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Spatial Analysis of Adherence to Treatment Guidelines for Advanced-Stage Ovarian Cancer and the Impact of Race and Socioeconomic Status

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Abstract

OBJECTIVE—To determine the impact of geographic location on advanced-stage ovarian cancer care adherence to National Comprehensive Cancer Network (NCCN) guidelines in relation to race and socioeconomic status (SES).

METHODS—Patients diagnosed with Stage IIIC/IV epithelial ovarian cancer (1/1/96-12/31/06) were identified from the California Cancer Registry. Generalized additive models were created to assess the effect of spatial distributions of geographic location, proximity to a high-volume hospital (≥20 cases/year), distance travelled to receive care, race, and SES on adherence to NCCN guidelines, with simultaneous smoothing of geographic location and adjustment for confounding variables. Disparities in geographic predictors of treatment adherence were analyzed with the χ^2 test for equality of proportions.

RESULTS—Of the 11,770 patients identified, 45.4% were treated according to NCCN guidelines. Black race (OR=1.49, 95%CI=1.21-1.83), low-SES (OR=1.46, 95%CI=1.24-1.72), and geographic location ≥80km/50mi from a high-volume hospital (OR=1.88, 95%CI=1.61-2.19) were independently associated with an increased risk of non-adherent care, while high-volume hospital treatment (OR=0.59, 95%CI=0.53-0.66) and travel distance to receive care ≥32km/20mi (OR=0.80, 95%CI=0.69-0.92) were independently protective. SES was inversely associated with location ≥80km/50mi from a high-volume hospital, ranging from 6.3% (high-SES) to 33.0% (low-SES) (p<0.0001). White patients were significantly more likely to travel ≥32km/20mi to receive care (21.8%) compared to Blacks (14.4%), Hispanics (15.9%), and Asian/Pacific Islanders (15.5%) (p<0.0001).

CONCLUSION—Geographic proximity to a high-volume hospital and travel distance to receive treatment are independently associated with NCCN guideline adherent care for advanced-stage

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ovarian cancer. Geographic barriers to standard ovarian cancer treatment disproportionately affect racial minorities and women of low-SES.

INTRODUCTION

In the United States, more than 22,000 new cases of ovarian cancer are diagnosed annually, with over 14,000 disease-related deaths [1]. Recently, adherence to National Comprehensive Cancer Network (NCCN) treatment guidelines for ovarian cancer has been validated as correlating with improved disease-specific survival and suggested as a viable process measure of quality cancer care [2]. Improving adherence to evidence-based processes that improve survival has been championed as a key requirement for improving the quality of ovarian cancer care [3]. Race, poverty level, and insurance status have been identified as independent predictors of both an increased likelihood of nonstandard treatment and worse survival [4-9].

The U.S. Department of Health and Human Services has targeted disparities in access to health care as the centerpiece of the Healthy People 2020 campaign [10]. For ovarian cancer, perhaps more so than any other gynecologic malignancy, improving survival outcomes for all segments of the population hinges upon universal access to expert care and the administration of effective contemporary treatment programs [11-15]. While racial minorities and the socioeconomically disadvantaged are confronted with multiple barriers to appropriate care, the potential contribution of geography to disparities in ovarian cancer treatment has not been widely explored. The objective of the current study was to determine the impact of geographic location on adherence to NCCN treatment guidelines for advanced-stage ovarian cancer care in relation to race and socioeconomic status (SES).

METHODS

The study design was a retrospective population-based analysis of the effect of geographic variation on adherence to NCCN guidelines for treatment of advanced-stage invasive epithelial ovarian cancer reported to California Cancer Registry using generalized additive models (GAMs), with simultaneous smoothing of location and adjustment for known confounders [16, 17]. The study received exempt status by the Institutional Review Board of the University of California, Irvine (HS#2011-8317). Registry case reporting is estimated to be 99% for the entire state of California, with follow-up completion rates exceeding 95% [18]. International Classification of Disease Codes for Oncology based on World Health Organization's criteria was used for tumor location and histology. Cases were identified using ovarian Surveillance, Epidemiology, and End Results (SEER) primary site code (C569).

The initial study population included women who were age ≥18 years at diagnosis of a first or only invasive epithelial ovarian cancer. A total of 21,044 incident cases were identified during the time period 1/1/96-12/31/06. We sequentially excluded: 101 borderline tumors, 165 of non-epithelial histology, 246 cases that had missing ICD-O-2 morphology code, 742 cases prepared from autopsy or death certificate only, 1,410 with incomplete clinical information, 78 with incomplete hospital information or location outside of California, and

98 with missing census tract information. Among the remaining 18,204 cases of all stages, 11,770 patients diagnosed with International Federation of Gynecology and Obstetrics (FIGO) stage IIIC/IV disease were selected as the study population and represents a subset of a prior analysis investigating predictors of access to high-volume providers [11].

The primary analysis was the effect of geographic variation on adherence to NCCN treatment guidelines for stage IIIC/IV epithelial ovarian cancer based on recommendations for surgery and chemotherapy according to the time period of diagnosis [19-23]. A minimum of oophorectomy (with or without hysterectomy) and omentectomy was considered adherent surgical care, and either initial surgery or chemotherapy was characterized as appropriate. Administration of multi-agent chemotherapy was characterized as adherent care. Dichotomous variables, adherence or non-adherence, were created for the overall treatment program.

The GAM estimates the log odds of NCCN guideline treatment adherence throughout California by applying a bivariate smooth of the latitude and longitude of participants' location, represented by the centroid of the address census block. A locally weighted regression smoother (loess) was used in the analyses. The loess smoother predicts the log odds by fitting a regression to data points closest to the prediction point and weighting the data points with a tri-cube function of their distance from the prediction point [24]. The number of data points used for smoothing was determined by minimizing Akaike's Information Criterion. An evenly spaced grid of prediction points approximately 5km apart that extended across the latitude and longitude coordinates of participants' locations throughout California was generated, resulting in in a grid of over 13,000 prediction points. At each point on the grid the log odds and odds ratios were calculated, with the study area serving as the referent group; the log odds at each point was divided by the log odds from a reduced model which did not include the smooth of latitude and longitude [16, 17].

