.52	0.26	1.14	62.5	0.65	0.28	1.51	24.3	0.55	0.24	1.25
Charlson comorbidity score												
0[b]	43.5	1.00			70.6	1.00			33.5	1.00		
1+	41.2	0.90	0.63	1.29	67.0	0.82	0.56	1.20	33.4	0.99	0.67	1.48
Stage												
II[b]	24.7	1.00			75.5	1.00			19.2	1.00		
III	***50.0***	***3.29***	***2.14***	***5.06***	72.7	0.85	0.54	1.33	***39.8***	***3.06***	***1.86***	***5.02***
IV	***37.2***	***1.88***	***1.19***	***2.97***	***63.2***	***0.51***	***0.33***	***0.80***	27.2	1.63	0.97	2.71
GO consultation												
Yes[b]	49.1	1.00			72.8	1.00			37.4	1.00		
No	33.9	0.82	0.60	1.13	66.1	0.69	0.47	1.03	***27.2***	***0.60***	***0.39***	***0.90***
Large teaching hospital												
Yes[b]	45.5	1.00			69.4	1.00			33.4	1.00		
No	41.2	0.82	0.60	1.13	70.0	1.04	0.72	1.51	33.5	1.01	0.72	1.41

Values in bold and italics are significantly different from the reference group.
[a]Standardized percents are adjusted for variables shown in the model.
[b]Denotes reference group.

Our study had limitations that need to be considered. The analysis focuses on guideline care and does not address whether or not receiving guideline care is appropriate in specific situations. For example, older women or women with many comorbidities may not be able to tolerate chemotherapy or may not be candidates for surgery. We also do not have information on patient preferences, the provider's perspective, or other factors that contribute to treatment decisions made between a woman and her physician. Therefore, we cannot make a statement about whether the treatment received was appropriate for a patient. Factors related to determining the most appropriate treatment for a patient are beyond the scope of this analysis.

Treatment information was abstracted from the medical record by abstractors and reports from the treating physician. It is possible that documentation of treatment may be incomplete, either because it was not recorded in the medical record or reported by the physician. We used data from 2002 to 2011. During this time, there was no increase in guideline surgery, although there was increased use of chemotherapy (29). Finally, because this is an observational analysis, the significant variables in the models reflect associations not causation.

In conclusion, we found that although guideline care was low for all women with ovarian cancer, black women received significantly less guideline care compared with white women. The importance of understanding why black women do not receive guideline care is underscored by our finding that the risk of ovarian cancer death is similar between white and black patients when adjusting for receipt of guideline care and other factors. The challenge is how to improve the percent of patients who received guideline care. In 2016, the National Academy of Sciences issued a report on ovarian cancer research and care (30). The report recommended investigation into how to ensure patients receive current standards of care, including treatment by a specialist. From our findings, seeing a GO increased the likelihood of receiving guideline care, however it was not sufficient to ensure guideline care. The question that has received little attention is why so many black women are not receiving any surgery, even for those who see GOs. The lack of guideline care among black women compared with white women may reflect patient preference or the perspective of providers. Understanding factors that contribute to treatment decisions should be a priority to address the disparity between white and black women in ovarian cancer treatment.

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Table 5. Cox hazards model for death due to ovarian cancer among white and black women diagnosed (SEER POCs, 2002 and 2011)

	Unadjusted model				Adjusted model			
		95% CIs				95% CIs		
	Wt. HR	Lower	Upper	*P* value	Wt. HR	Lower	Upper	*P* value
Race								
NH white[a]	1.00			<0.0001	1.00			0.4215
NH black	***1.33***	***1.17***	***1.51***		1.05	0.92	1.20	
Guideline care								
Yes[a]	1.00			<0.0001	1.00			<0.0001
No	***1.29***	***1.19***	***1.40***		***1.24***	***1.14***	***1.35***	
Age group								
<50[a]	1.00			<0.0001	1.00			<0.0001
50–64	***1.42***	***1.24***	***1.62***		***1.43***	***1.25***	***1.63***	
65–74	***2.06***	***1.79***	***2.37***		***1.75***	***1.51***	***2.03***	
75+	***3.11***	***2.72***	***3.56***		***2.91***	***2.53***	***3.35***	
Year of diagnosis								
2002[a]	1.00			0.0066	1.00			0.0016
2011	***0.89***	***0.82***	***0.97***		***0.86***	***0.78***	***0.95***	
Marital status								
Married/partnered[a]	1.00			<0.0001	1.00			<0.0001
Single	***1.45***	***1.34***	***1.56***		***1.11***	***1.02***	***1.21***	
Unknown	***1.72***	***1.39***	***2.13***		***1.64***	***1.32***	***2.04***	
Type of insurance								
Private[a]	1.00			<0.0001	1.00			<0.0001
Any Medicaid	***1.71***	***1.51***	***1.94***		***1.60***	***1.40***	***1.83***	
Medicare only	***1.96***	***1.76***	***2.19***		***1.37***	***1.22***	***1.55***	
None	***1.35***	***1.10***	***1.65***		***1.33***	***1.08***	***1.63***	
Charlson comorbidity score								
0[a]	1.00			<0.0001	1.00			<0.0001
1+	***1.51***	***1.38***	***1.66***		***1.38***	***1.25***	***1.51***	
Stage								
II[a]	1.00			<0.0001	1.00			<0.0001
III	***2.56***	***2.17***	***3.02***		***2.90***	***2.46***	***3.43***	
IV	***5.30***	***4.47***	***6.28***		***5.38***	***4.53***	***6.38***	
GO consultation								
Yes[a]	1.00			<0.0001	1.00			<0.0001
No	***1.47***	***1.36***	***1.58***		***1.25***	***1.15***	***1.36***	
Large teaching hospital								
Yes[a]	1.00			0.1371	1.00			0.0241
No	1.06	0.98	1.15		***0.91***	***0.84***	***0.99***	

[a]Denotes reference group. Values in bold and italics are significantly different from the reference group.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Authors' Contributions

Conception and design: K.A. Cronin, J.L. Warren
Development of methodology: K.A. Cronin, E.L. Trimble, L.C. Harlan, J.L. Warren
Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis): K.A. Cronin, N. Howlader, J.L. Stevens, L.C. Harlan, J.L. Warren
Writing, review, and/or revision of the manuscript: K.A. Cronin, N. Howlader, E.L. Trimble, J.L. Stevens, L.C. Harlan, J.L. Warren
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