The effect of neighborhood-level socioeconomic status on racial differences in ovarian cancer treatment in a population-based analysis in Chicago

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HIGHLIGHTS

• Racial inequality exists in receipt of even the most basic level of oncologic care for OVCA in Cook County, Illinois
• Neighborhood-level concentrated advantage appears to play a role in receipt of chemotherapy, but not in receipt of surgery
• Inequality in treatment for OVCA persisted despite adjustment for both individual-level clinical factors and neighborhood-level SES (concentrated affluence and disadvantage)

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ABSTRACT

Background. Less than half of women with ovarian cancer and blacks specifically receive therapy adherent to National Comprehensive Cancer Network (NCCN) guidelines. The purpose is to assess the effect of neighborhood-level socioeconomic status (SES) on black–white treatment differences in a population-based analysis in a highly-segregated community.

Methods. Illinois State Cancer Registry data for invasive epithelial ovarian cancer cases diagnosed in Cook County, IL in non-Hispanic white (NHW) or black (NHB) women from 1998 to 2009 was analyzed. As few women receive NCCN-adherent care, variables were constructed to assess extent of treatment, including receipt of: 1) debulking surgery; 2) any surgery; 3) multi-agent chemotherapy; and 4) any chemotherapy. Two measures (concentrated affluence and disadvantage) were used to estimate neighborhood-level SES. Multivariable logistic regression was used to compute odds ratios (OR) and 95% confidence intervals (95% CI), with generalized linear mixed models to account for hierarchical data.

Results. 2766 (81.0%) NHW and 647 (19.0%) NHB women were diagnosed. Adjusting for covariates, NHB were less likely to receive debulking surgery (OR: 0.39; 95% CI: 0.30–0.50), any surgery (OR: 0.38; 95%CI: 0.29–0.49), multi-agent chemotherapy (OR: 0.56; 95% CI: 0.45–0.71) and any chemotherapy (OR: 0.58; 95% CI: 0.45–0.74). Concentrated affluence but not disadvantage was significant in final models for multi-agent and any chemotherapy, but not debulking or any surgery.

Conclusions. Results identify black–white differences consistent across treatments that persist despite adjustment for neighborhood-level SES.

Impact. Results advance inequality awareness beyond "ideal" NCCN-adherent care, indicating inequality exists in delivery of even the most basic oncologic care.

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Introduction

Ovarian cancer is the leading cause of gynecologic cancer deaths, with an estimated 21,980 new cases and 14,270 deaths in 2014 in the

United States [1]. An absence of effective screening contributes to late stage diagnoses and poor survival, and considerable evidence supports black-white survival disparities [2–5], including stage-specific survival disparities [6–9]. Survival rates that are worsening in blacks while improving in whites contribute to escalating disparities [1,3,7,8].

Black-white differences in stage at diagnosis exist, despite heterogeneity across studies [2,3,10–12]. Lower neighborhood socioeconomic status (SES) has been associated with tumor characteristics indicative of more advanced and aggressive disease [13]. Although significant treatment differences contribute to survival disparities with analysis of national data [3–5,14], poorer black survival persists despite uniform stage, treatment, and follow-up in analysis of data pooled from Phase III randomized clinical trials (trials conducted from 1974 to 2001) [15]. More recent analyses at a tertiary referral center setting identified that black-white survival differences are largely mitigated with equal access to highly specialized care [9].

Primary therapy for advanced ovarian carcinoma according to National Comprehensive Cancer Network (NCCN) guidelines should include radical cytoreductive surgery followed by a chemotherapy doublet with a platinum agent (i.e., cisplatin or carboplatin) and a taxane (i.e., paclitaxel or docetaxel) delivered through intravenous or intraperitoneal routes for women with FIGO stage III/IV disease (NCCN v 2010). More recent recommendations include the "dose dense" approach, with paclitaxel given in a lower dose weekly for 3 weeks per cycle (NCCN v 3.2012). Analysis of National Cancer Data Base (NCDB) data indicated less than half of women with ovarian cancer receive care adherent to NCCN guidelines [5]. In addition, analysis of California Cancer Registry data in women with late-stage disease indicated less than 5% received treatment at high-volume hospitals with high-volume physicians, which together was an independent predictor of survival [16].

Increasing survival disparities with ovarian cancer mirror the progressively widening differences in black-white mortality with breast cancer, which is better studied as it is not a rare cancer. In Chicago, breast cancer black-white mortality disparities increased from 1990 to 2005 after being non-existent in 1980 [17,18], and analysis in 2005 demonstrated considerably larger mortality disparities in Chicago versus New York City and elsewhere [19]. A comparative analysis of the 25 most populous US cities identified median household income and Index of Dissimilarity (an index of segregation) [20] as significantly related to black-white disparities [21], and analysis over time (between 1990 and 2009) demonstrated large and growing black-white disparities with considerable heterogeneity by city [22]. Further, research with other health outcomes [e.g., mortality secondary to coronary heart disease [23] and diabetes mellitus [24]] has similarly identified significant US geographical heterogeneity in black-white differences, even though cities ranked differently by disease-specific disparity [21, 22,24], emphasizing the importance of local contextual factors that may operate differently in chronic and acute disease [24].