GAMs provide a useful framework for hypothesis testing [25]. We used permutation tests to test the null hypothesis that the odds of adherence to NCCN guidelines was not dependent on the geographic location of subjects. Residential locations were permuted 999 times while preserving participants' outcome status and covariates. For each permutation, the GAM was refit and a global deviance statistic was computed. If the global statistic indicated that residential location was a significant predictor of the outcome ($p<0.05$), point-wise departures from the null hypothesis using the same set of permutations were evaluated. Areas of significantly increased or decreased odds were defined as points ranking in the extreme 2.5% of the distribution of permuted odds ratios at each point. Spatial analyses were conducted in the R Package (version 2.12.02; Vienna, Austria) using the gam and MapGam packages. Odds ratios were mapped in ArcMap (version 10.0, ESRI; Redlands, CA) using a continuous color scheme (dark red to dark blue) and a constant scale range. Areas of significantly elevated or lowered odds were mapped using black contour bands.

Without the bivariate smooth term, the GAM reduces to an ordinary logistic regression. The model included age at diagnosis as a continuous variable, tumor characteristics (FIGO stage, grade, histology and tumor size), insurance type, race, and SES. Insurance type was grouped into 6 categories: Managed Care (managed care, HMO, PPO, other private insurance),

Medicare, Medicaid, Other Insurance (military, county-funded), Not Insured (self-pay), and Unknown. SES was classified according to increasing quintile of Yost score: lowest (SES-1), low-middle (SES-2), middle (SES-3), high-middle (SES-4) and highest (SES-5) [18]. The Yost score is an index of SES level based on a principal components analysis of variables at the census block-level and includes education, household income, proportion below 200% poverty level, house value, rent, percent employed, and percent with blue-collar employment [26]. In addition, the model included a variable to indicate if the hospital for each subject was a high-volume hospital (HVH) or a low-volume hospital (LVH). Hospital volume was calculated based on the average annual number of all ovarian cancer cases (stages I-IV) that were admitted in that hospital. Hospitals with ≥20 cases per year were classified as HVH, and hospitals with <20 cases per year were considered low-volume [12-15]. Lastly, the model included variables for distance between each subject and the treating hospital, as well as distance to the closest HVH. Distances were calculated using ArcMap (version 10.0, ESRI; Redlands, CA) and categorized by quintiles: distance to care (<5km/3mi; 5-9km/3-5mi; 10-16km/6-9mi; 17-31km/10-19mi; ≥32km/20mi) and distance to closest HVH (<9km/5mi; 9-17km/5-10mi; 18-33km/11-20mi; 34-79km/21-49mi; ≥80km/50mi).

Secondary analyses investigated disparities across racial and SES classifications associated with geographic characteristics identified by the GAM as significantly predictive of treatment non-adherent to NCCN guidelines. Differences across distance quintiles according to racial and SES variables were analyzed with the χ^2 test for equality of proportions using the R Package (version 2.12.02; Vienna, Austria).

RESULTS

Population Characteristics

The median age at diagnosis for the 11,770 subjects was 65.0 years (mean=63.8 years, range=18-104 years), and 7,218 patients (61.3%) had stage IIIC disease (Table 1). The majority of patients were White (71.7%) followed in frequency by Hispanic (15.3%), Asian/Pacific Islander (8.3%), and Black (4.7%). Managed Care (44.8%) and Medicare (32.2%) were the most common payer categories. Overall, 5,343 patients (45.4%) were treated according to NCCN guidelines (Figure 1A). A total of 378 hospitals provided care to the study population (Figure 1B). Of these, 12 hospitals (3.2%) were high-volume (2,112 patients, 17.9% of cases) and 366 were low-volume (9,658 patients, 82.1% of cases).

Distances between subject location and the hospital where they received care were calculated, divided by quintiles, and stratified according to hospital volume. Comparison of patients treated at HVHs versus those treated at LVHs revealed an inverse relationship for distance travelled to receive care. Among patients treated at a HVH, the proportion in each travel distance quintile were: <5km/3mi = 10.8%, 5-9km/3-5mi = 14.1%, 10-16km/6-9mi = 16.4%, 17-31km/10-19mi = 25.1% and ≥32km/20mi = 33.0%. Among patients treated at a LVH, the proportion in each travel distance quintile were: <5km/3mi = 22.0%, 5-9km/3-5mi = 21.3%, 10-16km/6-9mi = 20.8%, 17-31km/10-19mi = 18.9%, and ≥32km/20mi = 17.0%). The differences in distance travelled to receive care according to each quintile were statistically significant ($p<0.0001$).

Spatial Analysis of Adherence to NCCN Guidelines

The initial iteration of the spatial analysis reflects the effect of geographic location on the likelihood of treatment non-adherent to NCCN guidelines without adjusting for the effects of other variables and shows the odds of care being non-adherent to NCCN guidelines at each location relative to the odds for the entire state. The impact of geographic distribution on treatment adherence to guidelines was affected as additional variables were introduced into the model in a stepwise fashion (Figure 2). The global test for location was highly significant for all analyses ($p<0.001$), indicating that the likelihood of adherence to NCCN treatment guidelines was significantly associated with the geographic location of subjects. After controlling for disease-related characteristics, the final model showed that Black race (OR=1.49, 95%CI=1.21-1.83) and SES were independently associated with an increased likelihood of treatment non-adherent to NCCN guidelines (Table 2). Compared to the highest SES group (SES-5), the likelihood of non-standard treatment was increased by 22% for SES-3, 34% for SES-2, and 46% for SES-1. Treatment at a HVH was significantly protective (OR=0.59, 95%CI=0.53-0.66). Age, stage, tumor histology, and tumor grade were also significantly associated with deviation from NCCN guideline care.

