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Racial disparities and patterns of ovarian cancer surgical care in California

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Abstract

Objective—To investigate disparities in the frequency of ovarian cancer-related surgical procedures and access to high-volume surgical providers among women undergoing initial surgery for ovarian cancer according to race.

Methods—The California Office of Statewide Health Planning and Development database was accessed for women undergoing a surgical procedure that included oophorectomy for a malignant ovarian neoplasm between 1/1/06 and 12/31/10. Multivariate logistic regression analyses were used to evaluate differences in the odds of selected surgical procedures and access to high-volume centers (hospitals≥20 cases/year) according to racial classification.

Results—A total of 7,933 patients were identified: White=5,095 (64.2%), Black=290 (3.7%), Hispanic/Latino=1,400 (17.7%), Asian/Pacific Islander=836 (10.5%) and other=312 (3.9%). White patients served as reference for all comparisons. All minority groups were significantly younger (Black mean age 57.7 years, Hispanic 53.2 years, Asian 54.5 years vs. 61.1 years, p <0.01). Hispanic patients had lower odds of obtaining care at a high-volume center (adjusted OR (adj. OR)=0.72, 95% CI=0.64-0.82, p<0.01) and a lower likelihood of lymphadenectomy (adj. OR=0.80, 95%CI=0.70–0.91, p<0.01), bowel resection (adj. OR=0.80, 95% CI=0.71–0.91, p<0.01), and peritoneal biopsy/omentectomy (adj. OR=0.69, 95% CI=0.58–0.82, p<0.01). Black racial classification was associated with a lower likelihood of lymphadenectomy (adj. OR=0.76, 95%CI=0.59–0.97, p=0.03).

Conclusions—Among women undergoing initial surgery for ovarian cancer, Hispanic patients are significantly less likely to be operated on at a high-volume center, and both Black and Hispanic patients are significantly less likely to undergo important ovarian cancer-specific surgical procedures compared to White patients.

Keywords

Ovarian cancer; racial disparities

CONFLICT OF INTEREST:
All authors do not have any conflicts of interest to disclose.

INTRODUCTION

The National Cancer Institute has estimated 22,240 cases of and 14,030 deaths from ovarian cancer in 2013 (1). It is the leading cause of gynecologic cancer related mortality among American women, with approximately 70% of patients presenting with advanced disease. Optimal ovarian cancer care requires that patients have access to specialty-trained surgeons and tertiary care centers that provide multidisciplinary oncologic care. Studies have shown the positive relationship between surgeon and hospital case volume and clinical outcome for malignancies treated with technically complex surgical procedures (2-5). Racial classification and insurance status have previously been associated with substandard ovarian cancer care (6-8). Not surprisingly, disparities in treatment administration or allocation are reflected in overall survival. For ovarian cancer in particular, population-based studies have documented worse survival outcomes for Black women (9, 10). Unfortunately, in a recent study of racial disparities in mortality rates after diagnosis of ovarian cancer, Terplan et al. found that adjusted hazard ratios for all-cause and ovarian cancer specific mortality have worsened over the last 3 decades (11). Recent data from the National Center for Health Statistics and the National Cancer Institute confirm that from 1975 to 2004, the 5-year survival rate for Black women actually decreased from 43% to 38% during the same time interval (12).

Important determinants of the quality of ovarian cancer care include the completeness of the initial surgical effort for staging and cytoreduction, receipt of recommended chemotherapy, and the specialty and surgical volume of the treating clinician and hospital (13, 14). Aranda et al. conducted the most recent study of access to high volume surgeons and race disparities in ovarian cancer care in California (15). Their retrospective analysis of 13,186 ovarian cancer cases from the California Cancer Registry from 1991-2002 found that Black ($RR=0.70$, $p<0.05$) and Hispanic women ($RR=0.75$, $p<0.05$) were less likely to be operated on by high volume surgeons. In an effort to develop a more complete and updated understanding of the treatment and healthcare system-related factors contributing to the race-based gap in ovarian cancer survival in California, the current study investigated differences according to racial classification in the frequency of important ovarian cancer related surgical procedures as well as access to high-volume surgical providers using the resource of the California Office of Statewide Health Planning and Development (OSHPD) database (16). The purpose of this study was to characterize the patterns of surgical care among women admitted for ovarian cancer in California according to annual hospital case volume and racial classification. We hypothesized that a disparity in access to high volume hospitals and rates of ovarian cancer related procedures persist in Black and Hispanic women after controlling for clinical and sociodemographic factors.

