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Evaluating socioeconomic status, racial, and US geographic regional differences in biomarker testing and treatment in advanced ovarian cancer

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Objective

- To characterize the socioeconomic status (SES), racial, and US regional differences in the use of biomarker testing and first-line maintenance (1LM) therapy among US patients with advanced ovarian cancer (AOC) who were diagnosed between January 2019 and March 2022

Conclusions

- In this study of US patients with AOC, predominantly from a community clinic setting, the overall breast cancer gene mutation (BRCAm) testing rates were 87%
  - In contrast, homologous recombination deficiency (HRD) testing rates were 28% among patients with BRCA wild type (BRCAwt) or BRCAunknown (BRCAu) status
- While biomarker-testing rates were broadly comparable across US geographic regions, some differences in testing rates by SES and race were observed
- Overall, the use of biomarker testing was a robust indicator of whether patients received 1LM therapy, with the majority of patients who were not biomarker tested receiving no 1LM therapy
- Among those patients who were biomarker tested, 1LM therapy use was broadly comparable across SES, race, and US geographic region
- Further exploration of the observed differences in biomarker-testing rates by SES and race/ethnicity is required to better understand potential disparities in testing, treatment, and outcomes

Plain language summary

Why did we perform this research?
Ovarian cancer remains a leading cause of gynecological cancer death in the US. Inequalities in advanced ovarian cancer (AOC) diagnosis, treatment, and survival outcomes are well documented, and factors such as patients' socioeconomic status (SES), race, and geographic location have been identified as predictors of treatment quality and survival. This study aimed to investigate differences in the use of biomarker testing, specifically for breast cancer gene mutations (BRCAm) or homologous recombination deficiency (HRD; when cells are unable to accurately repair breaks in both strands of DNA), and for first-line maintenance (1LM) therapy in US patients with AOC, according to their SES, race, and location.

How did we perform this research?
Patients were selected from the nationwide Flatiron Health electronic health record (EHR)-derived de-identified database; all were diagnosed with AOC between January 01, 2019 and March 31, 2022 and had at least one recorded contact with a clinical care provider following diagnosis. Testing rates for BRCAm and HRD (defined as having a recorded BRCAm and/or HRD biomarker status in the database), and the use of 1LM therapy were investigated for the overall patient population, and broken down according to patients' SES (scored from 1 [low]–5 [high]), race/ethnicity, and US region.

What were the findings of this research?
907 patients with AOC were included, and most (87%; n=787/907) were tested for BRCAm. Overall, 28% (n=255/907) of patients were tested for HRD, and 59% (n=533/907) were only tested for BRCAm. Patients with the lowest SES score of 1 had numerically lower testing rates versus the overall population and the relationship between BRCAm testing rates and SES was significant (P<0.05). Generally, BRCAm and HRD testing rates were similar across all US geographic regions. Most BRCAm or HRD+ patients received 1LM therapy (71.1% [n=96/135] and 70.0% [n=84/120] respectively). Overall, 1LM therapy use was similar across SES, race, and US region. Most (82%; n=98/119) patients who did not receive BRCAm or HRD testing did not receive 1LM therapy.

What are the implications of this research?
Our findings indicate that, while most patients with AOC underwent BRCAm testing, disparities in biomarker-testing rates may be influenced by SES and race; further studies are needed to explore this further. In this study, the use of 1LM therapy did not appear to be influenced by patients' SES, race, or location. Notably, in the overall population, biomarker testing appeared to be a strong indicator of whether patients with AOC received maintenance therapy.

