Individual, Social, and Societal Correlates of Health-Related Quality of Life Among African American Survivors of Ovarian Cancer: Results from the African American Cancer Epidemiology Study

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Abstract

Objective: While the incidence of epithelial ovarian cancer (EOC) is lower among African American (AA) women compared with European American (EA) women, AA women have markedly worse outcomes. In this study, we describe individual, social, and societal factors in health-related quality of life (HRQL) in AA women diagnosed with EOC in the African American Cancer Epidemiology Study (AACES) that we hypothesize may influence a patient's capacity to psychosocially adjust to a diagnosis of cancer.

Methods: There were 215 invasive EOC cases included in the analysis. HRQL was measured using the SF-8 component scores for physical (PCS) and mental (MCS) health. We used least squares regression to test the effects of individual dispositional factors (optimism and trait anxiety); social level (perceived social support); and societal-level factors (SES defined as low family income and low educational attainment, and perceived discrimination) on HRQL, while adjusting for patient age, tumor stage, body mass index, and comorbidity. Mediation analysis was applied to test whether social support and physical activity buffer impacts of EOC on HRQL.

Results: Optimism, trait anxiety, social support, poverty, and past perceived discrimination were significantly associated with HRQL following diagnosis of EOC. Specifically, higher family income, lower phobic anxiety, and higher social support were associated with better wellbeing on the MCS and PCS ($p < 0.01$). Higher perceived discrimination was associated with both lower MCS and PCS, whereas higher optimism was associated with higher MCS. Physical activity (MET-min/week) and social support displayed significant overall mediation for effects of SES on MCS and PCS, but not for trait anxiety.

Conclusions: Both pre- and postdiagnosis characteristics of AA women with EOC are important predictors of HRQL after cancer diagnosis. Individual, social, and societal-level factors each contribute to HRQL status with EOC and should be assessed.

Keywords: ovarian cancer, quality of life, African American; cancer survivorship; psychosocial predictors

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Introduction

EPITHELIAL OVARIAN CANCER (EOC) is the fifth leading cause of cancer death in U.S. women and has an overall poor survival (46% 5-year relative survival).¹ As EOC patients experience chemotherapy-related toxicities, current treatment options may offer only small improvements in survival. Among EOC patient groups, African American (AA) women have the highest risk for poor outcomes regardless of stage,^{1,2} raising the need to better understand the health and wellbeing of EOC survivors, especially within this racial/ethnic patient population.

Health-related quality of life (HRQL) broadly refers to patients' appraisal of their health status and wellbeing across dimensions of psychological, social, and physical health. In the context of cancer, HRQL status provides clinically relevant information on the stressors related to diagnosis, including treatment burden, the need or desire to resume daily roles or activities, managing risk for recurrence, and adapting to uncertainty to achieve optimal wellbeing and survival.^{3–10} Within theories on patient adaptation or coping with major life events such as cancer, a concept of "reserve capacity" has been advanced to understand the dynamic associations among low socioeconomic status (SES), stressful experiences, psychosocial resources, emotion and cognition, and biological and behavioral pathways on health outcomes or disparities.¹¹

This conceptualization may be useful to organize and test the importance of social and societal factors,¹² such as financial strain, social position or neighborhood characteristics,¹³ employment status¹⁴ and perceived discrimination,¹⁵ and patient cognitive factors, such as disposition toward negative and positive emotion that may intrinsically influence a patient's perceptions and response to EOC.

Studies of EOC cancer patients have found increased risk for depressive affect, anxiety, worry and general distress, social functioning,^{16,17} and other deficits such as insomnia¹⁸ and loss of intimacy.¹⁹ However, there is a general lack of evidence on the importance of multilevel factors in the HRQL of EOC survivors,⁹ especially in underrepresented minority women.

In the present study, we examine individual, social, and societal correlates of AA women diagnosed with EOC HRQL to inform healthcare providers and patient advocates about the HRQL experiences and needs of disadvantaged women following a diagnosis with EOC.

Methods

Study population

AACES is a multisite, population-based observational study of invasive EOC in AA women. Age- and geographically matched controls were also enrolled.

The current study is restricted to only EOC cases. The methods have been described previously.²⁰ Briefly, cases are AA women between 20 and 79 years of age, newly diagnosed with EOC between December 2010 and December 2015, and a resident of one of the following geographic locations: Alabama, Georgia, Illinois, Louisiana, Michigan, New Jersey, North Carolina, Ohio, South Carolina, Tennessee, and Texas. Institutional Review Board approval was obtained from participating sites and all participants consented to

participate in the study. Institutional Review Board approval was obtained from Duke University (lead institution) and all participating institutions

Data collection

A baseline questionnaire was administered by telephone, within, on average, 5.5 months from the date of diagnosis. During the initial interview, participants were asked to report height and weight, parity, levels of physical activity, physical symptoms, comorbidities, and family income for the period *before* their EOC diagnosis (Table 1). Patients were also asked to report their *present* levels of social support and perceived discrimination. Approximately 12 months following the initial interview, participants completed a follow-up survey (repeated at 12-month intervals) by telephone that reassessed physical activity and social support and collected data on coping and HRQL (see Study Variables and Framework for detailed description). Additional clinical information concerning tumor characteristics (*e.g.*, tumor stage) and treatment information (*e.g.*, neoadjuvant and adjuvant chemotherapy) were obtained from medical records. A centralized pathology review to confirm the diagnosis of EOC, histology, and grade was conducted by the study pathologist.