The final model also revealed that geographic characteristics were significant predictors of non-standard treatment after accounting for disease-related and demographic variables. Patient travel distance to receive care demonstrated a threshold effect, with no statistically significant difference for travel distances <32km/20mi. However, travel distance to receive care ≥32km/20mi was associated with an independent and statistically significant protective effect against treatment that deviated from NCCN guidelines (OR=0.80, 95%CI=0.69-0.92). A linear trend was observed between increasing distances from a HVH and the likelihood of treatment deviation from NCCN guidelines, which reached statistical significance at the threshold of the farthest distance quintile. Specifically, geographic location ≥80km/50mi from a HVH was independently associated with an increased risk of non-adherent care (OR=1.88, 95%CI=1.61-2.19).

Race, Socioeconomic Status, and Geographic Predictors of Treatment

The potential interaction between race and SES and the geographic variables predictive of treatment adherence to NCCN guidelines were explored through a series of contingency tables and radar plots. Analysis of distance to receive care revealed statistically significant ($p<0.0001$) trends across each quintile of distance stratified by racial category (Figure 3A). The most notable difference was within the longest distance quintile, with a larger proportion of White patients travelling ≥32km/20mi for care (21.8%) compared to Blacks (14.4%), Asian/Pacific Islanders (15.9%), and Hispanics (15.5%). Stratification across SES categories also revealed statistically significant differences for each distance quintile ($p<0.0001$). The higher SES groups (SES-4 and SES-5) were more likely to travel intermediate distances to receive care (5-31km/3-19mi), while the lowest SES group (SES-1) was the most likely (23.6%) to receive care <5km/3mi from their location of residence (Figure 3B).

Race was significantly associated with geographic proximity to a HVH across all distance quintiles ($p<0.0001$) (Figure 4A). White patients were significantly more likely to live

≥80km/50mi from a HVH (22.9%) compared to Hispanics (17.8%), Blacks (8.6%), and Asian/Pacific Islanders (5.2%), while non-White races were more likely to live within 17km/10mi of a HVH. Conversely, Whites were less likely to live within 9km/5mi of a HVH (17.5%) compared to Hispanics (21.3%), Asian/Pacific Islanders (32.9%) and Blacks (31.2%). Statistically significant differences were also observed for SES and proximity to a HVH across all distance quintiles ($p<0.0001$) (Figure 4B). The most notable difference was the inverse linear relationship between SES and the proportion of patients living ≥80km/50mi from a HVH, ranging from 33.0% for the lowest SES group (SES-1) to 6.3% for the highest SES group (SES-5).

DISCUSSION

The contribution of geography to variation in health care access, utilization, and cancer survival has generated interest among both health care planners and social epidemiologists [27]. However, there is limited data examining these relationships for ovarian cancer [28, 29]. In two large studies utilizing the SEER-Medicare database, Polsky et al. and Thrall and coworkers identified regional variation in both surgery and chemotherapy for ovarian cancer [30, 31]. While individual patient-level factors were thought to explain much of the variance, both studies concluded that provider supply could account for many of the geographic differences. In Canada, Dehaeck et al. reported a population-based study of ovarian cancer within five health authority regions in the province of British Columbia demonstrating geographic variation in practice patterns in the context of a single-payer, publicly funded health care system [32]. Significant differences were observed across provincial regions for access to a gynecologic oncologist, the rate of optimal debulking, and administration of combination chemotherapy. There was no significant effect for geography (health authority region) on survival, however, after adjusting for treatment-related factors.

Such regional differences in health services can point to disparities in access to health care, and only a handful of studies have addressed this question in ovarian cancer. Fairfield and coworkers studied 4,589 patients from the SEER database (1998-2002) and found that hospital referral region was associated with the likelihood of cancer directed surgery but not chemotherapy use [33]. Hospital referral regions also significantly predicted all-cause mortality; however, after adjusting for cancer-directed surgery, that correlation was no longer significant. Non-White race was independently negatively associated with cancer-directed surgery, chemotherapy use, and all-cause mortality, while income and education level were not. The authors concluded that improving access to high-quality cancer surgery might improve outcomes, particularly for minorities and for older women. In a more detailed analysis of demographic variables, Ulanday and coworkers investigated geographical and socioeconomic variation in the frequency of lymph node dissection among 5,243 patients with early-stage ovarian cancer using the SEER database (2000-2008) [34]. These authors found that after adjusting for demographics, tumor characteristics, and area-based socioeconomic measures, there was a significant relationship between SEER region and the frequency of lymph node dissection. In addition to SEER region, older age, Black race, unemployment, and poverty level were associated with a lower likelihood of lymph node assessment.

The current study is unique in several respects. In contrast to previous investigators, we utilized a composite ovarian cancer quality of care process measure that has been validated to correlate with disease-specific survival, adherence to NCCN treatment guidelines, rather than individual treatment components [2, 4]. In addition, the current analysis employed a GAM to estimate the likelihood of guideline adherence throughout California based on a grid of over 13,000 geographic prediction points. After controlling for other variables, Black race, low-SES, and remoteness to a HVH were independently associated with an increased risk of non-adherent care, while high-volume hospital treatment and farther travel distance to care were independently protective. We observed significant socio-demographic disparities within geographic predictors of adherence to treatment guidelines. Increasing SES was inversely associated with the distance from a HVH, while White patients were significantly more likely to travel farther to receive care compared to patients of other races.

Strengths of the current study include the large study population size, the proven reliability of the California Cancer Registry, and examination of a contemporary time period during which no major treatment paradigm shifts occurred. There are also several limitations that must be considered when interpreting these data. First, this was a retrospective study design using a population-based data set and is subject to the inherent potential for reporting and selection bias that accompanies such methodology. Second, and perhaps most importantly, we were unable to control for potentially important unreported variables that could influence both adherence to treatment guidelines as well as referral patterns. Such variables include the presence of medical comorbidities, the extent of initial disease, patient preferences and ability to travel, and health care provider bias. A third potential limitation is that the current dataset utilized de-identified patient data, such that the census block of residence for each subject was used rather than the exact latitude and longitude of patient residence. It is possible that the results could be affected by more precise reference points for geographic location, although it is not possible to predict in which direction the observed associations might migrate. Finally, we were unable to examine the potential effect of physician specialty, as the California Cancer Registry does not capture this information routinely, or physician volume, as multiple site physician practices would confound geographic analysis.

