Associations of Healthcare Affordability, Availability, and Accessibility with Quality Treatment Metrics in Patients with Ovarian Cancer

Tomi F. Akinyemiju[1,2], Lauren E. Wilson[1], Nicole Diaz[1], Anjali Gupta[1], Bin Huang[3], Maria Pisu[4], April Deveaux[1], Margaret Liang[4,5], Rebecca A. Previs[6], Haley A. Moss[6], Ashwini Joshi[1], Kevin C. Ward[7], Maria J. Schymura[8], Andrew Berchuck[6], and Arnold L. Potosky[9]

ABSTRACT

Background: Differential access to quality care is associated with racial disparities in ovarian cancer survival. Few studies have examined the association of multiple healthcare access (HCA) dimensions with racial disparities in quality treatment metrics, that is, primary debulking surgery performed by a gynecologic oncologist and initiation of guideline-recommended systemic therapy.

Methods: We analyzed data for patients with ovarian cancer diagnosed from 2008 to 2015 in the Surveillance, Epidemiology, and End Results–Medicare database. We defined HCA dimensions as affordability, availability, and accessibility. Modified Poisson regressions with sandwich error estimation were used to estimate the relative risk (RR) for quality treatment.

Results: The study cohort was 7% NH-Black, 6% Hispanic, and 87% NH-White. Overall, 29% of patients received surgery and 68% initiated systemic therapy. After adjusting for clinical variables, NH-Black patients were less likely to receive surgery [RR, 0.83; 95% confidence interval (CI), 0.70–0.98]; the observed association was attenuated after adjusting for healthcare affordability, accessibility, and availability (RR, 0.91; 95% CI, 0.77–1.08). Dual enrollment in Medicaid and Medicare compared with Medicare only was associated with lower likelihood of receiving surgery (RR, 0.86; 95% CI, 0.76–0.97) and systemic therapy (RR, 0.94; 95% CI, 0.92–0.97). Receiving treatment at a facility in the highest quartile of ovarian cancer surgical volume was associated with higher likelihood of surgery (RR, 1.12; 95% CI, 1.04–1.21).

Conclusions: Racial differences were observed in ovarian cancer treatment quality and were partly explained by multiple HCA dimensions.

Impact: Strategies to mitigate racial disparities in ovarian cancer treatment quality must focus on multiple HCA dimensions. Additional dimensions, acceptability and accommodation, may also be key to addressing disparities.

Introduction

In the United States (US), ovarian cancer survival has improved steadily over the past few decades; five-year survival for patients with invasive ovarian cancer increased from 27% in 1990–1994 to 37% in 2010–2014 (1). However, although the five-year survival for White ovarian cancer patients increased from 35% to 47% between 1975–77 and 2008–2014, the rate for Black patients declined from 42% to 39% in the same period (2). Lack of access to quality treatment contributes to the observed racial disparities in survival (3–6). In fact, some studies have shown that receipt of guideline adherent ovarian cancer treatment is associated with *equivalent* survival benefit across racial groups (3, 5, 7). On the contrary, other studies have shown that survival disparities remain even upon receipt of guideline adherent treatment (4, 8), highlighting the complexity of fully characterizing racial and ethnic disparities in ovarian cancer outcomes. Nevertheless, lack of access to treatment is a key driver of survival disparities. Indeed, important racial differences have been reported in indicators of high quality treatment, including receipt of ovarian cancer surgery (9, 10), care by gynecologic oncologists (11–13), and receipt of guideline-recommended chemotherapy (8, 14). For example, treatment by a gynecologic oncologist increases the likelihood of guideline adherent treatment and is associated with improved patient survival (11, 15, 16). Strikingly, only about a third of patients with ovarian cancer receive appropriate surgical care (17), highlighting an urgent need to better characterize measures of healthcare access (HCA) driving treatment quality in diverse patient groups.

Although HCA is fundamental to receipt of quality treatment, it has been inconsistently and narrowly defined in the literature to date. Penchansky and Thomas (18) proposed five dimensions of HCA: Affordability (ability to pay for healthcare), availability (type, quality, and quantity of healthcare resources), accessibility (location of healthcare resources relative to patient), accommodation (organization of healthcare resources relative to patient preferences), and acceptability (patient experience, and quality of patient–provider interaction). Although certain aspects, for example, affordability, have been well characterized in the scientific literature (7, 12, 19–21), others remain largely unexamined. Three of these dimensions: affordability, availability, and accessibility are measurable in administrative claims

[1]Department of Population Health Sciences, Duke University School of Medicine, Durham, North Carolina. [2]Duke Cancer Institute, Duke University School of Medicine, Durham, North Carolina. [3]Department of Biostatistics and Kentucky Cancer Registry, University of Kentucky, Lexington, Kentucky. [4]Division of Preventive Medicine and O'Neal Comprehensive Cancer Center, University of Alabama at Birmingham, Birmingham, Alabama. [5]Department of Obstetrics and Gynecology, Division of Gynecologic Oncology, University of Alabama at Birmingham, Birmingham, Alabama. [6]Division of Gynecologic Oncology, Duke Cancer Institute, Duke University School of Medicine, Durham, North Carolina. [7]Georgia Cancer Registry, Emory University, Atlanta, Georgia. [8]New York State Department of Health, New York State Cancer Registry, Albany, New York. [9]Cancer Prevention and Control Program, Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, Washington DC.

Note: Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (http://cebp.aacrjournals.org/).

Corresponding Author: Tomi F. Akinyemiju, Duke University School of Medicine, 215 Morris Street, Durham, NC 27708. E-mail: tomi.akinyemiju@duke.edu

Cancer Epidemiol Biomarkers Prev 2022;31:1383–93

doi: 10.1158/1055-9965.EPI-21-1227

©2022 American Association for Cancer Research

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

databases, providing a unique opportunity to examine how they independently and jointly affect cancer treatment outcomes. Thus, the purpose of this study is to examine measures of affordability, availability, and accessibility among non-Hispanic (NH)-Black, Hispanic and NH-White patients with ovarian cancer in relation to two treatment quality metrics: receipt of primary debulking ovarian cancer surgery performed by a gynecologic oncologist and initiation of guideline-recommended systemic therapy.

Materials and Methods

Study population

This was a retrospective cohort study of Surveillance, Epidemiology, and End Results (SEER)–Medicare patients of NH-Black, Hispanic or NH-White race and ethnicity ages 65+ diagnosed with a primary ovarian cancer from 2008 to 2015 (**Fig. 1**). The SEER-Medicare database combines cancer registry data from 12 US States with linked Medicare claims. Patients with cancers originating from the fallopian tubes or peritoneum were not included in this study due to very small numbers ($N < 11$). Patients were excluded if they were diagnosed at autopsy/death, or if their ovarian cancer was not their first or second primary tumor in the SEER registry. Patients were also required to have: (i) at least 12 months of continuous enrollment in Medicare fee-for-service parts A and B before diagnosis; (ii) at least one Medicare inpatient, outpatient, or carrier claim with a diagnosis code for ovarian cancer (*ICD-9-CM and ICD-10-CM* diagnosis codes 183.0 or C569) within two months of the SEER diagnosis; and (iii) continuous fee-for-service Medicare enrollment in the 12 months following their diagnosis date, or until death, whichever came first.