METHODS

The study design was a cross-sectional analysis of hospital discharge data from licensed hospitals in California collected by OSHPD. The University of California at Irvine (UCI) Human Research Protections Program and the UCI Chao Comprehensive Cancer Center Clinical Trial Protocol Review and Monitoring Committee approved the analysis for exempt

status after review of the study proposal (IRB study number HS#2012-8683 and Cancer Center study number UCI 12-05).

All adult female patients (18 years of age and older) who were admitted in California from January 1, 2006 and December 31, 2010 for malignant ovarian neoplasm, malignant fallopian tube neoplasm, or primary peritoneal malignancy were sorted from the OSHPD database. This cohort was further filtered into a group of women who underwent a surgical procedure including oophorectomy. The International Classification of Disease, 9th revision (ICD-9) codes 183.0 (malignant ovarian neoplasm), 183.2 (malignant fallopian tube neoplasm), and 158.9 (primary peritoneal malignancy) were used for sorting. All cell types were included. The surgical procedures included in the analysis were limited to oophorectomy or salpingo-oophorectomy (65.29, 65.49, 65.51, 65.52, 65.61, 65.62), as these were felt to be the most likely to capture those patients undergoing initial surgery for ovarian cancer.

Hospitalization data was obtained from California's OSHPH, which collects annual data from all inpatients discharged from acute care hospitals licensed by the state of California. Each hospital discharge abstract in the Patient Discharge Database contains demographic data (e.g. gender, age, race/ethnicity, type of insurance, zip code of residence), reason for admission, primary and secondary (up to 24) diagnoses, primary and secondary (up to 20) procedures, dates of procedure, and discharge information (e.g. length of stay, disposition). The information is de-identified information. All diagnoses and procedures are coded using the ICD-9. We identified the hospitalization when the surgical resection occurred and identified the type of insurance and all diagnoses reported for that admission. The modified Charlson Comorbidity Index (excluding cancer) was derived from the reported diagnoses (17). Patient characteristics were analyzed according to surgical procedures and high-volume hospitals. Hospitals were included in the analysis if at least 1 ovarian cancer surgery was performed during the entire study period. Hospitals with ≥20 cases/year were categorized as high-volume, while those with <20 cases/year were categorized as low-volume (2).

The independent variables of interest included patient demographics, comorbid disease, and payer status. Patient-level characteristics included the following: age, race/ethnicity (Non-Hispanic White, Black, Hispanic, Asian, and other), and payer status (private insurance, Medicare/other government coverage, self-pay, and other). Hospital surgical volume was also analyzed for associations with patient-level characteristics. In addition to oophorectomy, surgical procedures were grouped in the following categories: hysterectomy, lymphadenectomy, bowel surgery, and excision of peritoneal/abdominal tissue.

The primary statistical endpoints in this study were racial differences in the receipt of surgical procedures and racial differences in access to high-volume hospitals. Factors associated with these outcomes were selected based on cross tabulations and multivariate logistic regression modeling (18). Comparisons of racial differences in surgical procedures were adjusted for age, comorbidity risk score, and payer category. Comparisons of demographic characteristics according to racial classification were analyzed using t-test and

Fisher's exact test as appropriate. All p-values reported are two-sided. Computations were performed using the Statistical Analysis System (SAS) 9.2.

RESULTS

A total of 14,117 patients were admitted in California between 2006 and 2010 with a primary diagnosis of ovarian, fallopian tube, or primary peritoneal malignancy. From that population, 7,933 patients were identified who underwent a primary surgical procedure that included oophorectomy for their primary diagnosis. Our analysis of racial differences in access to high volume hospitals and ovarian cancer related procedures was based on this cohort of 7,933 women. Table 1 shows their demographic distribution. Minority patients were on average younger compared to Whites (mean age 61.1 years (standard deviation (SD)=13.7 years) vs. Black mean age 57.7 years (SD=14.0 years), Hispanic mean age 53.2 years (SD=14.8 years), Asian mean age 54.5 years (SD=13.0 years)).