Despite these limitations, several conclusions can be drawn from the current study. First, these data confirm that race and SES are independently predictive of disparities in adherence to ovarian cancer treatment guidelines [4-9]. Second, geographic location is associated with the likelihood of guideline care. Specifically, proximity to a high-volume hospital and travel distance to receive treatment are independent predictors of NCCN guideline adherent care for advanced-stage ovarian cancer. Third, geographic barriers to receipt of standard ovarian cancer treatment disproportionately affect racial minorities and women of low-SES, and associations between race and SES and geographic risk factors may in part explain previously observed disparities in survival.

These data are relevant to the national health care landscape, as the demographic dynamic in California serves as a bellwether for the shift that the country will experience over the next 30 years. Racial minorities, now roughly one-third of the U.S. population, are expected to become a majority by 2042, a milestone reached in California in 2000 [35, 36]. Additional research is needed to precisely define the necessary changes in our health care delivery

system that will optimize work force distribution to underserved populations and facilitate performance-based concentration of services for all women with ovarian cancer. Centralization of care for women with ovarian cancer is possible [37]. However, in the United States, transplant surgery probably offers the best template for how regionalization of health care services for a relatively uncommon condition that carries a high risk of mortality without expert care can be successfully implemented. A program for ovarian cancer might include a national organization providing oversight, regional center designation based on hospital resources (e.g. intensive care unit, multidisciplinary care and tumor board), available sub-specialists (e.g. gynecologic oncologist), and minimum hospital and surgeon annual volume requirements. Center designation would require an active quality improvement program and participation in a patient registry, with comprehensive reporting of data on consecutive patients for morbidity, mortality, risk-adjusted quality process measures (e.g. the proportion of patients receiving NCCN guideline treatment, undergoing complete cytoreduction, treated neoadjuvant chemotherapy), and cost-effectiveness benchmarks. Ultimately, performance metrics, including risk-adjusted survival data, would be available to potential patients, health insurance organizations, and health care administrators. As for transplant surgery, third party payers would cover care at an approved center, and resources would be available to patients to facilitate regional referral as well as coordination of care closer to home. In this way, concentration of services for ovarian cancer care could be an effective means to reduce disparities in treatment and outcomes and promote health equity. Ultimately, all people should be afforded the same standard of care, including access to appropriately qualified surgeons and an optimal treatment setting, regardless of race, SES, or where they reside [32].

Supplemental material Figure 2 (video): effect of geographic location on risk of non-adherence to NCCN treatment guidelines for advanced-stage ovarian cancer adjusted for the effects of other variables.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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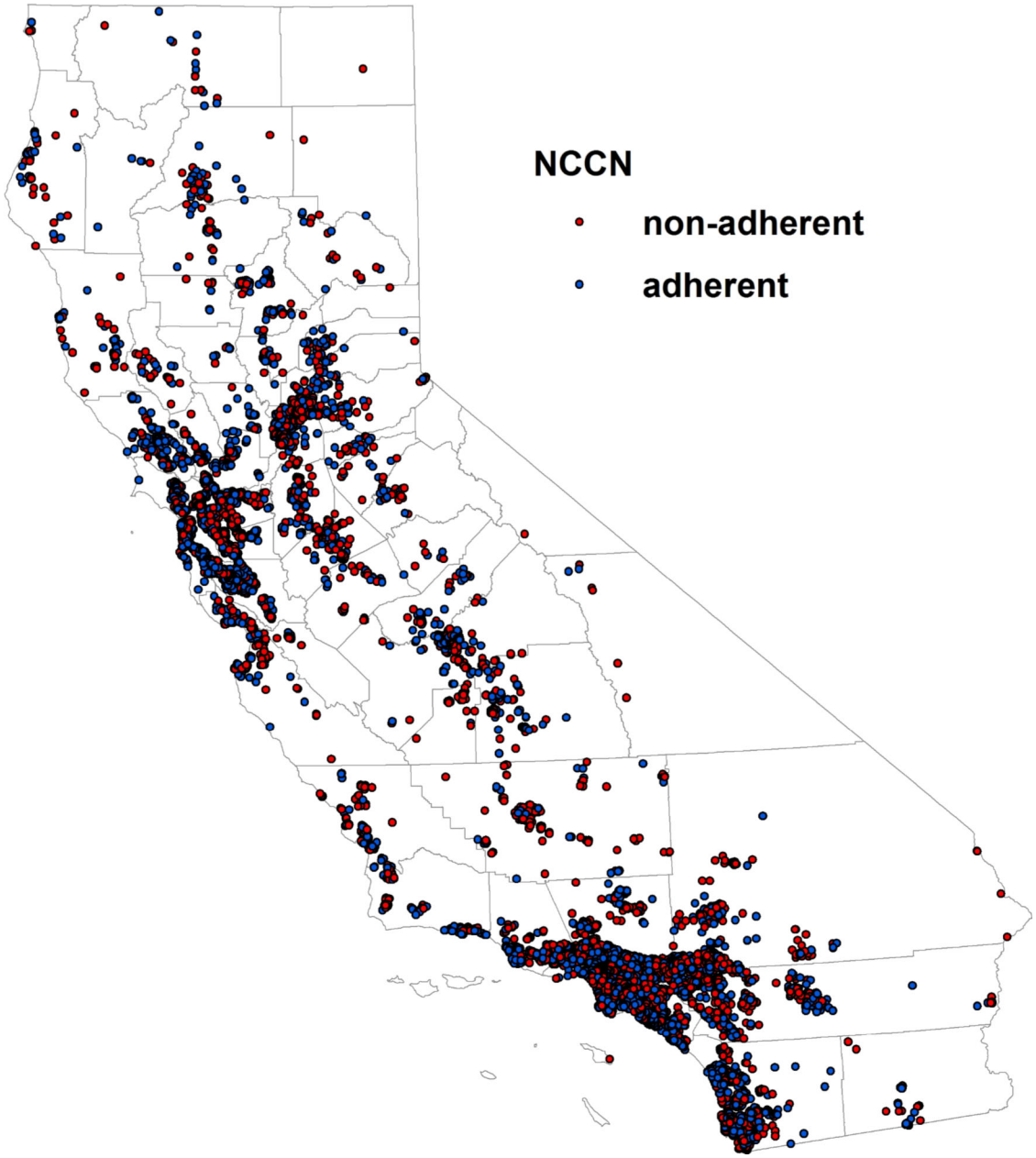
A.



