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Unraveling the etiology of ovarian cancer racial disparity in the deep south: Is it nature or nurture?

Jerlinda Ross [c], Katelyn V. Braswell [a], Luciana Madeira da Silva [a], Frances Mujica [b], Sam Stutsman [b], Michael A. Finan [a], William Nicolson [a], Mary Danner Harmon [a], Megan Missanelli [a], Alex Cohen [a], Ajay Singh [a], Jennifer M. Scalici [a], Rodney P. Rocconi [a,*]

[a] Mitchell Cancer Institute, University of South Alabama, Mobile, AL, USA
[b] University of South Alabama, Department of Earth Sciences, Mobile, AL, USA
[c] University of Chicago, Gynecologic Oncology Division, Chicago, IL, USA

HIGHLIGHTS

- A racial disparity exists in black patients with ovarian cancer in the Deep South
- Racial disparity exists despite controlling for environmental and treatment factors
- Tumor biology plays a role in racial disparity and warrants further study

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ABSTRACT

Background. Our objective was to evaluate racial treatment and survival disparities in black women with ovarian cancer in the Deep South and to determine how environmental factors / socioeconomic status (SES) influence survival.

Methods. A retrospective study of ovarian cancer patients from 2007 to 2014 was performed. Socioeconomic status (SES) was obtained though U.S. Census block data and compared using Yost scores. Comparisons were performed using standard statistical approaches.

Results. A total of 393 patients were evaluated, 325 (83%) white and 68 (17%) black. Demographic information and surgical approach were similar in each racial group. However, compared to whites, black patients had lower rates of optimal debulking [89% vs. 71%, respectively ($p = 0.001$)] and intraperitoneal chemotherapy (19% vs. 11%, $p = 0.01$). Black women had lower SES parameters including education, income, and poverty. As a result, more black patients had the lowest SES (SES-1) when compared to white patients (17% vs. 41%, $p < 0.001$). When controlling for these factors by cox regression analysis, a survival disadvantage was seen in black women for both progression free survival (16 vs. 27 months, $p = 0.003$) and overall survival (42 vs. 88 months, $p < 0.001$).

Conclusions. Despite controlling for clinical and environmental factors, a survival disadvantage was still observed in black patients with ovarian cancer in the Deep South. Black women had lower optimal debulking rates and more platinum resistant disease. These data suggest other factors like tumor biology may play a role in racial survival differences, however, more research is needed to determine this causation.

1. Background

Ovarian cancer is the most lethal gynecologic cancer, and the fifth leading cause of cancer death in the United States. This year in the US alone, it is expected to inflict nearly 22,280 women with 14,240 to succumb to this disease [1,2] . Apart from this, racial and ethnic differences in cancer-related health outcomes have been well documented [3]. African American or black women bear a disproportionate share of the cancer mortality in various types of cancer, and ovarian cancer is no exception [4]. In fact, it appears that racial disparities in treatment and survival for ovarian cancer not only exist for black patients, but have become worse [5].

Despite the fact, Caucasian American or white women have a 30% greater risk of developing ovarian cancer, black women have significantly poorer survival [6]. Over a 10-year span, the five-year survival rate for white women with ovarian cancer has improved from 37% to

* Corresponding author at: University of South Alabama Mitchell Cancer Institute, 1660 Springhill Avenue, Mobile, AL, 36604., United States.
E-mail address: rocconi@health.southalabama.edu (R.P. Rocconi).

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45% with advances in surgical techniques and introduction of platinum-based chemotherapy. However this improvement is one-sided with survival remaining shorter for black women. The 5-year survival rate for black patients with ovarian cancer has declined from 43% to 38% [6–8]. Studies demonstrate that although black women are diagnosed with ovarian cancer at a later stage, these women are less likely to receive standard chemotherapy and undergo recommended surgery including lymphadenectomy with staging [5].

Race has been suggested to be a prognostic factor in women suffering from ovarian cancer. The etiology of racial disparities in treatment and survival is multifactorial. However, the cause of these disparities likely consists of differences in tumor biology, medical comorbidities, treatment receipt, and environmental components such as socioeconomic status (SES) – or some combination of these factors [3,5]. Particularly in regards to race, the association of SES and health outcomes in ovarian cancer has been established [2,7,9,10]. Race and SES affect ovarian cancer health outcomes by influencing a patient's access to healthcare resources, which ultimately may attenuate or aggravate an adverse outcome [2,9]. Differential social conditions between racial and SES groups may be the underlying reason for persistent racial disparities in ovarian cancer [9]. However, despite this, racial disparities in treatment and survival persist even when black and white women have similar psychosocial/environmental influences like insurance status and SES as well as have homogenous histopathological factors such as stage, grade, and histologic subtype. Furthermore, evidence suggests that ovarian cancer racial disparities in treatment and survival still exist in the face of improvements in access to care and utilization of healthcare resources [5]. Parham et al. demonstrated that black women experienced poorer prognosis even after controlling for age, residential income, and cancer care facility [6].