Nearly equal numbers of women received care at low (n=4,129, 52.1%) and high volume medical centers (n=3,804, 48.0%) (Table 1). In addition to oophorectomy, 5,952 (75.0%) women underwent hysterectomy, 3,336 (38.9%) underwent lymphadenectomy, 3,816 (44.5%) underwent a bowel resection, and 7,207 (84.1%) had a peritoneal or other abdominal procedure (Table 2). Compared to White women, both Black and Hispanic women were significantly less likely to have commercial health insurance, 43.1% vs. 51.7%, p<0.01 and 40.6% vs. 51.7%, p<0.01, respectively (Table 3).

On multivariate logistic regression analysis of the surgical procedures, Asian women had lower odds of hysterectomy compared to Whites (adj. OR=0.77, 95% CI 0.59-1.00, p=0.05) after adjusting for payer category, comorbidity, and health center volume (Table 4). Both Black and Hispanic women had significantly lower odds of lymphadenectomy, with adj. OR=0.76 (95% CI 0.59-0.99, p=0.04) and adj. OR=0.81 (95% CI 0.71-0.92, p<0.01), respectively. Hispanic women had significantly lower odds of bowel surgery (adj. OR=0.80, 95% CI 0.71-0.91, p<0.01) and peritoneal/abdominal excision procedure (adj. OR=0.70, 95% CI 0.59-0.82, p<0.01) compared to White women. Asian women had higher odds of hysterectomy (adj. OR=1.52, 95% CI 1.25-1.84, p<0.01) and lymphadenectomy (adj. OR=1.20, 95% CI 1.04-1.40, p=0.02) but lower odds of peritoneal/abdominal excision procedures (adj. OR=0.81, 95% CI 0.66-1.00, p=0.05).

When stratified on hospital volume, certain procedure-related disparities were eliminated among those admitted at high volume hospitals (Table 4). Specifically, odds of lymphadenectomy were no longer significantly different for Blacks and Hispanic women compared to White patients. For Hispanic women, the odds of bowel resection was no longer different, though odds of peritoneal excision remained significantly lower compared to White women. On multivariate logistic regression analysis with high and low volume hospitals as the outcome of interest, Hispanic women and publically funded patients had significantly lower odds of receiving treatment at a high volume hospital (adj. OR=0.72, 95% CI 0.64-0.82, <0.01; and adj. OR=0.82, 95% CI 0.71-0.95, p<0.01, respectively) (Table 5). Public payer status was also associated with significantly lower odds of admission at a high-volume center (adj. OR=0.82, 95% CI 0.71-.095, p<0.01). The multivariate model was

adjusted for payer category, race, comorbidity score, and age. When a term was included in the model to assess for interaction between race and payer status, adjusted odds ratios did not change significantly for racial classification or payer status (data not shown).

DISCUSSION

This cross-sectional analysis of a cohort of 7,933 women who underwent ovarian cancer related surgery in California between 2006 and 2010 identified several associations between minority racial classification and both surgical procedures and high volume hospitals. Evidence-based guidelines recommend that experienced surgeons perform cytoreductive surgery, the mainstay of treatment for ovarian cancer. Receipt of surgical care at a hospital that performs ≥20 cases/year has also been associated with a higher likelihood of standard treatment for later stage ovarian cancer (2), and in this analysis, once stratified on high volume centers, Blacks and Hispanics no longer had significantly lower adjusted odds for certain important ovarian cancer related procedures.

While Blacks were more likely to receive care at a high volume hospital in our study, they had a lower chance of lymphadenectomy during their initial surgical effort. Several studies have demonstrated a treatment disparity among Black women diagnosed with ovarian cancer (8, 15, 19-21). A comprehensive literature review published in 2013 highlighted that Black women suffer discrepancies in care from diagnosis to treatment that detrimentally affects survival for all stages of disease (7). However, recent studies from 2 high-volume medical centers, the Surveillance, Epidemiology and End Results-Medicare database, and Gynecologic Oncology Group clinical trials have found that under equal access and treatment environments, the survival disparity of Black women largely disappears (22-25).