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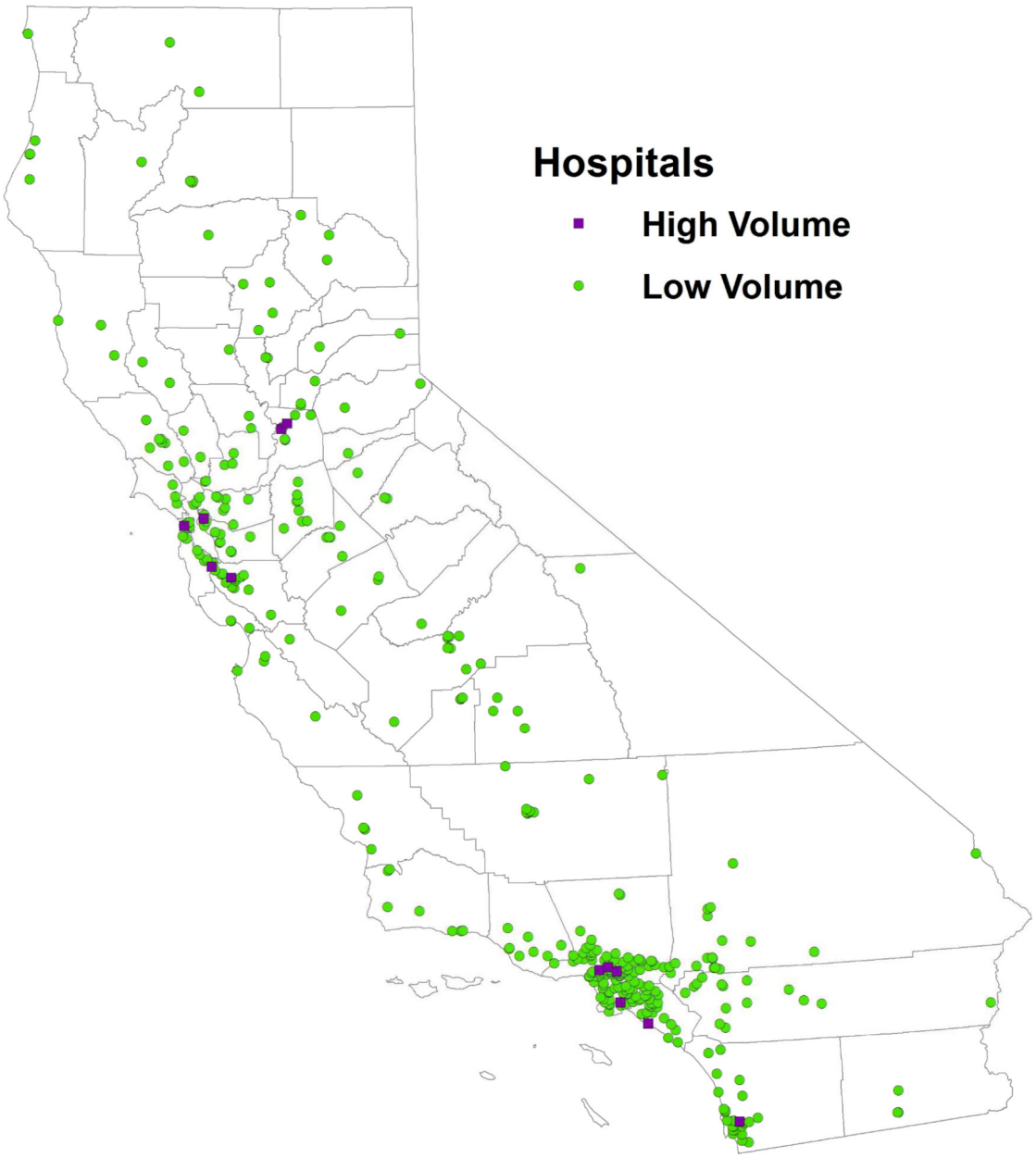


Figure 1.

(A) Geographic distribution of 11,770 cases of stage IIIC/IV epithelial ovarian cancer stratified by adherence and non-adherence to NCCN treatment guidelines for advanced-stage ovarian cancer; (B) Geographic distribution of hospitals stratified by high-volume (n=12) and low-volume hospital (n=366).