Poster

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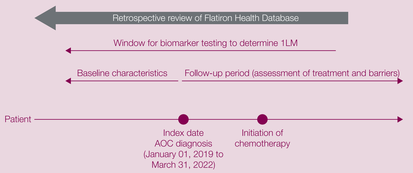
Introduction

- Ovarian cancer is the leading cause of gynecologic cancer death in the United States, with an estimated 19,710 new cases and 13,270 deaths in 2023 alone[1]
- Reported disparities in access to and use of biomarker testing in patients with AOC may result in worse outcomes[2,3]
- Variables such as SES, race, and geographic location have been identified as predictive factors associated with deviation from the National Comprehensive Cancer Network ovarian cancer treatment guidelines and may also be determinants of survival[2–4]
- Data on potential real-world disparities in relation to HRD genomic instability testing and the use of poly(ADP-ribose) polymerase (PARP) inhibitors as maintenance therapy for AOC are limited
- This real-world study aimed to describe SES, racial, and US regional differences in the use of biomarker testing and 1LM therapy among a representative sample of US patients with AOC

Methods

- This retrospective longitudinal cohort study utilized the nationwide health record-derived Flatiron Health database, comprising de-identified patient-level structured and unstructured data[5] originating from approximately 280 US community and academic cancer clinics (approximately 800 sites of care), curated via technology-enabled abstraction[6]
  - Patients aged ≥18 years who were newly diagnosed with AOC (International Federation of Gynecology and Obstetrics [FIGO] Stage III/IV) and had received chemotherapy, or patients diagnosed with earlier-stage disease who developed a locoregional or distant recurrence within 12 months of diagnosis between January 01, 2019 and March 31, 2022 were included
  - All patients had ≥1 recorded contact with a clinical care provider in the real-world dataset following the contact for diagnosis
  - Exclusion criteria included patients who received chemotherapy more than 30 days prior to diagnosis of advanced disease; and patients with a history of other cancers (and associated treatments) within the 12 months prior to the date of diagnosis of AOC
- The study design is shown in Figure 1

Figure 1. Study design



- SES prior to AOC diagnosis date was characterized and ranked (scored 1 [low] to 5 [high]) according to a factor-based index that used census-based poverty, education, housing quality, and employment indicators
- The following outcomes were evaluated by SES, patient-reported race, and US region using descriptive statistics and chi-squared testing:
  - The use of biomarker testing, defined as a recorded BRCAm and/or HRD biomarker status
  - Receipt of 1LM therapy, including PARP inhibitors (olaparib, rucaparib or niraparib) ± bevacizumab, bevacizumab monotherapy or other 1LM therapy
- Data were analyzed descriptively, and the relationships between BRCAm and HRD testing, and SES, race, and US geographic region were evaluated using chi-squared testing (significance was defined as P<0.05)

Results

- Baseline characteristics are provided in Table 1
  - Most patients were White (n=519, 57.2%) and resided in the south of the US (n=429, 47.3%); 27.4% (n=248) of patients were in the lowest SES categories 1 and 2, and 38.9% (n=352) of patients were in the highest SES categories 4 and 5

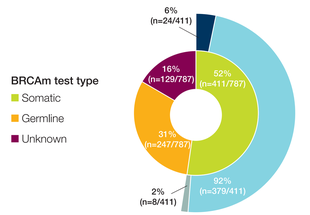
Table 1. Baseline characteristics

Characteristics	Total (N=907)
Age at advanced diagnosis, years	
Median (IQR)	68.0 (59.0, 74.0)
Mean (SD)	66.0 (11.29)
Year of diagnosis of AOC, n (%)	
2019	300 (33.1)
2020	265 (29.2)
2021	263 (29.0)
2022	79 (8.7)
Stage, n (%)	
Stage III	531 (58.5)
Stage IV	376 (41.5)
Received surgery, n (%)	
No	198 (21.8)
Yes	709 (78.2)
Race, n (%)	
Asian	19 (2.1)
Black or African American	59 (6.5)
Other	310 (34.2)
White	519 (57.2)
SES, n (%)	
SES 1	114 (12.6)
SES 2	134 (14.8)
SES 3	162 (17.9)
SES 4	181 (20.0)
SES 5	171 (18.9)
Missing/Unknown	145 (16.0)
Geographic location of patient residence, n (%)	
Midwest*	98 (10.8)
Northeast†	98 (10.8)
Other‡	120 (13.2)
South¶	429 (47.3)
West§	162 (17.9)
Clinic setting, n (%)	
Academic	80 (8.8)
Community	827 (91.2)
Commercial health plan	
No	143 (15.8)
Yes	764 (84.2)

*IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI; †CT, MA, ME, NH, NJ, NY, PA, RI, VT; ‡Armed forces, American Samoa, Federated State of Micronesia, Guam, Marshall Islands, Commonwealth of the Northern Mariana Islands, Puerto Rico, Palau, Virgin Islands; §AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV; ¶AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, WY. IQR, interquartile range; SD, standard deviation

- Overall, 86.8% (n=787/907) of all patients were BRCAm tested; 58.7% (n=533/907) of all patients were only tested for BRCAm
  - Further details of BRCAm testing by test type are provided in Figure 2
- In total, 28.1% (n=255/907) of all patients were HRD tested
  - Of all non-BRCAm patients (defined as germline or somatic BRCAwt or BRCAunknown patients), 28.2% (218/772) underwent HRD testing; they were more likely to have had surgery (91% vs 71%) vs those who were not HRD tested

Figure 2. Proportion of patients who underwent BRCAm testing by test type*



ctDNA, circulating tumor DNA
*Numbers may not sum to 100% due to rounding

- Patients with SES score 1 and Black/African American patients had numerically lower BRCAm testing rates, and Black patients had numerically higher HRD testing rates, compared with the overall population; the relationship between BRCAm testing rates and SES was significant (P<0.05; Table 2)
  - Rates in biomarker testing were broadly comparable across all US geographic regions (Table 2)

Table 2. Biomarker-testing rates by SES score, race, and US region

SES score, n (%)†	SES1 (N=114)	SES2 (N=134)	SES3 (N=162)	SES4 (N=181)	SES5 (N=171)
BRCAm tested*	88 (77.2)	123 (91.8)	142 (87.7)	155 (85.6)	154 (90.1)
HRD tested	22 (19.3)	42 (31.3)	46 (28.4)	50 (27.6)	51 (29.8)

Race, n (%)	Asian (N=19)	Black/African American (N=59)	White (N=519)	Other (N=310)	–
BRCAm tested	19 (100.0)	46 (78.0)	452 (87.1)	270 (87.1)	–
HRD tested	5 (26.3)	19 (32.2)	136 (26.2)	95 (30.6)	–

US region, n (%)	Midwest (N=98)	Northeast (N=98)	South (N=429)	West (N=162)	Other (N=120)
BRCAm tested	86 (87.8)	87 (88.8)	372 (86.7)	145 (89.5)	97 (80.8)
HRD tested	29 (29.6)	29 (29.6)	111 (25.9)	54 (33.3)	32 (26.7)

*P=0.016, †SES was missing/unknown for 145 patients

- Of all biomarker-tested patients, 49.1% (n=387/788) received 1LM therapy
  - Overall, 1LM therapy use was comparable across SES, race, and US regions (Table 3)

Table 3. Receipt of 1LM therapy for patients who received biomarker testing, by SES score, race, and US region

SES score, n (%)*	SES1 (N=88)	SES2 (N=123)	SES3 (N=142)	SES4 (N=155)	SES5 (N=155)
Maintenance therapy	45 (51.1)	56 (45.5)	70 (49.3)	91 (58.7)	70 (45.2)
PARP inhibitor	19 (21.6)	30 (24.4)	37 (26.1)	46 (29.7)	37 (23.9)
PARP inhibitor and bevacizumab	7 (8.0)	10 (8.1)	13 (9.2)	13 (8.4)	5 (3.2)
Bevacizumab monotherapy	18 (20.5)	15 (12.2)	18 (12.7)	23 (14.8)	25 (16.1)
Other†	1 (1.1)	1 (0.8)	2 (1.4)	9 (5.8)	3 (1.9)
No maintenance therapy	43 (48.9)	67 (54.5)	72 (50.7)	64 (41.3)	85 (54.8)