The number of Hispanic women in our cohort allowed us to analyze parameter estimates for this minority group. Hispanic women were significantly less likely to undergo all the important classified surgical procedures associated with improved survival in women with ovarian cancer: lymphadenectomy, bowel resection and peritoneal/abdominal excision. Furthermore, Hispanic women have the lowest odds of receiving treatment at high volume hospitals. Hispanic women have the second highest incidence of ovarian cancer after Whites in the United States (11), and this finding has significant implications on addressing improved quality of treatment and care for these women. The OSHPD database does not have physician level information; therefore, the rates of operation with a high volume surgeon could influence these results. Because Hispanics are currently the largest ethnic group in the United States, the provision of equal and appropriate care for Hispanic women will contribute significantly to reducing healthcare disparities among minorities. With this in mind, it is important to recognize that the Hispanic racial classification includes a heterogeneous collection of different ethnicities and associated characteristics (26).

The findings on Asian racial classification in our study population are novel. While Asians are the fastest growing ethnic group in the United States, there are currently few studies looking at the epidemiology and treatment patterns for ovarian cancer specifically among Asian American women owing to their relatively small numbers. California has the largest population of Asians in the United States. Our results suggest that they do not suffer from

similar disparities in care as their Black and Hispanic counterparts in California. In the study by Aranda et al., Asians were equally as likely as Whites to undergo surgery with high volume surgeons (15). Several reasons may account for these results. Asian Americans have better socioeconomic characteristics compared to other minorities in the United States. In this study, over 60% of Asians had commercial health insurance, the highest of any racial group. In the 2010 Census, the median household income for Asian Americans was $65,469, compared to $51,861 for whites, $32,584 for Blacks, and $38,039 for Hispanics (27). Approximately 50% of Asian Americans graduate with a college degree or more, compared to 30% of Whites, 20% of Blacks, and 15% of Hispanics (28). Data from the California Cancer Registry show that Asian women have lower incidence and mortality from breast cancer but higher overall incidence and mortality from cervical cancer, though rates varied widely based on the specific Asian sub-group (29). Like the Hispanic racial classification, it is important to recognize the diversity within the Asian racial group. As these populations grow in the United States, more research and appropriate characterization will allow for more nuanced assessments in health outcomes.

Several limitations should be considered when interpreting these data. The OSHPD database does not have record of all possible confounders for our analysis. For example, there is no past surgical history information and our finding of a lower odds of concurrent hysterectomy for Black women may be reflected in higher hysterectomy rates among Black women, which would confound the odds for hysterectomy in our study. Recent literature has suggested that the hysterectomy prevalence effect could contribute to an underestimation of uterine cancer rates in Black women (30-32). The database also relies on reporting of procedure and diagnosis codes from different institutions, leading to the possibility of primary coding errors. However, a recent analysis evaluating the accuracy of OSHPD administrative data and clinical record in identifying a risk model for coronary artery bypass graft surgery demonstrated moderate to strong agreement for the majority of administrative risk factors (33). The limitations of registry data are inherent to this analysis (34). Surgeon level volume was also not available from the database so this level of detail could not be analyzed. While racial classification was based on patient self-report, the basic categories in the OSHPD database do not account for ethnic heterogeneity or patients of mixed racial background. The OSHPD database also does not have information on the stage, histology, and overall survival of the patients beyond outcomes recorded during admission.