SEER patient demographics and clinical characteristics

We examined patient demographic and clinical characteristics from SEER data, including race and ethnicity (NH-White, NH-Black, or Hispanic), age at diagnosis, sex, cancer stage at diagnosis (stages I–IV or other), histology at diagnosis (type I epithelial, type II epithelial, or other), marital status (married or not married), geographic region of residence (Midwest, Northeast, South, West, or not available), and residence in a metropolitan area. We used validated coding algorithms to assess patient comorbidities and to calculate the patient's Charlson Comorbidity Index score in the 12 months before ovarian cancer diagnosis using diagnosis codes (Supplementary Table S1) from inpatient, outpatient, and carrier Medicare claims files (22, 23).

Assignment of primary provider and hospital treatment facility

Each patient was assigned a primary cancer treatment physician and a primary treatment hospital based on the provider and facility listed on the plurality of cancer claims and the plurality of inpatient and outpatient claims, respectively. This is described in more detail in the Supplementary Methods. Physician specialties were determined from Medicare claims files using Health Care Financing Administration (HCFA) specialty codes (17).

Measures of healthcare affordability

Measures of healthcare affordability included dual enrollment in Medicaid, census tract-level measures of socioeconomic status (SES), and county-level health insurance coverage. A patient's dual Medicaid enrollment status in the 12 months before ovarian cancer diagnosis was sourced from the SEER-Medicare dataset, as were the following SES indicators of the patient's residential census tract at the time of diagnosis drawn from data from the US Census Bureau's American Community Survey: percentage of Black residents, percentage of adults 25+ with less than a high school education, and percentage of households with incomes below the poverty level. Measures of census tract SES were categorized into quartiles and presented as binary variables (highest quartile vs. lower three quartiles). More details on the included affordability measures are presented in the Supplementary Methods.

Measures of healthcare accessibility

A patient's residence in a metropolitan or rural area at the time of diagnosis was drawn from SEER data. Distance to main hospital facility was calculated using a straight-line distance approach from the center point of the patient's residential zip code to the center of the hospital facility's zip code (24).

Measures of healthcare availability

Healthcare availability metrics for the patient's county and healthcare referral regions (HRR) were linked to SEER-Medicare data using year of diagnosis, county and state Federal Information Processing Standards codes, and patient zip codes from the Area Healthcare Resources File and the Dartmouth Atlas Project. More detail on this linkage and the included measures are included in the Supplementary Methods. The National Cancer Institute (NCI) hospital file was used to determine hospital facility-associated availability metrics, including the hospital's ownership (Non-profit/Proprietary/Government), affiliation with a medical school (Yes/No), NCI Cancer Center designation (Yes/No), critical access status (Yes/No), and number of beds (<100/100–200/200+) in the year of the patient's cancer diagnosis. If the hospital's information was missing in a calendar year, the information was imputed as the highest availability value for the hospital recorded in the study time period. Ovarian cancer surgical volume for Medicare beneficiaries for each facility was calculated per year by summing the number of Medicare claims among all SEER-Medicare patients with ovarian cancer in the calendar year with a Current Procedural Terminology (CPT) code for any ovarian surgical procedure (Supplementary Table S2), allowing 1 surgical claim per patient per day.

Measures of treatment quality: receipt of primary debulking surgery performed by a gynecologic oncologist and initiation of guideline-recommended systemic therapy

Among patients with available tumor stage, grade, and histology information who were not classified as having borderline epithelial tumors, receipt of ovarian cancer debulking surgery performed by a gynecologic oncologist was assessed. Ovarian cancer primary debulking surgery performed by a gynecologic oncology specialist in the two months before/six months following a patient's diagnosis date were identified in Medicare claims using CPT codes for debulking surgery (Supplementary Table S3), and physician identifiers and their HCFA specialty codes. The 2013 National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines for Ovarian Cancer specify recommended treatment based on tumor stage, grade, and histology (ref. 25; Supplementary Figs. S1 and S2). Patients were considered to have initiated a guideline-recommended systemic therapy if they had at least one Medicare claim with a CPT code or National Drug Code for administration of one of the recommended systemic therapies for the patient's stage, grade, and histology in the 12 months following the patient's diagnosis date (Supplementary Table S4).

Statistical analysis

Healthcare affordability, accessibility, and availability metrics were calculated for the full cohort and stratified by patient race and

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

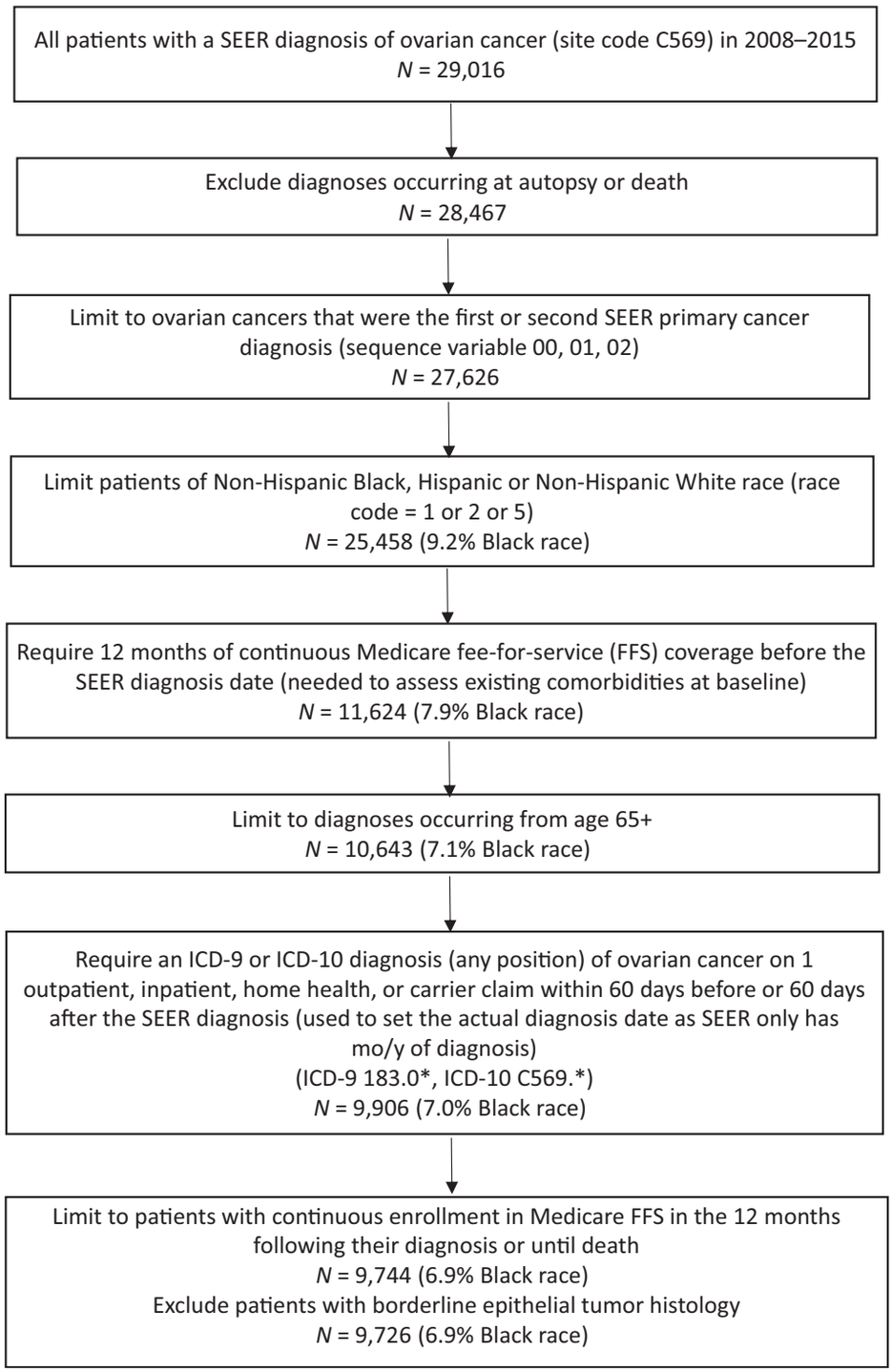

Figure 1.
Participant flowchart for Non-Hispanic Black, Hispanic, and Non-Hispanic White ovarian cancer patients, SEER-Medicare 2008–2015.