Our objectives were to evaluate possible racial healthcare disparities in treatment and survival in black patients diagnosed with ovarian cancer in the Deep South and to determine how environmental factors / socioeconomic status (SES) influence survival.

2. Methods

After Institutional Review Board approval, a retrospective chart review was performed for patients treated at the University of South Alabama Mitchell Cancer Institute in Mobile, Alabama diagnosed with epithelial ovarian cancer (Stage I – IV) from 2007 to 2014. Demographic, treatment, and disease-related survival data were extracted from the electronic medical record for each patient. The patient demographic variables of interest included age at the time of diagnosis, body mass index (BMI), and GOG performance status. The following pathologic and treatment variables were evaluated: tumor grade, histologic subtype, surgical management (primary versus interval debulking), cytoreduction status (optimal versus suboptimal), route of chemotherapy administration (intravenous [IV] versus intraperitoneal [IP]), and platinum status (resistant versus sensitive). Cytoreduction status was defined as optimal if there was ≤1 cm of residual disease following surgical management or defined as suboptimal if there was >1 cm residual disease following debulking surgery. Platinum status was as sensitive if recurrence of disease was >6 months or resistant if recurrence of disease was ≤6 months.

SES information was obtained and aggregated at the census block group level using US Census data. Census block level data is preferred over census tract level data due to block groups being more homogeneous in regards to SES parameters. As a result, census block level data is a more accurate approximation of SES measured at the individual level [11,12]. Therefore, census block group SES can be used as a proxy for patient SES [11]. Block group level data was obtained from the 2010 U.S. Census Bureau.

Socioeconomic status (SES) was classified using the Yost index score [13]. The Yost score is a composite SES index generated by principal component analysis and comprised of census block group level characteristics including education, household income, poverty, house value, rent, unemployed rate, and rate of blue collar employment [13]. The Yost score of SES was divided into 5 categories based on increasing quintiles: lowest (SES-1), low-middle (SES-2), middle (SES-3), high-middle (SES-4), and highest (SES-5) [13,14]. Patients were assigned an SES score based on the census block group in which their residence was located.

Overall survival (OS) was calculated from the date of diagnosis until death from any cause, or last follow-up. Progression free survival (PFS) was calculated from the time of completion of primary therapy to first disease progression. PFS and OS survival were estimated using the Kaplan-Meier method with comparison of black women and white women using the long-rank test. Multivariable conditional proportional hazards models were built to determine factors associated with PFS and OS. A threshold of statistical significance of 0.05 was used for all analyses.

3. Results

3.1. Demographics

The medical records of 393 women diagnosed with Stage I-IV ovarian cancer were evaluated. In the cohort, 325 patients (83%) were white and 68 (17%) were black. The demographic features between the two racial classifications are listed in Table 1. Black and white patients were similar in regards to age, GOG performance status, stage of disease, grade of tumor, and histologic tumor subtype. In regards to cancer treatment, there was no significant difference between surgical management with primary debulking or interval debulking in each racial group ($p = 0.09$). However, despite similar surgical management, optimal debulking rates were significantly lower in black women when compared to white women (71% and 89%, respectively, $p = 0.001$). As a byproduct of lower optimal debulking rates, black women also had lower intraperitoneal (IP) chemotherapy utilization when compared to white women (11% and 19%, respectively, $p = 0.01$). (See Table 2.)

3.2. Socioeconomic data

To investigate the treatment differences within this population, patient environmental factors specifically, socioeconomic status were assessed via census block group level data used to generate the Yost score. (Table 3). In this cohort, significantly more black women had "*no high school diploma*" compared to white women (20% and 15.8%, respectively $p = 0.023$). Although there was no difference between the groups in regards to "*some college education*", there were significantly

Table 1
Demographics of participants in this retrospective cohort stratified by race ($n = 393$).

	White $N = 325$ (%)	Black $N = 68$ (%)	*P* value
Age (mean)	61.0	63.1	0.43
BMI (mean)	28.1	32.1	0.28
GOG Status			0.07
0	223 (68.6)	38 (56.0)	
1	76 (23.4)	27 (39.4)	
2	26 (8.0)	3 (4.5)	
Stage			0.58
I/II	80 (24.5)	16 (24.2)	
III/IV	245 (75.5)	52 (75.8)	
Histology			0.49
Serous	243 (74.8)	54 (79.4)	
Endometrioid	37 (11.4)	7 (10.9)	
Mixed	23 (7.2)	4 (6.3)	
Clear Cell	22 (6.6)	3 (4.7)	
Grade			0.10
1	25 (7.7)	3 (5.1)	
2	50 (15.3)	5 (6.8)	
3	250 (77.0)	60 (88.1)	

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