The purpose of this analysis is to assess the effect of neighborhood-level SES on black-white difference in ovarian cancer treatment administration in a population-based analysis in highly-segregated Cook County, IL [25]. Value exists in assessing treatment in Cook County as: a) treatment is one of few modifiable prognostic factors [26]; b) treatments over the past few decades have significantly increased survival [27–32]; c) women infrequently receive care adherent with NCCN guidelines, particularly blacks [5,16,33]; and, d) geographic heterogeneity suggests population-based analyses may be informative in a county segregated and large enough for sufficiently powered analysis.

Materials and methods

Study population

The Institutional Review Board (IRB) at the University of Illinois at Chicago and the Illinois Public Health Department, Illinois State Cancer Registry both reviewed and approved this research. Cancer registry data for ovarian cancer cases diagnosed from June 1, 1995–December 31, 2009 in Cook County, Illinois was obtained from the Illinois State Cancer Registry, the only source of population-based cancer incidence data for the state [34]. Illinois State Cancer Registry records included standardized data on age, race, Hispanic ethnicity, and Surveillance Epidemiology and End Results (SEER) general summary stage at diagnosis [35], with data for diagnosis years 1995–2009 estimated as 98–100% [36] complete based on North American Association of Central Cancer Registry (NAACCR) certification, meeting the NAACCR gold certification criteria for all years analyzed. First course treatment data, based on Facility Oncology Registry Data Standards (FORDS) standards, was available for cases diagnosed 1998 or later (excluding 2003), so analyses were restricted to non-Hispanic women who were black or white diagnosed from 1998 to 2009.

Cook County, which is highly segregated [25,37] and the second most populous county in the US [38], includes 1,350 census tracts (850 in Chicago, 500 in suburban Cook County) with the majority of predominantly black census tracts located on the south side. More than one-third of Cook County census tracts (n = 495) are designated by the US Department of Health and Human Services as being Medically Underserved Areas/Populations [39]. In 2000, the black-white Index of Dissimilarity [20] for Cook County was 82.5% [37], which exceeded other US metropolitan areas with the exception of Milwaukee and Detroit [25]. The Index of Dissimilarity (an index of segregation) quantifies the degree to which the minority group is distributed differently than whites across census tracts [20,25].

Case ascertainment and variable definition

Analysis included all cases of invasive epithelial ovarian cancer in non-Hispanic white (NHW) or non-Hispanic black (NHB) women aged 20 years or older [40] at diagnosis (ICD-03 epithelial histology codes included [41,42]: 8010–8046, 8441–8442, 8460–8462, 8470–8472, 8480–8482, 8380–8382, 8140–8260, 8050–8074, 8562, 8120, 8130, 9014, 8313, 9015, 8800, 8801, 9000, 8310, 8323, 8440, 8450, 8490, 8570, 8574). Tumor grade was dichotomized for analysis: 1) well or moderately differentiated tumors; and, 2) poorly differentiated, undifferentiated, or anaplastic tumors [5]. To minimize data missingness, stage was constructed by using the pathologic stage group, or clinical stage group if pathologic stage was not reported [5,43]. Age was evaluated as continuous and categorical [40,44,45], but analyzed as categorical (<50 years, 50–64 years, 60–74 years, and 75+ years) [40] since it was significantly associated with each treatment outcome. Year of diagnosis was dichotomized on the median year to allow comparison of treatment effects over time (1998–2003; 2004–2009).

Neighborhood SES variables

Similar to previous work [13], two well-established measures of neighborhood SES were constructed: concentrated disadvantage (disadvantage) and concentrated affluence (affluence) [46,47]. Residential address at diagnosis was geocoded using ArcGIS US Street Locator (ESRI, 12.0; Redlands, CA) to obtain patient census tract and matched to 2000 US Census data to obtain census tract-level demographic variables. Census variables were standardized and summed with equal weighting to create the final neighborhood-level disadvantage and advantage scores [13,46,47]. Census 2000 variables used to create final neighborhood-level disadvantage and advantage scores include the following: 1) neighborhood-level disadvantage: percent below poverty, percent unemployed, percent receiving public assistance, percent in female-headed households, percent under age 18, and percent black [46]; 2) neighborhood-level affluence: percent of families with incomes above $75,000, percent of adults with college educations; and the percent of the civilian labor force employed in professional/managerial occupations [47].