ethnicity. Continuous variables were described using mean (SD) or median (Q1 and Q3). Categorical variables were described using percentages. To describe the associations between race and receipt of quality care and between measures of HCA and quality care, and to assess whether inclusion of HCA measures attenuate observed associations between race and treatment receipt, we modeled associations between race and treatment receipt, race + each individual HCA dimension measures and treatment receipt, and race + all HCA dimension measures and treatment receipt. All models were adjusted for patient clinical covariates. Univariable and multivariable-adjusted modified Poisson regression with robust error estimation (26) were used to assess the relative risk (RR) associations between patient race and ethnicity, HCA dimension variables, and two indicators of access to quality cancer care: (i) receiving debulking surgery performed by a

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

gynecologic oncologist and (ii) initiating a guideline recommended systemic therapy. Because multiple variables were expected to be collinear as they are measures of the same dimensions of HCA, collinearity of model variables was assessed using the variance inflation factor method; variables were excluded from the model if they had a variance inflation factor of >10. Models with adjustment for the following covariable sets were run: (i) patient race and ethnicity and clinical characteristics; (ii) patient race and ethnicity, clinical characteristics, and measures of affordability; (iii) patient race and ethnicity, clinical characteristics, and measures of availability; (iv) patient race and ethnicity, clinical characteristics, and measures of accessibility; and (v) patient race and ethnicity, clinical characteristics, and measures of affordability, accessibility, and availability. Variables excluded due to collinearity were type of hospital ownership and most county-level measures of healthcare availability (due to collinearity with HRR-level measures of availability). To determine whether inclusion of non-epithelial ovarian tumors was influencing the results by introducing heterogeneity, a sensitivity analysis limited to patients with epithelial ovarian tumors was conducted. All analyses were conducted using SAS 9.4.

Data availability

The SEER-Medicare database is owned and managed by the National Cancer Institute. Information on how to obtain these data is available here: https://healthcaredelivery.cancer.gov/seermedicare/obtain/.

Results

Study population and clinical characteristics

The study cohort included 9,726 patients with ovarian cancer diagnosed from 2008 to 2015: 672 (7.0%) NH-Black, 580 (6.0%) Hispanic, and 8,474 (87%) NH-White (**Table 1**). The mean age at diagnosis for NH-Black patients was slightly lower than for NH-White patients [NH-Black Mean (SD) = 76.4 (6.9); NH-White Mean (SD) = 77.6 (7.4)]. NH-Black and Hispanic patients had higher total comorbidity burdens at diagnosis than NH-White patients (median score of 3 and 3 vs. 2). NH-Black and Hispanic patients were also more likely to be diagnosed with Stage IV disease (40% and 34% vs. 32%). Hispanic patients were more likely to be diagnosed with unknown stage disease compared with NH-White and NH-Black patients (16% vs. 13% for both NH-White and NH-Black patients).

Healthcare affordability indicators

About 42% of NH-Black patients and 49% of Hispanic patients were dual-enrolled in Medicaid and Medicaid in the year before diagnosis compared with 11% of NH-White patients (**Table 2**). NH-Black and Hispanic patients were also twice as likely as NH-White patients to live in a census tract in the highest quartile of adult residents without a high school degree, and in the highest quartile of households living below the poverty line.

Healthcare accessibility and availability indicators

NH-Black and Hispanic patients were more likely to live in a metropolitan area than NH-White patients (90% and 92% vs. 83%; **Table 2**). NH-Black patients lived in counties with higher per capita number of hospitals, hospitals with American College of Surgeons cancer programs, hospital acute care beds, primary care physicians, and obstetrician–gynecologist physicians than NH-White patients, whereas Hispanic patients had lower availability in many of these metrics. NH-Black patients were more likely to be seen at a hospital with a medical school affiliation than NH-White patients (61% vs. 50%; **Table 3**), whereas only a quarter of Hispanic patients were seen at a medical school-affiliated hospital. NH-White patients were seen at facilities with fewer numbers of beds on average than NH-Black and Hispanic patients and were more likely to be seen at a hospital designated as a critical access facility. However, on measures of the quality of available healthcare in the HRR (**Table 2**), NH-Black patients did slightly worse than NH-White and Hispanic patients, living in regions with HRRs that had higher rates on average of discharges for ambulatory sensitive conditions (65 vs. 58 per 1000) and slightly higher rates of 30-day hospital readmission rates (16.1% vs. 15.5%).

Utilization of debulking surgery performed by a gynecologic oncologist

A total of 8,155 patients in the cohort had complete tumor stage, grade, and histology information and met the study eligibility criteria. Of these, 2,343 (28.7%) underwent debulking surgery that was performed by a gynecologic oncologist in the two months before/six months following their diagnosis date; 21% of NH-Black patients compared with 29% of NH-White patients and 28% of Hispanic patients (**Table 3**). In adjusted Poisson regression analyses (**Table 4**), NH-Black patients were less likely than NH-White patients [RR, 0.83; 95% confidence interval (CI), 0.70–0.98] to receive debulking surgery by a gynecologic oncologist after adjusting for clinical characteristics; however, after adjustment for measures of affordability, the racial disparity became attenuated (RR, 0.91; 95% CI, 0.77–1.08). In fully adjusted models, dual enrollment in Medicaid remained associated with lower likelihood of debulking surgery performed by a gynecologic oncologist (RR, 0.86; 95% CI, 0.76–0.97) compared with patients with Medicare only, while receiving treatment at a facility in the highest quartile of ovarian cancer patient surgical volume was associated with higher likelihood (RR, 1.12; 95% CI, 1.04–1.21). Patients living in HRRs with higher rates of Medicare beneficiaries being seen regularly by a primary care doctor were also slightly more likely to receive this procedure (RR, 1.02; 95% CI, 1.01–1.03). A sensitivity analysis limited to patients with epithelial ovarian tumors only ($N = 8,086$) resulted in similar findings (Supplementary Table S5).

Initiation of guideline-recommended systemic therapy

A total of 7,702 patients were eligible for this analysis based on 2013 NCCN Guidelines. Of these, 5,213 (67.6%) initiated systemic therapy in the 12 months following diagnosis; 59% of NH-Black patients, compared with 68% of NH-White patients and 68% of Hispanic patients (**Table 3**). However, in Poisson regression analyses adjusted for clinical characteristics, including age at diagnosis, stage at diagnosis, histology and comorbid conditions, the racial disparity among Black patients was attenuated (RR, 0.96; 95% CI, 0.92–1.01; **Table 5**). Results by stage indicated that patients with stage IV cancer were the least likely to receive systemic therapy (data not shown). In models with additional adjustment for measures of HCA, the only HCA measure associated with initiation of recommended systemic therapy was Medicaid dual-enrollment; patients with dual enrollment in both Medicaid and Medicare were less likely to initiate recommended therapy compared with those enrolled in Medicare only (RR, 0.94; 95% CI, 0.92–0.97; **Table 5**). A sensitivity analysis limited to patients with epithelial ovarian tumors only ($N = 7,670$) resulted in similar findings (Supplementary Table S6)

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

Table 1. Baseline clinical and sociodemographic characteristics of patients with OC by race ($N = 9{,}726$).