Despite these limitations, several conclusions can be drawn from this analysis. Among women undergoing initial surgery for ovarian cancer, Hispanic women are significantly less likely to be operated on at a high-volume hospital and to undergo important ovarian cancer-specific surgical procedures compared to White patients. Black women also continue to have a lower chance of undergoing certain ovarian cancer specific procedures. These findings have significant implications as a comprehensive surgical effort that best ensures minimal residual tumor burden is associated with improved survival in women with ovarian cancer (23, 35, 36). The issue of health disparities is complex and requires improving access to care through education of patients and providers, the provision of adequate healthcare coverage, and better understanding of biologic heterogeneity and genetic polymorphisms. In each of these areas, more research is needed to help equalize care among all women with ovarian cancer. Addressing inequalities in access to high-volume hospitals and appropriate surgical

intervention will help ensure that all women with ovarian cancer have a comprehensive approach to treatment and maximizing survival.

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Highlights

► Minority racial status in California is associated with lower odds of important ovarian cancer related procedures.

► Hispanic race and public funding are associated with lower odds of surgery at high-volume centers.

► Differences in important ovarian cancer related procedures are mitigated by care at high-volume centers.

Table 1

Characteristics of women admitted for primary surgical intervention with ovarian or fallopian tube cancer in the California OSHPD Database, 2006-2010

Characteristic	N	%
Age		
18-64 years old	5,130	64.7
≥65 years old	2,803	35.3
Race		
White	5,095	64.2
Black	290	3.7
Hispanic	1,400	17.7
Asian/Pacific Islander	836	10.5
Other	312	3.9
Payer Category		
Medicare/Other Govt	2,678	33.8
Public	1,091	13.8
Private	4,003	50.5
Self-pay	145	1.8
Other	16	0.2
Comorbidity score		
0	7,226	91.1
1	435	5.5
2	195	2.5
>2	77	1.0
Hospital volume		
Low (<20 cases/year)	4,129	52.1
High (≥20 cases/year)	3,804	48.0
Number of procedures		
Oophorectomy only	97	1.2
2-5	3,813	48.1
6-10	3,372	42.5
More than 10	651	8.2
Total	**7,993**	

Table 2

Insurance coverage, stratified by race, in the California OSHPD database, 2006-2010

Racial Classification	N	Private	Medicare/other govt	Public	Self-pay	Other
White	5,095	2,634 (51.7%)	2,025 (39.7%)	359 (7.1%)	65 (1.3%)	12 (0.2%)
Black	290	125 (43.1%)	98 (33.8%)	64 (22.1%)	3 (1.0%)	0
Hispanic	1,400	568 (40.6%)	296 (21.1%)	483 (34.5%)	50 (3.6%)	3 (0.2%)
Asian/Pacific Islander	836	526 (62.9%)	161 (19.3%)	129 (15.4%)	19 (2.3%)	1 (0.1%)
Other	312	150 (48.1%)	98 (31.4%)	56 (18.0%)	8 (2.6%)	0
Total	**7,933**	**4,003 (50.5%)**	**2,678 (33.8%)**	**1,091 (13.8%)**	**145 (1.8%)**	**16 (0.2%)**

Table 3

Proportion of patients receiving ovarian cancer related surgical procedures, stratified by race, in the California OSHPD database, 2006-2010.

Racial classification	N	Hysterectomy	Lymphadenectomy	Bowel resection	Peritoneal/abdominal excision
White	5,095	3,748 (73.6%)	2,015 (40.0%)	2,403 (47.2%)	4,453 (87.4%)
Black	290	201 (69.3%)	96 (33.1)	126 (43.5%)	244 (84.1%)
Hispanic	1,400	1,060 (75.7%)	487 (34.8%)	570 (40.7%)	1,142 (81.6%)
Asian/Pacific Islander	836	696 (83.3%)	383 (12.3%)	383 (45.8%)	706 (10.4%)
Other	312	247 (79.2%)	134 (43.0%)	140 (44.9%)	260 (83.3%)
Total	**7,933**	**5,952 (75.0%)**	**3,115 (39.3%)**	**3,622 (45.7%)**	**6,805 (85.8%)**

Table 4

Multivariate logistic regression of surgical procedures, adjusting for insurance, race, comorbidity, age and hospital volume status, and stratified by hospital volume status in the California OSHPD database, 2006-2010.