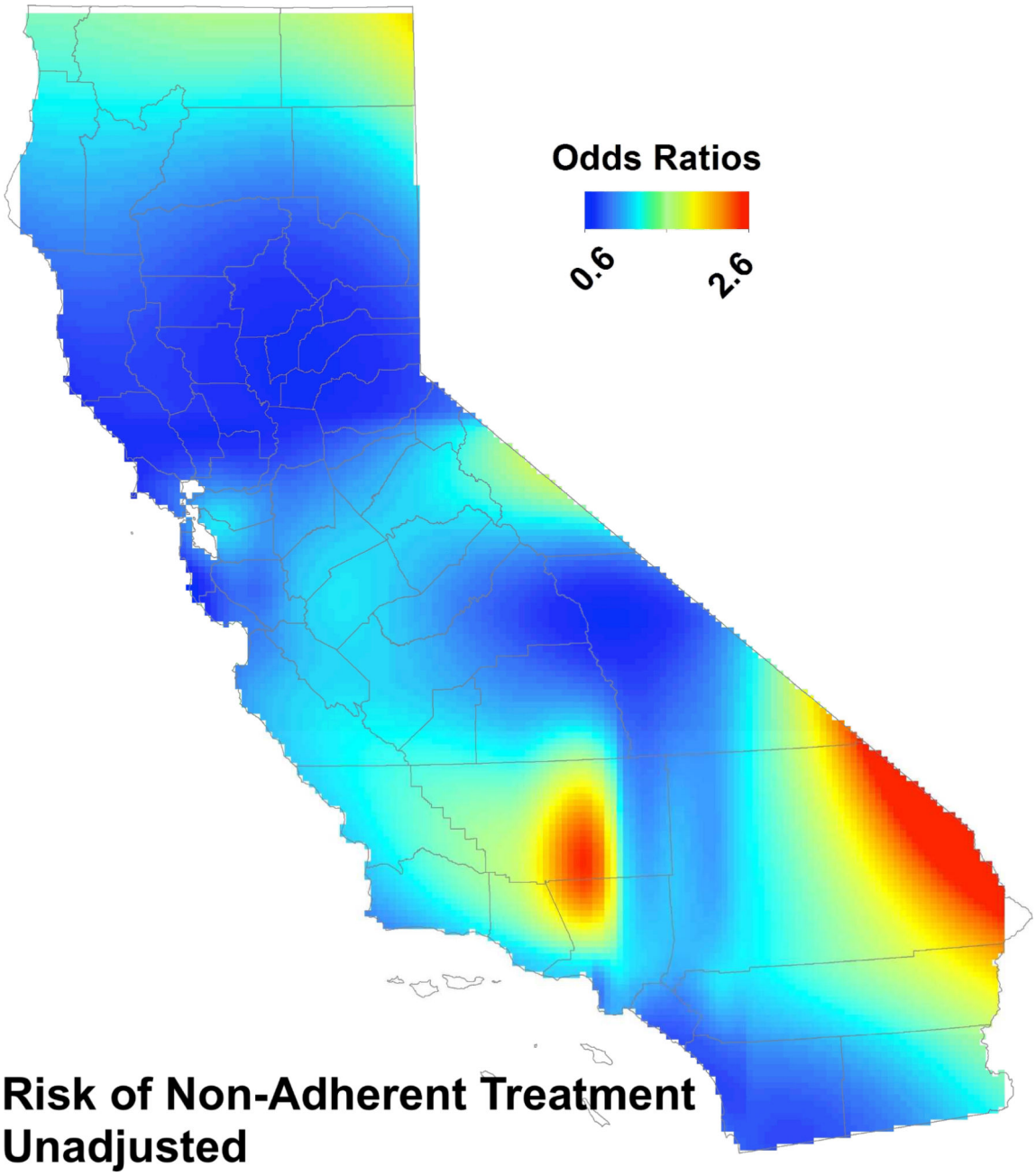
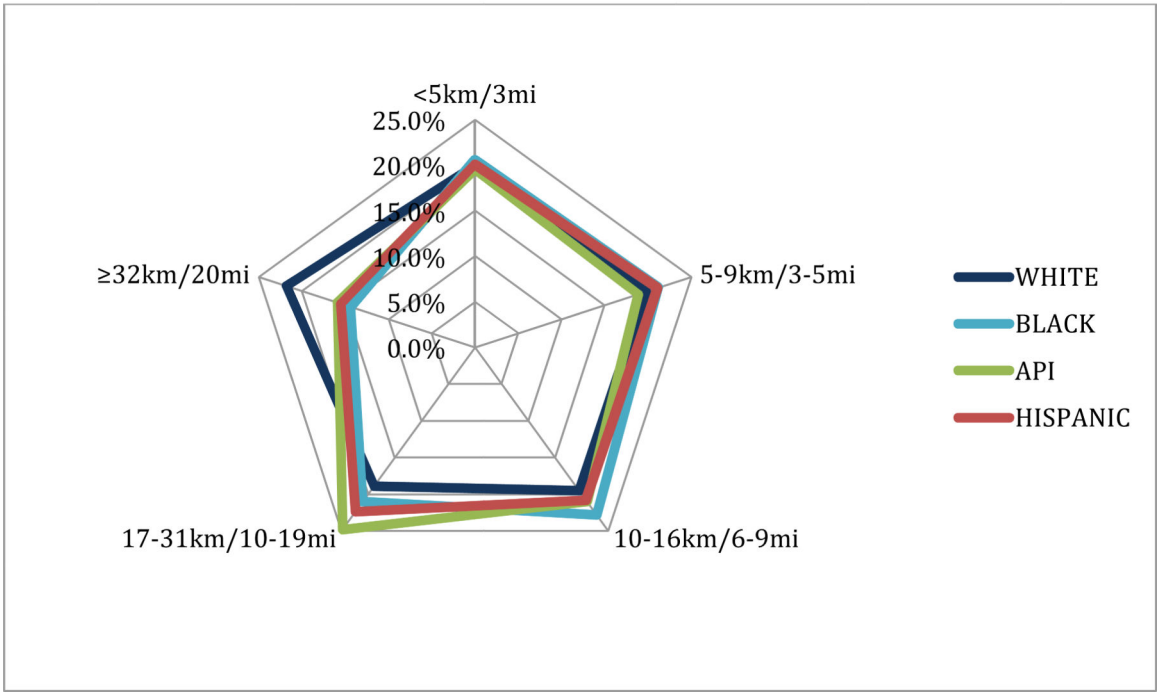


Figure 2.
Effect of geographic location on risk of non-adherence to NCCN treatment guidelines.

A.



B.