Variable	Non-Hispanic-White	Non-Hispanic-Black	Hispanic
N	8,474	672	580
Patient characteristics			
Age at OC diagnosis, mean (SD)	77.6 (7.4)	76.4 (6.9)	76.3 (7.0)
Tumor stage at diagnosis			
I	978 (11.5)	68 (10.1)	63 (10.9)
II	561 (6.6)	40 (5.9)	34 (5.9)
III	3,103 (36.6)	203 (30.2)	194 (33.4)
IV	2,743 (32.4)	271 (40.3)	199 (34.3)
Unknown	1,089 (12.8)	90 (13.4)	90 (15.5)
Histology			
Type I epithelial	932 (11.0)	69 (10.3)	80 (13.8)
Type II epithelial	6,939 (81.9)	529 (78.7)	455 (78.4)
Other	603 (7.1)	74 (11.0)	45 (7.7)
Married	3,551 (41.9)	139 (20.7)	192 (33.1)
Geographic region			
Midwest	1,073 (12.7)	96 (14.3)	20 (3.4)
NA	783 (9.2)	90 (13.4)	<11[a]
Northeast	1,875 (22.1)	150 (22.3)	88 (15.2)
South	1,306 (15.4)	<215 [a]	<25 [a]
West	3,437 (40.6)	123 (18.3)	448 (77.2)
Median comorbidity score (IQR)	2.0 (1.0, 4.0)	3.0 (2.0, 5.0)	3.0 (1.0, 5.0)
Patient comorbidities			
Hypertension	6,386 (75.4)	602 (89.6)	458 (79.0)
Any diabetes	2,146 (25.3)	287 (42.7)	252 (43.4)
Chronic obstructive pulmonary disease	2,139 (25.2)	171 (25.4)	144 (24.8)
Peripheral vascular disease	1,634 (19.3)	175 (26.0)	119 (20.5)
Congestive heart failure	1,339 (15.8)	167 (24.8)	116 (20)
Cardiovascular disease	1,343 (15.8)	132 (19.6)	90 (15.5)
Mild liver disease	1,245 (14.7)	107 (15.9)	118 (20.3)
Renal disease	960 (11.3)	132 (19.63)	85 (14.6)
Diabetes with complications	559 (6.6)	107 (15.9)	100 (17.2)
Rheumatologic disease	509 (6.0)	47 (7.0)	50 (8.6)
Myocardial infarction	456 (5.4)	54 (8.0)	32 (5.5)
Dementia	320 (3.8)	47 (7.0)	33 (5.7)
Peptic ulcer disease	242 (2.8)	25 (3.7)	22 (3.8)
Hemiplegia or paraplegia	94 (1.1)	13 (1.9)	<11[a]
Year of diagnosis			
2008	1,240 (14.6)	92 (13.7)	76 (13.1)
2009	1,144 (13.5)	83 (12.3)	69 (11.9)
2010	1,111 (13.1)	85 (12.6)	77 (13.3)
2011	998 (11.8)	92 (13.7)	68 (11.7)
2012	984 (11.6)	97 (14.4)	72 (12.4)
2013	1,002 (11.8)	85 (12.6)	73 (12.6)
2014	986 (11.6)	70 (10.4)	79 (13.6)
2015	1,009 (11.8)	68 (9.7)	66 (11.4)

Abbreviations: IQR, interquartile range; NA, not available; OC, ovarian cancer; SD, Standard deviation.
[a]Value anonymized to conform to SEER-Medicare cell size suppression policy.

Discussion

In the first comprehensive analysis of multiple HCA dimensions among NH-Black, Hispanic, and NH-White patients with ovarian cancer in the SEER-Medicare database, we document significant disparities in measures of healthcare affordability, availability, and accessibility. Although NH-Black patients were more likely to reside in neighborhoods with greater per capita availability of healthcare resources, that is, number of hospitals, primary care physicians and obstetrician–gynecologist physicians, those healthcare resources were of lower quality, for example, facilities with higher readmission rates, compared with those in neighborhoods with NH-White patients. In addition, NH-Black patients with ovarian cancer were less likely than NH-White and Hispanic patients to receive primary tumor debulking performed by a gynecologic oncologist; this difference appeared to be driven partially by differential access to health care. NH-Black patients also had lower rates of recommended systemic therapy initiation, which appeared to be explained largely by clinical factors, including age at diagnosis, stage at diagnosis, tumor histology, and comorbid conditions.

The pattern of higher neighborhood availability of healthcare resources among Black patients compared with White patients but lower utilization of quality treatment has been previously described (9, 27–29). Indeed, multiple factors influence treatment receipt beyond the local availability of healthcare resources, including

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

Table 2. Baseline patient measures of healthcare affordability, accessibility, and availability at time of OC diagnosis by patient race ($N = 9{,}726$).

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
N	8,474	672	580
Affordability			
Patient is dual enrolled in Medicaid	959 (11.3)	285 (42.4)	285 (49.1)
Census Tract in highest quartile: Residents of Black race	1,757 (20.7)	539 (80.2)	93 (16.0)
Census Tract in highest quartile: Adults 25+ <high school education	1,762 (20.8)	324 (48.2)	299 (51.5)
Census tract in highest quartile: Households below poverty	1,773 (20.9)	390 (58.0)	230 (39.6)
County of residence: Percentage of residents without health insurance, Mean (SD)	14.0 (5.0)	15.8 (4.6)	16.2 (5.1)
Accessibility			
Patient lives in metropolitan area	7,044 (83.1)	604 (89.9)	531 (91.6)
Patient lives in rural area	204 (2.4)	<11[a]	<11[a]
Availability			
County of residence characteristics			
Number of hospitals per 1K population, Mean (SD)	2.0 (2.2)	2.2 (2.1)	1.5 (1.6)
Hospitals with ACS cancer program per 1K population, Mean (SD)	0.4 (0.5)	0.5 (0.4)	0.3 (0.3)
Hospitals with medical schools per 1K population, Mean (SD)	0.4 (0.5)	0.4 (0.4)	0.3 (0.4)
PCPs per 1K population, Mean (SD)	75.7 (28.2)	76.7 (26.8)	73.2 (24.3)
Ob–Gyns per 1K population, Mean (SD)	12.1 (7.5)	15.2 (8.5)	12.0 (6.0)
Ob–Gyns seeing patients per 1K population, Mean (SD)	11.8 (7.3)	14.7 (8.3)	11.6 (5.8)
HRR characteristics			
Acute care beds available per 1K population, Mean (SD)	2.3 (0.5)	2.6 (0.6)	2.0 (0.4)
Physicians per 100K population, Mean (SD)	210.1 (30.6)	206.2 (29.0)	206.4 (31.8)
PCPs per 100K population, Mean (SD)	74.5 (11.2)	71.9 (9.9)	73.9 (12.0)
Hematologists/Oncologists per 100K population, Mean (SD)	3.3 (0.9)	3.3 (0.9)	3.1 (0.8)
Ob–Gyns per 100K women 15–44, Mean (SD)	60.0 (14.7)	60.0 (11.9)	56.5 (14.7)
Percentage of Medicare beneficiaries that died that year, Mean (SD)	4.4 (0.6)	4.6 (0.5)	4.0 (0.5)
Percentage of beneficiaries seeing a PCP that year, Mean (SD)	77.2 (4.8)	77.3 (5.0)	74.0 (4.6)
Discharges for ambulatory sensitive conditions per 1K, Mean (SD)	57.6 (18.3)	65.2 (16.4)	51.4 (13.5)
Hospital discharge 30-day readmission rates, Mean (SD)	15.5 (1.2)	16.1 (1.0)	15.4 (1.2)
Hospital discharge 30-day return to ER rates, Mean (SD)	19.6 (1.4)	19.8 (1.3)	19.3 (1.5)