					High Volume[a]				Low Volume[a]			
Hysterectomy	**OR**	**95% CI**		**P-value**	**OR**	**95% CI**		**value**	**OR**	**95% CI**		**p-value**
Insurance Coverage												
Private	1.00				1.00		--	--	1.00	--	--	--
Medicare/Other Govt	0.76	0.62	0.92	<0.01	0.86	0.65	1.14	0.30	0.68	0.52	0.88	<0.01
Public	0.89	0.75	1.06	0.18	1.05	0.80	1.37	0.74	0.80	0.63	1.00	0.05
Self-pay	0.70	0.48	1.04	0.07	0.53	0.26	1.11	0.09	0.75	0.47	1.20	0.23
Race												
White	1.00				1.00	--	--	--	1.00	--	--	--
Black	0.77	0.59	1.00	0.05	0.73	0.51	1.05	0.09	0.81	0.55	1.19	0.28
Hispanic	0.98	0.84	1.13	0.75	0.84	0.66	1.05	0.12	1.08	0.89	1.31	0.42
Asian/Pacific Islander	1.52	1.25	1.84	<0.01	1.39	1.04	1.85	0.03	1.62	1.24	2.12	<0.01
Modified Charlson Score												
0	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
1	0.75	0.61	0.92	0.01	0.79	0.58	1.09	0.15	0.71	0.54	0.95	0.02
2	0.66	0.49	0.89	0.01	0.48	0.32	0.72	<0.01	0.94	0.60	1.48	0.80
>2	1.03	0.62	1.72	0.90	0.77	0.37	1.58	0.47	1.34	0.65	2.77	0.43
Age												
18-64 years old	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
≥65 years old	0.54	0.45	0.65	<0.01	0.52	0.39	0.69	<0.01	0.56	0.43	0.72	<0.01
Volume												
Low (<20 cases/year)	1.00	--	--	--								
High (≥20 cases/year)	1.06	0.95	1.17	0.29								
Lymphadenectomy	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**
Insurance Coverage												

Lymphadenectomy	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**
Private	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Medicare/Other Govt	0.89	0.75	1.07	0.22	0.90	0.69	1.16	0.40	0.91	0.71	1.16	0.44
Public	0.77	0.67	0.89	<0.01	0.70	0.56	0.87	<0.01	0.83	0.69	1.01	0.06
Self-pay	0.86	0.61	1.21	0.38	0.88	0.44	1.73	0.71	0.88	0.59	1.31	0.54
Race												
White	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Black	0.76	0.59	0.99	0.04	0.77	0.54	1.09	0.13	0.77	0.53	1.11	0.16
Hispanic	0.81	0.71	0.92	<0.01	0.86	0.70	1.05	0.14	0.77	0.65	0.92	<0.01
Asian/Pacific Islander	1.20	1.04	1.40	0.02	1.28	1.03	1.60	0.03	1.15	0.93	1.41	0.20
Modified Charlson Score												
0	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
1	0.83	0.68	1.03	0.09	0.82	0.60	1.12	0.21	0.85	0.64	1.13	0.27
2	0.73	0.53	1.00	0.05	0.68	0.44	1.06	0.09	0.80	0.51	1.26	0.33
>2	0.45	0.26	0.79	<0.01	0.46	0.20	1.06	0.07	0.46	0.22	0.97	0.04
Age												
18-64 years old	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
≥65 years old	0.67	0.56	0.80	<0.01	0.61	0.47	0.79	<0.01	0.72	0.57	0.92	<0.01
Volume												
Low (<20 cases/year)	1.00	--	--	--								
High (≥20 cases/year)	1.12	1.02	1.23	0.02								

Bowel resection	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**
Insurance Coverage												
Private	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Medicare/Other Govt	0.79	0.66	0.93	<0.01	0.66	0.51	0.85	<0.01	0.93	0.73	1.18	0.53
Public	0.88	0.76	1.01	0.07	0.83	0.67	1.03	0.09	0.93	0.77	1.12	0.45
Self-pay	0.93	0.66	1.30	0.66	1.11	0.57	2.18	0.76	0.90	0.61	1.34	0.61
Race												
White	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Black	0.87	0.68	1.10	0.24	0.84	0.60	1.16	0.29	0.91	0.64	1.29	0.60