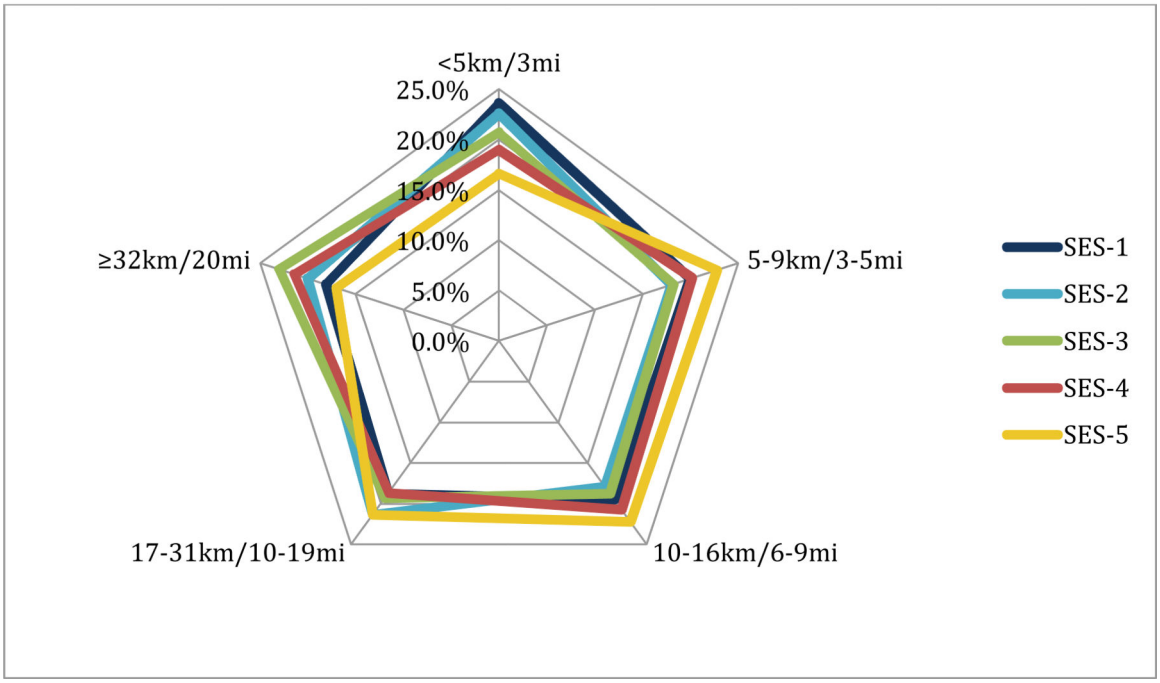
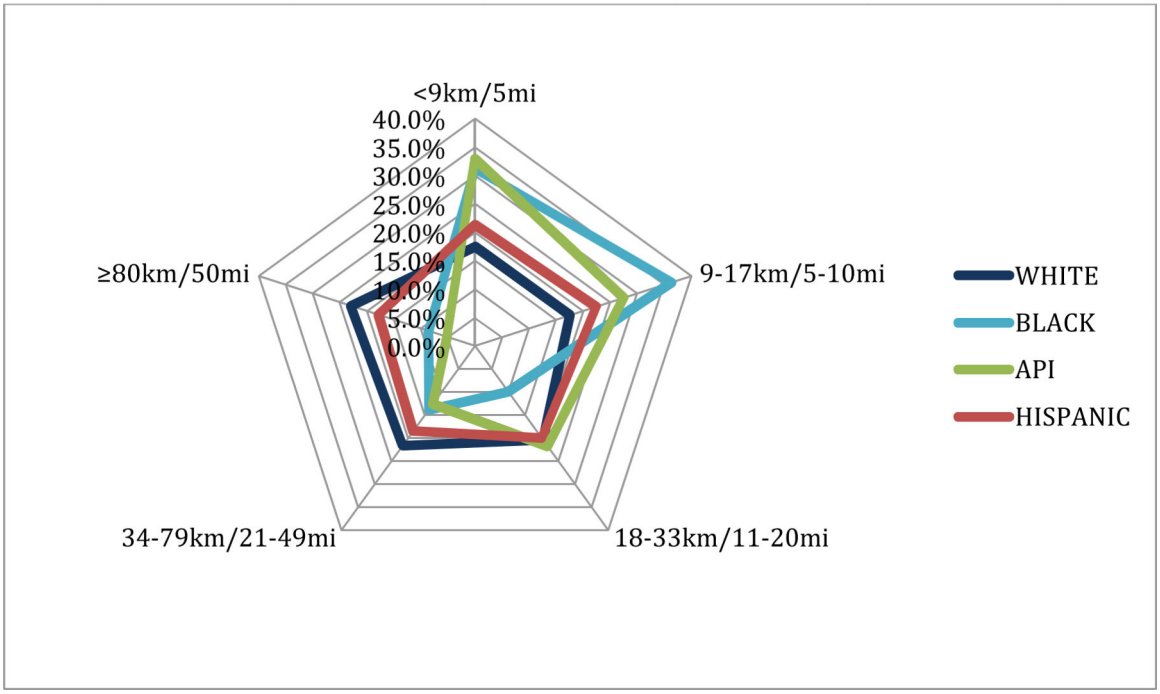


Figure 3.

Radar plot: proportional distribution of subject location and distance to receive care quintile stratified by race (A) and SES category (B). API: Asian/Pacific Islander

A.