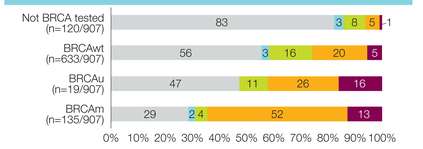
Race, n (%)	Asian (N=19)	Black/African American (N=46)	White (N=453)	Other (N=270)	–
Maintenance therapy	13 (68.4)	26 (56.5)	229 (50.6)	119 (44.1)	–
PARP inhibitor	≤6 (≤31.6)	16 (34.8)	128 (28.3)	54 (20.1)	–
PARP inhibitor and bevacizumab	≤6 (≤31.6)	≤6 (≤13.0)	31 (6.8)	16 (6.0)	–
Bevacizumab monotherapy	≤6 (≤31.6)	≤6 (≤13.0)	59 (13.0)	42 (15.7)	
Other†	0 (0.0)	≤6 (≤13.0)	11 (2.4)	7 (2.6)	
No maintenance therapy	≤6 (≤31.6)	20 (43.5)	224 (49.4)	151 (55.9)	–

US region, n (%)	Midwest (N=86)	Northeast (N=87)	South (N=373)	West (N=145)	Other (N=97)
Maintenance therapy	47 (54.7)	40 (46.0)	186 (49.9)	71 (49.0)	43 (44.3)
PARP inhibitor	29 (33.7)	20 (23.0)	88 (23.6)	38 (26.2)	28 (28.9)
PARP inhibitor and bevacizumab	≤6 (≤7.0)	≤6 (≤6.9)	32 (8.6)	8 (5.5)	3 (3.1)
bevacizumab monotherapy	9 (10.5)	12 (13.8)	56 (15.0)	22 (15.2)	11 (11.3)
Other†	≤6 (≤7.0)	≤6 (≤6.9)	10 (2.7)	3 (2.1)	1 (1.0)
No maintenance therapy	39 (45.3)	47 (54.0)	187 (50.1)	74 (51.0)	54 (55.7)

*SES was missing/unknown for 125 patients; †Treatments included under "Other" were: bevacizumab + gemcitabine, bevacizumab + paclitaxel, bevacizumab-awwb + paclitaxel, bevacizumab-bvzr + paclitaxel, gemcitabine, and paclitaxel

- Most BRCAm patients (71.1%; n=96/135) received 1LM therapy, with 51.9% (n=70/135) receiving PARP inhibitors, and a further 12.6% (n=17/135) receiving PARP inhibitors with bevacizumab (Figure 3)
  - Among patients who were not BRCAm tested, 82.5% (n=99/120) did not receive 1LM therapy (Figure 3)

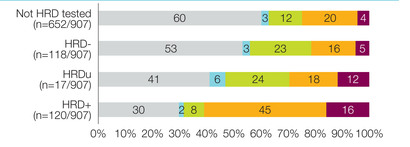
Figure 3. Breakdown of 1LM therapy by patients' BRCAm status



The clustered bar graph shows a breakdown of 1LM therapy received according to all patients' BRCAm status

- Most HRD+ patients (70.0%; n=84/120) received 1LM therapy, with 45.0% (n=54/120) receiving PARP inhibitors, and a further 15.8% (n=19/120) receiving PARP inhibitors with bevacizumab (Figure 4)
  - Among patients who were not HRD tested, 60.3% (n=393/652) did not receive 1LM therapy (Figure 4)

Figure 4. Breakdown of 1LM therapy by HRD status



The clustered bar graph shows a breakdown of 1LM therapy received according to all patients' HRD status
HRDu, HRD unknown

Limitations

- The sample size differences observed between some subgroups of this unique dataset may not be representative of the US population, which is a limitation of the secondary data source
  - The sample sizes for Asian patients were too low to draw conclusions, and the sample size of Black or African American patients was low (6.5%) and results of this subgroup should be interpreted with caution
  - SES and race subgroups had relatively high proportions of "missing/unknown" and "other" data, respectively
- The observed differences in numbers of patients between community and academic hospital settings could imply demographic or clinical protocol differences, or possibly systematic differences in the way data were collected

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