Bowel resection	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**
Hispanic	0.80	0.71	0.91	<0.01	0.85	0.70	1.03	0.10	0.77	0.65	0.91	<0.01
Asian/Pacific Islander	0.95	0.82	1.10	0.46	0.93	0.75	1.16	0.51	0.96	0.78	1.17	0.66
Modified Charlson Score												
0	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
1	0.96	0.79	1.17	0.69	0.75	0.56	1.00	0.05	1.19	0.91	1.56	0.20
2	0.93	0.70	1.24	0.62	0.71	0.48	1.07	0.10	1.26	0.83	1.91	0.28
>2	0.94	0.59	1.48	0.77	0.97	0.49	1.91	0.92	0.92	0.50	1.71	0.80
Age												
18-64 years old	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
≥65 years old	1.14	0.96	1.35	0.12	1.25	0.98	1.60	0.08	1.05	0.84	1.32	0.68
Volume												
Low (<20 cases/year)	1.00	--	--	--								
High (≥20 cases/year)	1.33	1.22	1.45	<0.01								

Peritoneal excision	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**	**OR**	**95% CI**		**p-value**
Insurance Coverage												
Private	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Medicare/Other Govt	0.82	0.64	1.05	0.11	0.90	0.60	1.34	0.60	0.78	0.57	1.07	0.12
Public	0.89	0.74	1.08	0.23	0.82	0.60	1.13	0.22	0.93	0.73	1.18	0.54
Self-pay	0.88	0.57	1.37	0.58	1.01	0.35	2.91	0.98	0.86	0.53	1.40	0.56
Race												
White	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
Black	0.78	0.56	1.08	0.13	0.75	0.46	1.22	0.25	0.80	0.52	1.25	0.33
Hispanic	0.70	0.59	0.82	<0.01	0.70	0.52	0.94	0.02	0.70	0.57	0.86	<0.01
Asian/Pacific Islander	0.81	0.66	1.00	0.05	0.77	0.55	1.08	0.14	0.83	0.64	1.09	0.18
Modified Charlson Score												
0	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
1	1.08	0.80	1.44	0.63	0.90	0.57	1.41	0.63	1.21	0.83	1.78	0.32
2	0.72	0.49	1.05	0.09	0.59	0.34	1.01	0.05	0.86	0.51	1.45	0.57
>2	0.76	0.42	1.37	0.37	1.24	0.38	4.12	0.72	0.62	0.31	1.24	0.18

Peritoneal excision	OR	95% CI		p-value	OR	95% CI		p-value	OR	95% CI		p-value
Age												
18-64 years old	1.00	--	--	--	1.00	--	--	--	1.00	--	--	--
≥65 years old	1.27	1.00	1.61	0.05	1.18	0.79	1.75	0.42	1.31	0.97	1.77	0.08
Volume												
Low (<20 cases/year)	1.00	--	--	--								
High (≥20 cases/year)	1.66	1.46	1.90	<0.01								

[a] High volume is defined as having at least 20 ovarian cancer surgical cases per year. Low volume is defined as having less than 20 ovarian cancer surgical cases per year.

Table 5

Multivariate analysis of patient characteristics and high volume hospital status in the California OSHPD database, 2006-2010.

High volume hospital[a]	OR	95% CI		p-value
Insurance Coverage				
Private	1.00	--	--	--
Medicare/Other Government	1.02	0.86	1.21	0.85
Public	0.82	0.71	0.95	0.01
Self pay	0.35	0.24	0.51	<0.01
Race				
White	1.00	--	--	--
Black	1.16	0.92	1.48	0.22
Hispanic	0.72	0.64	0.82	<0.01
Asian/Pacific Islander	0.85	0.73	0.99	0.03
Modified Charlson Score				
0	1.00	--	--	--
1	0.89	0.73	1.09	0.27
2	1.16	0.87	1.55	0.31
>2	0.84	0.53	1.32	0.44
Age				
18-64 years old	1.00	--	--	--
≥65 years old	0.96	0.82	1.14	0.66

[a] High volume is defined as having at least 20 ovarian cancer surgical cases per year.