Abbreviations: ACS, American College of Surgeons; ER, emergency room; IQR, interquartile range; Ob–Gyn, obstetrician–gynecologist; OC, ovarian cancer; PCP, primary care physician, SD, standard deviation.
[a]Value anonymized to enhance confidentiality by suppressing small cell sizes.

cost of care, personal preferences, values and goals, trust in the healthcare system, and patient–provider relationships (30). A consequence of broad historic and contemporary inequality and problematic interactions between health systems and local communities, many studies have documented higher rates of medical mistrust and experiences of racism among Black patients (31–34), potentially resulting in treatment delay or avoidance. Efforts to address structural racism and biases within the healthcare system, building long-lasting, trusting relationships with minority communities, and policies to enhance the quality of available healthcare resources in these communities are needed to address inequitable HCA as a key strategy in mitigating disparities in ovarian cancer outcomes.

Furthermore, consistent with our results, other studies have also documented that HCA significantly affects the quality of ovarian cancer treatment. Measures of availability and affordability, respectively, have previously been found to be independent predictors of quality ovarian cancer care (19, 35). For instance, hospital type (i.e., community cancer clinic vs. research intensive; ref. 36) and treatment in hospitals located in rural areas (37) were associated with poor quality care. We expand upon the prior literature by simultaneously examining multiple dimensions of access in the same study population to identify those most significantly associated with ovarian cancer treatment. We observed that treatment at hospitals performing higher volumes of ovarian cancer surgeries, a measure of availability, was associated with substantially increased likelihood of receiving debulking surgery performed by a gynecologic oncologist. This is also consistent with evidence that higher volume facilities often provide higher quality care to patients (38–40) due to the presence of multidisciplinary teams, specialist care, and access to therapies and clinical trials that may not be widely available at less specialized hospitals. NH-Black and Hispanic patients with ovarian cancer were less likely to be treated at high volume facilities compared with NH-White patients, consistent with previous literature (41), highlighting that strategies to equalize access to high-volume academic cancer centers may provide immediate benefit in terms of higher quality of treatment and access to novel clinical trials for this patient group.

A key affordability measure, dual enrollment in Medicaid and Medicare, significantly predicted reduced likelihood of initiation of recommended systemic therapy and reduced risk of receiving debulking surgery performed by a gynecologic oncology specialist. Given that 42% of NH-Black and 49% of Hispanic patients with ovarian cancer in our cohort are dual enrolled, compared with 11% of NH-Whites, this disparity likely contributes significantly to our observed racial differences. Prior studies have documented similar associations of dual eligibility with higher rates of mortality, hospitalizations, and hospital-related mortality when compared with non-dually enrolled individuals, and specifically in the ovarian cancer population, with poor outcomes (42–44). Dually enrolled beneficiaries receive full Medicare and Medicaid benefits, including assistance with premiums. However, eligibility for Medicaid can be complex—whereas the program

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

Table 3. Distribution of treatment, availability, and accessibility characteristics for patients with OC by race ($N = 9,726$).

Variable	Non-Hispanic White	Non-Hispanic Black	Hispanic
N	8,474	672	580
Received primary debulking surgery ($N = 8,155$)	3,297 (38.9)	190 (28.2)	208 (35.9)
Primary debulking surgery performed by Gyn/Onc ($N = 8,155$)	2,099 (29.4)	115 (20.8)	129 (27.5)
Recommended systemic therapy initiation ($N = 7,702$)	4,608 (68.3)	301 (58.6)	304 (68.0)
Availability			
No primary physician identified	206 (2.4)	32 (4.8)	22 (3.8)
Saw Gyn/Onc at least once	4,608 (54.4)	299 (44.5)	270 (46.5)
Primary physician specialty			
Gynecologic Oncology	1,943 (22.9)	158 (23.5)	118 (20.3)
HemeOnc/MedOnc	3,901 (46.0)	246 (36.6)	266 (45.9)
Ob–Gyn	485 (5.7)	53 (7.9)	33 (5.7)
Internal Medicine	1,357 (16.0)	119 (17.1)	101 (17.4)
Other	582 (6.9)	64 (9.5)	40 (6.9)
No physician	206 (2.4)	32 (4.8)	22 (3.8)
Treatment facility affiliated with medical school			
Affiliated	4,200 (49.5)	410 (61.0)	291 (25.3)
Treatment facility ownership			
Non-profit	6,236 (73.6)	482 (71.7)	413 (71.1)
Proprietary	<750[a]	<75[a]	<70[a]
Government	1,502 (17.7)	123 (18.3)	104 (17.9)
Missing	<11[a]	<11[a]	<11[a]
Treatment facility NCI cancer center status			
No	7,710 (91.0)	618 (92.0)	515 (88.8)
Yes	740 (8.7)	>50[a]	>60[a]
Missing	24 (0.3)	<11[a]	<11[a]
Treatment facility critical access status			
No	8,062 (95.1)	657 (97.8)	>540[a]
Yes	388 (4.6)	15 (2.2)	<11[a]
Missing	24 (0.3)	0 (0)	<11[a]
Treatment facility: Number of beds			
<100	1,231 (14.4)	<65[a]	<65[a]
100–200	1,315 (15.5)	108 (16.1)	106 (18.3)
200+	5,898 (69.6)	507 (75.4)	415 (71.5)
Missing	30 (0.3)	<11[a]	<11[a]
Treatment facility: Highest quartile OC surgical volume	2,165 (25.5)	143 (21.3)	118 (20.3)
Accessibility			
Distance from patient zip code to facility zip code			
0–5 miles	3,410 (40.2)	307 (45.7)	254 (43.8)
5–10 miles	2,016 (23.8)	166 (24.7)	131 (22.6)
10–20 miles	1,532 (18.1)	102 (15.2)	93 (16.0)
20–50 miles	897 (10.6)	61 (9.1)	60 (10.3)
50+ miles	594 (7.0)	<40[a]	<45[a]
Missing	25 (0.3)	<11[a]	<11[a]

Abbreviations: Gyn/Onc, gynecologic oncologist; HemeOnc, hematologist oncologist; MedOnc, medical oncologist; NCI, National Cancer Institute; Ob–Gyn, obstetrician–gynecologist; OC, ovarian cancer.

[a]Value anonymized to enhance confidentiality by suppressing small cell sizes.

parameters are federally determined and cover certain mandated eligible groups such as low-income families and individuals receiving Supplemental Security Income (SSI), each state sets their own rules and may impose different eligibility requirements beyond those federally required (45). It is an imperfect measure of an individual's SES; however, it is the only SES indicator in the SEER-Medicare database that is available at the individual level. All other measures of SES are aggregate regional data. Individuals dual-enrolled in Medicaid are likely to experience other social determinant of health barriers such as poverty, housing insecurity, and residence in deprived neighborhoods (43). This is a uniquely at-risk population with significant barriers to care. Further examination of dual-enrolled patients will be necessary to understand unique barriers to treatment quality and to inform public policy regarding Medicare eligibility and requirements.