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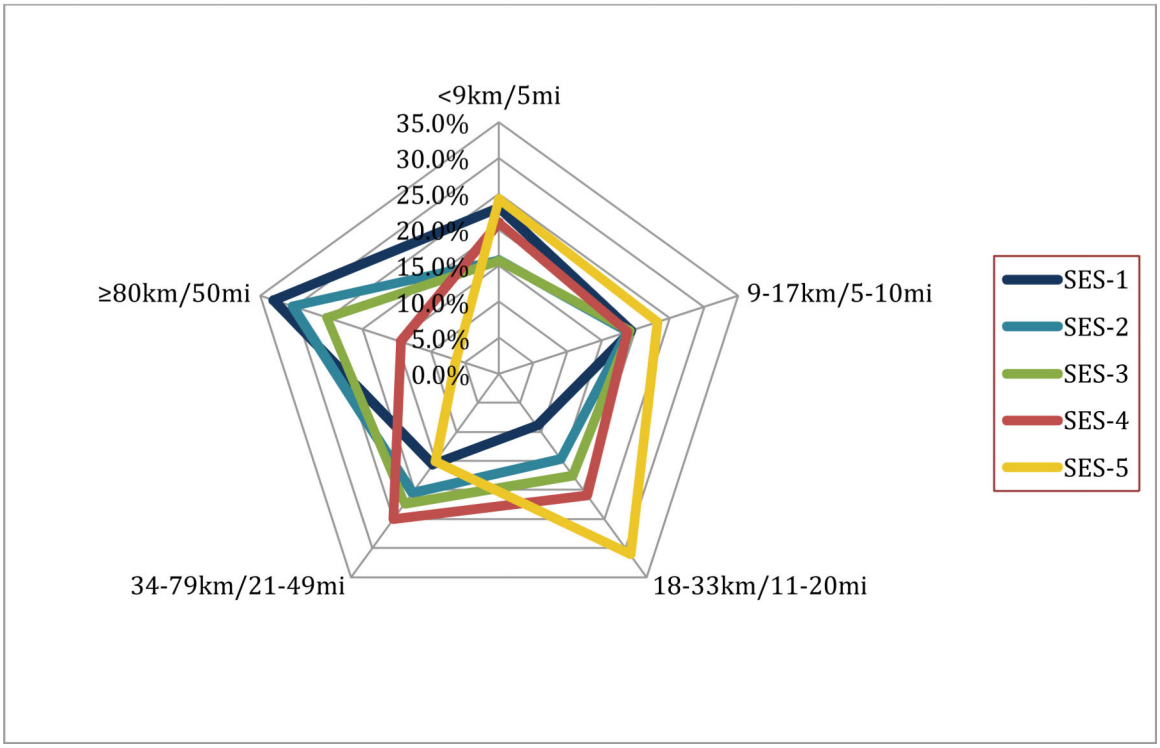

Figure 4.

Radar plot: proportional distribution of subject location and distance from a high-volume hospital quintile stratified by race (A) and SES (B). API: Asian/Pacific Islander

Table 1

Population characteristics.

Characteristic	n	Percent
Total	11770	100.0
Age (years)		
<45	1036	8.8
45-54	2062	17.5
55-69	4180	35.5
≥70	4492	38.2
Race		
White	8433	71.7
Black	557	4.7
Hispanic	1804	15.3
Asian/Pacific Islander	976	8.3
Insurance		
Managed care	5275	44.8
Medicare	3799	32.3
Medicaid	941	8.0
Other insurance	1109	9.4
Not insured	319	2.7
Unknown	327	2.8
Socioeconomic status		
Highest (SES-5)	2869	24.4
Higher-middle (SES-4)	2752	23.4
Middle (SES-3)	2483	21.1
Lower-middle (SES-2)	2137	18.2
Lowest (SES-1)	1529	13.0
Stage		
Stage IIIC	7218	61.3
Stage IV	4552	38.7
Tumor grade		
Grade 1	344	2.9
Grade 2	1562	13.3
Grade 3	4993	42.4
Grade 4	1240	10.5
Unknown	3631	30.9
Tumor histology		
Serous	5744	48.8
Clear cell	321	2.7
Endometrioid	638	5.4
Mucinous	415	3.5
Adenocarcinoma NOS*	1970	16.7

Characteristic	n	Percent
Other	2682	22.8
Tumor size		
<5cm	1274	10.8
5-10cm	2116	18.0
≥0cm	2001	17.0
Unknown	6379	54.2
Hospital volume		
High volume	2112	17.9
Low volume	9658	82.1
Treatment guideline adherence		
Adherent	5343	45.4
Non-adherent	6427	54.6

* NOS: not otherwise specified

Table 2

Multivariable analysis of predictors of treatment non-adherent to National Comprehensive Cancer Network guidelines.

Characteristic	Odds ratio	95% Confidence interval
Hospital volume		
Low-volume	1.00	referent
High-volume	0.59	0.53-0.66
Distance to care		
<5km/3mi	1.00	referent
5-9km/3-5mi	0.97	0.85-1.10
10-16km/6-9mi	0.92	0.81-1.05
17-31km/10-19mi	1.00	0.87-1.14
≥32km/20mi	0.80	0.69-0.92
Distance to High-Volume Hospital		
>9km/5mi	1.00	referent
9-17km/5-10mi	0.96	0.84-1.10
18-33km/11-20mi	1.05	0.91-1.20
34-79km/21-49mi	1.12	0.97-1.29
≥80km/50mi	1.88	1.61-2.19
Insurance status		
Managed care	1.00	referent
Medicare	1.10	0.99-1.22
Medicaid	1.03	0.88-1.21
Other insurance	1.20	1.04-1.39
Uninsured	1.11	0.86-1.43
Unknown	1.26	0.97-1.62
Socioeconomic status		
Highest (SES-5)	1.00	referent
Higher-middle (SES-4)	1.11	0.98-1.25
Middle (SES-3)	1.22	1.08-1.39
Lower-middle (SES-4)	1.34	1.16-1.54
Lowest (SES-1)	1.46	1.24-1.72
Race		
White	1.00	referent
Black	1.49	1.21-1.83
Hispanic	0.97	0.85-1.10
Asian/Pacific Islander	1.05	0.90-1.22
Age	1.03	1.03-1.04
Stage		
Stage IIIC	1.00	referent
Stage IV	1.59	1.46-1.73
Tumor grade		

Characteristic	Odds ratio	95% Confidence interval
Grade 1	1.41	1.11-1.80
Grade 2	1.22	1.08-1.38
Grade 3	1.00	referent
Grade 4	1.03	0.90-1.18
Unknown	2.99	2.69-3.33
Tumor histology		
Serous	1.00	referent
Clear cell	1.20	0.94-1.53
Endometrioid	1.36	1.14-1.62
Mucinous	1.73	1.38-2.17
Adenocarcinoma NOS*	3.14	2.75-3.58
Other	2.07	1.85-2.30

*NOS: not otherwise specified