This study provides a valuable look at real-world disparities in HCA among older adults with OC, highlighting aspects of all three HCA dimensions that impact ovarian cancer outcomes and contribute to observed disparities. However, the analysis is subject to the limitations inherent to retrospective analyses of registry and claims databases. All measures of SES aside from dual enrollment in Medicaid are based on census-tract level averages and may not reflect each patient's individual financial circumstances, and not all low-income Medicare enrollees who are eligible for Medicaid are dual-enrolled; therefore, we likely underestimated the proportion of individuals who have difficulty with healthcare affordability. Administrative claims data do not provide the full clinical picture that physicians use to make treatment recommendations, nor can they capture patient preferences for treatment. In addition, as the purpose of administrative claims is billing, dates of

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

Table 4. Association of healthcare affordability, accessibility, and availability with debulking surgery performed by a gynecologic oncologist ($N = 8{,}155$).

Parameter	***Model 1*** **Clinical**	***Model 2*** **Clinical + affordability**	***Model 3*** **Clinical + accessibility**	***Model 4*** **Clinical+ availability**	***Model 5*** **All covariates**
Race (ref: Non-Hispanic White)					
Non-Hispanic Black	0.83 (0.70–0.98)	0.91 (0.77–1.08)	0.83 (0.71–0.98)	0.87 (0.74–1.02)	0.91 (0.77–1.08)
Hispanic	0.97 (0.84–1.12)	1.03 (0.89–1.20)	0.97 (0.84–1.12)	0.99 (0.86–1.15)	1.03 (0.89–1.19)
Age at diagnosis (ref: 65–70)					
71–75	0.94 (0.87–1.01)	[a]	[a]	[a]	[a]
76–80	0.85 (0.77–0.93)	[a]	[a]	[a]	[a]
81+	0.56 (0.51–0.63)	[a]	[a]	[a]	[a]
Stage at diagnosis (ref: IV)					
I	1.50 (1.32–1.71)	[a]	[a]	[a]	[a]
II	1.98 (1.74–2.25)	[a]	[a]	[a]	[a]
III	1.98 (1.81–2.16)	[a]	[a]	[a]	[a]
Tumor histology (ref: Type I epithelial)					
Type II epithelial	0.99 (0.90–1.10)	[a]	[a]	[a]	[a]
Other	0.60 (0.37–0.99)	[a]	[a]	[a]	[a]
Married	1.10 (1.03–1.17)	[a]	[a]	[a]	[a]
Dual enrolled in Medicaid		0.85 (0.75–0.97)			0.86 (0.76–0.97)
Census tract in highest quartile:					
Adults < high school education		1.02 (0.92–1.13)			1.03 (0.93–1.15)
Residents of Black race		0.94 (0.85–1.03)			0.96 (0.87–1.06)
Households in poverty		0.99 (0.89–1.09)			0.97 (0.87–1.08)
Percentage of county residents without health insurance		0.98 (0.98–0.99)			0.99 (0.98–1.00)
Lives in metro area			1.02 (0.93–1.12)		1.01 (0.91–1.12)
Distance to treatment facility (ref: 0–5 miles)					
5–10 miles			1.06 (0.98–1.15)		1.05 (0.96–1.14)
10–20 miles			1.04 (0.95–1.14)		1.01 (0.92–1.11)
20–50 miles			1.14 (1.03–1.27)		1.10 (0.99–1.23)
50+ miles			1.01 (0.89–1.16)		0.98 (0.85–1.12)
Missing			0.20 (0.03–1.31)		0.21 (0.03–1.40)
PCPs per 1K county population				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Percentage of Hospital discharges 30-day readmission				0.96 (0.91–1.01)	0.97 (0.91–1.03)
HRR: Percentage of Hospital discharges 30-day ER visit				1.02 (0.99–1.05)	1.02 (0.98–1.06)
HRR: Physicians per 100K population				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Heme/Onc per 100K population				0.97 (0.91–1.04)	0.96 (0.90–1.03)
HRR: Ob–Gyns per 100K women aged 15–44				1.00 (0.99–1.00)	1.00 (0.99–1.00)
HRR: Percentage of Medicare patients died diagnosis year				0.89 (0.77–1.02)	0.90 (0.78–1.05)
HRR: Percentage of Medicare patients saw PCP diagnosis year				1.02 (1.01–1.03)	1.02 (1.01–1.03)
HRR: Ambulatory sensitive discharges per 1K				1.00 (1.00–1.01)	1.00 (1.00–1.01)
Main facility: Highest OC surgical volume (age 65+ only)				1.14 (1.06–1.23)	1.12 (1.04–1.21)
Main facility: Affiliated with medical school				1.01 (0.94–1.09)	1.01 (0.94–1.09)
Main facility: Has NCI cancer center				0.99 (0.89–1.10)	0.98 (0.88–1.09)

Note: Log-binomial regression for relative risk (RR) of receiving debulking surgery performed by a gynecologic oncologist in the 2 months before/6 months after OC diagnosis. Affordability, accessibility, and availability metrics were added in stages. All models additionally adjusted for patient geographic region and patient comorbid conditions.

Abbreviations: ER, emergency room; HemeOnc, hematologic oncologist; HRR, healthcare referral region; NCI, National Cancer Institute; Ob–Gyn, obstetrician–gynecologist; OC, ovarian cancer; PCP, primary care physician.

[a]Included in model but estimates not shown.

procedures and diagnoses may not be exact and may reflect billing dates as opposed to actual dates of service; to address this, we searched Medicare claims for procedures with dates up to two months before the identified claims ovarian cancer diagnosis date. We also note that the physician specialty codes in Medicare are imperfect, and capture approximately 83%–90% of oncologists (17); this may result in an underestimate of the number of patients seeing gynecologic oncologists. However, there is no reason to believe that this misclassification would occur differentially by patient race, so it is unlikely to influence our finding of lower utilization of oncologists observed among NH-Black patients. The current SEER-Medicare database represents a less ethnically and racially diverse population compared with the total U.S.

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

Table 5. Association of healthcare affordability, accessibility, and availability with initiation of guideline-recommended systemic therapy (stage and histology specific) among Non-Hispanic Black, Hispanic, and Non-Hispanic White patients ($N = 7{,}702$).

Parameter	***Model 1*** **Clinical**	***Model 2*** **Clinical + affordability**	***Model 3*** **Clinical + accessibility**	***Model 4*** **Clinical+ availability**	***Model 5*** **All covariates**
Race (ref: Non-Hispanic White)					
Non-Hispanic Black	0.96 (0.92–1.01)	0.98 (0.93–1.03)	0.97 (0.93–1.01)	0.97 (0.93–1.01)	0.98 (0.94–1.03)
Hispanic	1.00 (0.96–1.03)	1.03 (0.99–1.07)	1.00 (0.97–1.04)	1.00 (0.97–1.04)	1.02 (0.99–1.06)
Age at diagnosis (ref: 65–70)					
71–75	0.99 (0.97–1.02)	[a]	[a]	[a]	[a]
76–80	0.94 (0.91–0.96)	[a]	[a]	[a]	[a]
81+	0.81 (0.78–0.83)	[a]	[a]	[a]	[a]
Stage at diagnosis (ref: IV)					
I	1.15 (1.11–1.19)	[a]	[a]	[a]	[a]
II	1.08 (1.03–1.12)	[a]	[a]	[a]	[a]
III	1.09 (1.07–1.12)	[a]	[a]	[a]	[a]
Tumor histology (ref: Type I epithelial)					
Type II epithelial	1.03 (0.99–1.06)	[a]	[a]	[a]	[a]
Other	0.52 (0.37–0.74)	[a]	[a]	[a]	[a]
Married	1.05 (1.03–1.07)	[a]	[a]	[a]	[a]
Dual enrolled in Medicaid		0.92 (0.88–0.95)			0.94 (0.92–0.97)
Census tract in highest quartile:					
Adults < high school education		0.99 (0.96–1.02)			1.00 (0.97–1.02)
Residents of Black race		1.02 (0.99–1.04)			1.01 (0.98–1.03)
Households in poverty		0.99 (0.96–1.02)			1.00 (0.97–1.02)
Percentage of county residents without health insurance		1.00 (1.00–1.00)			1.00 (1.00–1.00)
Lives in metro area			1.02 (0.99–1.05)		1.00 (0.97–1.03)
Distance to treatment facility (ref: 0–5 miles)					
5–10 miles			1.01 (0.99–1.04)		1.00 (0.98–1.03)
10–20 miles			1.02 (1.00–1.05)		1.01 (0.99–1.04)
20–50 miles			1.02 (0.99–1.05)		1.01 (0.98–1.04)
50+ miles			1.01 (0.98–1.05)		1.00 (0.96–1.03)
Missing			0.71 (0.51–0.99)		0.77 (0.58–1.01)
PCPs per 1K county population				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Percentage of Hospital discharges 30-day readmission				1.01 (0.99–1.02)	1.00 (0.99–1.02)
HRR: Percentage of Hospital discharges 30-day ER visit				1.00 (1.00–1.01)	1.00 (0.99–1.01)
HRR: Physicians per 100k population				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Heme/Onc per 100k population				1.02 (1.00–1.04)	1.02 (1.00–1.04)
HRR: Ob–Gyns per 100k women aged 15–44				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Percentage of Medicare patients died diagnosis year				1.00 (0.96–1.03)	0.99 (0.95–1.03)
HRR: Percentage of Medicare patients saw PCP diagnosis year				1.00 (1.00–1.00)	1.00 (1.00–1.00)
HRR: Ambulatory sensitive discharges per 1K				1.00 (1.00–1.00)	1.00 (1.00–1.00)
Main facility: Highest OC surgical volume (age 65+ only)				1.02 (1.00–1.04)	0.93 (0.87–1.00)
Main facility: Affiliated with medical school				0.99 (0.97–1.01)	0.99 (0.97–1.01)
Main facility: Has NCI cancer center				1.02 (0.99–1.05)	1.01 (0.99–1.04)

Note: Log-binomial regression for relative risk (RR) of initiating a recommended systemic therapy in the 12 months following OC diagnosis. Affordability, accessibility, and availability metrics were added in stages. All models additionally adjusted for patient geographic region and patient comorbid conditions.
Abbreviations: ER, emergency room; HemeOnc, hematologic oncologist; HRR, healthcare referral region; NCI, National Cancer Institute; Ob–Gyn, obstetrician–gynecologist; OC, ovarian cancer; PCP, Primary care physician.
[a]Included in model but estimates not shown.

population and covers approximately 35% of the U.S. population (46), so results may not be fully representative of national trends. In addition, our study focuses on older women with ovarian cancer (65 years or older); therefore, results may not be generalizable to younger women. We also acknowledge that using the SEER-Medicare database restricts to a patient population, which, by definition, has accessed healthcare, so results may not apply to the broader ovarian cancer patient population. However, the use of registry-linked administrative claims that data provide unique opportunities to study underserved patient populations and sicker patient populations, who are often difficult to enroll into prospective cohort studies.

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

In conclusion, strategies to address racial differences in affordability, availability, and accessibility will be critical for addressing the utilization gap, that is, higher quantity of healthcare resources but lower receipt of quality treatment for NH-Black and Hispanic patients. These efforts will help to mitigate the persistent racial disparities in quality ovarian cancer care.

Authors' Disclosures

L.E. Wilson reports grants from National Cancer Institute during the conduct of the study; and grants from AstraZeneca outside the submitted work. M. Pisu reports grants from NIH during the conduct of the study. R.A. Previs reports other support from Myriad Genetics and Natera outside the submitted work. K.C. Ward reports other support from NCI SEER during the conduct of the study. M.J. Schymura reports grants from NCI/Duke University School of Medicine during the conduct of the study. No disclosures were reported by the other authors.

Disclaimer

The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Authors' Contributions

T.F. Akinyemiju: Conceptualization, data curation, formal analysis, supervision, funding acquisition, investigation, visualization, writing–original draft, writing–review and editing. **L.E. Wilson:** Data curation, formal analysis, writing–original draft, writing–review and editing. **N. Diaz:** Data curation, formal analysis, writing–review and editing. **A. Gupta:** Writing–review and editing. **B. Huang:** Formal analysis, methodology, writing–review and editing. **M. Pisu:** Writing–original draft, writing–review and editing. **A. Deveaux:** Writing–original draft, writing–review and editing. **M. Liang:** Writing–original draft, writing–review and editing. **R.A. Previs:** Writing–review and editing. **H.A. Moss:** Writing–review and editing. **A. Joshi:** Writing–review and editing. **K.C. Ward:** Writing–review and editing. **M.J. Schymura:** Writing–review and editing. **A. Berchuck:** Writing–review and editing. **A.L. Potosky:** Writing–review and editing.

Acknowledgments

The authors acknowledge the helpful assistance provided by the SEER-Medicare reviewers, Information Management System coordinator Elaine Yanisko, and all the patients whose valuable data contributed to this study. Research reported in this publication was supported by the National Cancer Institute of the National Institutes of Health under award number R37CA233777 (to T.F. Akinyemiju).

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Received November 2, 2021; revised February 2, 2022; accepted April 18, 2022; published first April 27, 2022.

References

1. Wu SG, Wang J, Sun JY, He ZY, Zhang WW, Zhou J. Real-world impact of survival by period of diagnosis in epithelial ovarian cancer between 1990 and 2014. Front Oncol 2019;9:639.
2. American Cancer Society. Cancer Facts & Figures 2019. Atlanta; 2019.
3. Bristow RE, Chang J, Ziogas A, Campos B, Chavez LR, Anton-Culver H. Sociodemographic disparities in advanced ovarian cancer survival and adherence to treatment guidelines. Obstet Gynecol 2015;125:833–42.
4. Bristow RE, Powell MA, Al-Hammadi N, Chen L, Miller JP, Roland PY, et al. Disparities in ovarian cancer care quality and survival according to race and socioeconomic status. J Natl Cancer Inst 2013;105:823–32.
5. Howell EA, Egorova N, Hayes MP, Wisnivesky J, Franco R, Bickell N. Racial disparities in the treatment of advanced epithelial ovarian cancer. Obstet Gynecol 2013;122:1025–32.
6. Kim S, Dolecek TA, Davis FG. Racial differences in stage at diagnosis and survival from epithelial ovarian cancer: a fundamental cause of disease approach. Soc Sci Med 2010;71:274–81.
7. Cronin KA, Howlader N, Stevens JL, Trimble EL, Harlan LC, Warren JL. Racial disparities in the receipt of guideline care and cancer deaths for women with ovarian cancer. Cancer Epidemiol Biomarkers Prev 2019;28:539–45.
8. Bandera EV, Lee VS, Rodriguez-Rodriguez L, Powell CB, Kushi LH. Racial/ethnic disparities in ovarian cancer treatment and survival. Clin Cancer Res 2016;22:5909–14.
9. Sakhuja S, Yun H, Pisu M, Akinyemiju T. Availability of healthcare resources and epithelial ovarian cancer stage of diagnosis and mortality among Blacks and Whites. J Ovarian Res 2017;10:57.
10. Terplan M, Smith EJ, Temkin SM. Race in ovarian cancer treatment and survival: a systematic review with meta-analysis. Cancer Causes Control 2009;20:1139–50.
11. Ramzan AA, Behbakht K, Corr BR, Sheeder J, Guntupalli SR. Minority race predicts treatment by non-gynecologic oncologists in women with gynecologic cancer. Ann Surg Oncol 2018;25:3685–91.
12. Bristow RE, Zahurak ML, Ibeanu OA. Racial disparities in ovarian cancer surgical care: a population-based analysis. Gynecol Oncol 2011;121:364–8.
13. Aranda MA, McGory M, Sekeris E, Maggard M, Ko C, Zingmond DS. Do racial/ethnic disparities exist in the utilization of high-volume surgeons for women with ovarian cancer? Gynecol Oncol 2008;111:166–72.
14. Hildebrand JS, Wallace K, Graybill WS, Kelemen LE. Racial disparities in treatment and survival from ovarian cancer. Cancer Epidemiol 2019;58:77–82.
15. Bristow RE, Chang J, Ziogas A, Anton-Culver H. Adherence to treatment guidelines for ovarian cancer as a measure of quality care. Obstet Gynecol 2013;121:1226–34.
16. Chan JK, Kapp DS, Shin JY, Husain A, Teng NN, Berek JS, et al. Influence of the gynecologic oncologist on the survival of ovarian cancer patients. Obstet Gynecol 2007;109:1342–50.
17. Warren JL, Barrett MJ, White DP, Banks R, Cafardi S, Enewold L. Sensitivity of medicare data to identify oncologists. J Natl Cancer Inst Monogr 2020;2020:60–5.
18. Penchansky R, Thomas JW. The concept of access: definition and relationship to consumer satisfaction. Med Care 1981;19:127–40.
19. Bristow RE, Chang J, Ziogas A, Randall LM, Anton-Culver H. High-volume ovarian cancer care: survival impact and disparities in access for advanced-stage disease. Gynecol Oncol 2014;132:403–10.
20. Austin S, Martin MY, Kim Y, Funkhouser EM, Partridge EE, Pisu M. Disparities in use of gynecologic oncologists for women with ovarian cancer in the United States. Health Serv Res 2013;48:1135–53.
21. Birkmeyer JD, Sun Y, Wong SL, Stukel TA. Hospital volume and late survival after cancer surgery. Ann Surg 2007;245:777–83.
22. Klabunde CN, Warren JL, Legler JM. Assessing comorbidity using claims data: an overview. Med Care 2002;40:26–35.
23. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care 2005;43:1130–9.
24. Vincenty T. Direct and inverse solutions of geodesics on the ellipsoid with application of nested equations. Survey Review 1975;23:88–93.
25. Morgan RJ Jr, Alvarez RD, Armstrong DK, Burger RA, Chen LM, Copeland L, et al. Ovarian cancer, version 2.2013. J Natl Compr Canc Netw 2013;11:1199–209.
26. Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol 2004;159:702–6.
27. Akinyemiju T, Moore JX, Ojesina AI, Waterbor JW, Altekruse SF. Racial disparities in individual breast cancer outcomes by hormone-receptor subtype, area-level socio-economic status and healthcare resources. Breast Cancer Res Treat 2016;157:575–86.
28. Akinyemiju TF, Soliman AS, Johnson NJ, Altekruse SF, Welch K, Banerjee M, et al. Individual and neighborhood socioeconomic status and healthcare resources in relation to black-white breast cancer survival disparities. J Cancer Epidemiol 2013;2013:490472.
29. Akinyemiju T, Waterbor JW, Pisu M, Moore JX, Altekruse SF. Availability of healthcare resources and colorectal cancer outcomes among non-hispanic white and non-hispanic black adults. J Community Health 2016;41:296–304.

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024

30. Pozzar RA, Berry DL. Patient-centered research priorities in ovarian cancer: a systematic review of potential determinants of guideline care. Gynecol Oncol 2017;147:714–22.
31. LaVeist TA, Nickerson KJ, Bowie JV. Attitudes about racism, medical mistrust, and satisfaction with care among African American and white cardiac patients. Med Care Res Rev 2000;57:146–61.
32. Boulware LE, Cooper LA, Ratner LE, LaVeist TA, Powe NR. Race and trust in the health care system. Public Health Rep 2003;118:358–65.
33. Nelson A. Unequal treatment: confronting racial and ethnic disparities in health care. J Natl Med Assoc 2002;94:666–8.
34. Gamble VN. Under the shadow of Tuskegee: African Americans and health care. Am J Public Health 1997;87:1773–8.
35. Long B, Chang J, Ziogas A, Tewari KS, Anton-Culver H, Bristow RE. Impact of race, socioeconomic status, and the health care system on the treatment of advanced-stage ovarian cancer in California. Am J Obstet Gynecol 2015;212:468.
36. Chase DM, Fedewa S, Chou TS, Chen A, Ward E, Brewster WR. Disparities in the allocation of treatment in advanced ovarian cancer: are there certain patient characteristics associated with nonstandard therapy? Obstet Gynecol 2012;119: 68–77.
37. Goff BA, Matthews BJ, Larson EH, Andrilla CH, Wynn M, Lishner DM, et al. Predictors of comprehensive surgical treatment in patients with ovarian cancer. Cancer 2007;109:2031–42.
38. Joshi SS, Handorf ER, Sienko D, Zibelman M, Uzzo RG, Kutikov A, et al. Treatment facility volume and survival in patients with advanced prostate cancer. Eur Urol Oncol 2020;3:104–11.
39. Kommalapati A, Tella SH, Appiah AK, Smith L, Ganti AK. Association between treatment facility volume, therapy types, and overall survival in patients with stage IIIA non–small cell lung cancer. J Natl Compr Canc Netw 2019;17:229–36.
40. Lin JF, Berger JL, Krivak TC, Beriwal S, Chan JK, Sukumvanich P, et al. Impact of facility volume on therapy and survival for locally advanced cervical cancer. Gynecol Oncol 2014;132:416–22.
41. Huang LC, Ma Y, Ngo JV, Rhoads KF. What factors influence minority use of National Cancer Institute-designated cancer centers? Cancer 2014;120:399–407.
42. Doll KM, Meng K, Basch EM, Gehrig PA, Brewster WR, Meyer AM. Gynecologic cancer outcomes in the elderly poor: a population-based study. Cancer 2015;121: 3591–9.
43. Wadhera RK, Wang Y, Figueroa JF, Dominici F, Yeh RW., Joynt Maddox KE. Mortality and hospitalizations for dually enrolled and nondually enrolled medicare beneficiaries aged 65 years or older, 2004 to 2017. JAMA 2020;323:961–9.
44. Loomer L, Ward KC, Reynolds EA, von Esenwein SA, Lipscomb J. Racial and socioeconomic disparities in adherence to preventive health services for ovarian cancer survivors. J Cancer Surviv 2019;13:512–22.
45. Center for Medicare and Medicaid Services. Dually Eligible Beneficiaries under Medicare and Medicaid. US Department of Health and Human Services; 2020. Available from: https://www.cms.gov/outreach-and-education/medicare-learning-network-mln/mlnproducts/downloads/medicare_beneficiaries_dual_eligibles_at_a_glance.pdf.
46. Enewold L, Parsons H, Zhao L, Bott D, Rivera DR, Barrett MJ, et al. Updated overview of the SEER-medicare data: enhanced content and applications. JNCI Monographs 2020;2020:3–13

Downloaded from http://aacrjournals.org/cebp/article-pdf/31/7/1383/3175297/1383.pdf by guest on 09 October 2024