Study variables and framework

Outcomes. HRQL is the primary outcome variable of interest and was assessed using physical (PCS) and mental (MCS) component scores of the Medical Outcomes Study SF-8, a short form version of the SF-36 Health Survey Scales²¹ measurement system. SF-8 items were scaled from 0 to 100 and two summary scores, MCS and PCS, were calculated from regression formulas according to the SF-8 instruction manual and standardized using a t-score transformation and normed to a U.S. population (based on a 1990 norm) of a score of 50 and a standard deviation of 10.²² PCS in the SF-8 is derived to reflect physical function, role limitations caused by physical problems, bodily pain, and general health. Those with physical illness show lower scores on the subscales of physical illness, bodily pain, general health, and the overall PCS score. MCS in the SF-8 is derived to reflect role limitations caused by emotional problems, vitality, social functioning, and mental health. Scores were calculated such that higher scores indicated better wellbeing.

TABLE 1. AFRICAN AMERICAN CANCER EPIDEMIOLOGY STUDY HEALTH-RELATED QUALITY OF LIFE MODEL MEASURES COLLECTED BY INTERVIEW PERIOD

<i>Initial interview</i>	<i>Follow-Up (annual interview)</i>
Comorbidities	Health-related quality of life (HRQL)
Physical activity (last year)	Life Orientation Test
Body Mass Index (last year)	Phobic anxiety
Symptoms (prediagnosis)	Social support
Family income (last year)	Physical activity MET (average over prior year)
Parity (lifetime)	
Social support (current)	
Perceived discrimination (lifetime)	

Multilevel inputs on HRQL. Covariates of HRQL status in this study, modeled as predictors, were intended to capture inputs at the individual, social, and societal level to reflect unique dimensions or factors that can influence HRQL in the context of any disease or illness.

Measured as *individual-level* exposures were aspects of the patient's demographics, health status, and reproductive history before EOC diagnosis, including comorbid conditions in the year before diagnosis (Charlson index), leisure-time physical activity 1 year before diagnosis (scored as metabolic equivalents of task [MET]-minutes/week), body mass index (BMI), parity (number of births of a gestational age of 24 weeks or more regardless of disposition), and reported number of cancer symptoms present at diagnosis. Two key psychosocial inputs tested at the individual level were trait anxiety and dispositional optimism. Trait anxiety is a stable tendency to experience and report negative emotions, such as fears, worries, and anxiety across diverse situations. The latter was assessed as phobic anxiety using a modified 6-item Crown-Crisp Phobic Anxiety subscale.^{23,24} Dispositional optimism is a generalized positive expectancy for future outcomes and has been linked to better health outcomes, lower immune response to stress, and more behavioral engagement,²⁵ and assessed in this study using the Life Orientation Test-Revised (LOT-R).²⁶

HRQL inputs at the *social and behavioral levels* were examined by measuring patients' perceived social support, appraised at the time of the baseline telephone interview, and daily leisure physical activity. Social support has been shown to play a key role in coping with stress²⁷ and is associated with both better mental and physical HRQL in numerous cancer populations.^{28,29} We assessed social support using a 12-item version of the Multidimensional Scale of Perceived Social Support scale,³⁰ modified as a 5-point response format (a score of 1–3 was classified as low support; 3–4 moderate support; ≥ 4 high support). Physical activity has general protective effects on cancer risk³¹ and has been shown to improve HRQL in cancer survivors.^{32,33} Leisure time or recreational physical activity was assessed in AACES from self-report on the usual amount of activity engaged in each week, lasting 10 minutes or longer, excluding occupational activity and housework. Participants reported the times per week they engaged in each type of exercise and the average length of each exercise session. This information was used to calculate total weekly minutes of leisure-time physical activity for each intensity level.

Finally, *societal inputs* on HRQL for this study population were conceptualized as poverty, assessed from the level of prediagnosis period family income (category midpoints: \$5,000, \$17,500, \$37,500, \$62,500, \$87,500, \$120,000) and perceived discrimination or unfair treatment in daily life by others, assessed with the 6-item Major Experiences of Discrimination (abbreviated version) scale.³⁴ This scale measures everyday experiences, over the lifetime, of unfair treatment connected with paid employment, law enforcement, education, residential location, and lending practices.

Statistical analysis

Selected for the present study were all cases for whom the date of the first follow-up survey period was completed within 18 months of diagnosis. This period was chosen to

represent patient HRQL status reflected over an "early survivorship period" of a highly fatal disease, and after which the first round of treatment is completed.

We estimated adjusted linear trend effects of predictors on subscales and MCS/PCS HRQL using an ordinary least squares regression and adjusting for potential confounders, including age at diagnosis, parity, comorbidities, BMI (weight (kg)/height (m²)), stage, and income. To facilitate comparison of effects, predictors were scaled by the inter-quartile range. Missing data in the covariates for stage (3.7%) and income (1.4%) were handled by imputing missing stage discretely and missing income using the fully conditional imputation method, where variables are filled in as starting values and then uses a separate conditional distribution for each imputed variable.

Tests of formal mediation were conducted using the formulas and method described in Valeri and Vanderweele.³⁶ Analyses were conducted using both MCS and PCS as outcomes, and exposures representing both a hypothesized societal input to HRQL (family income) and an individual dispositional input (trait anxiety). Mediation, or indirect effects of physical activity and social support on HRQL were examined based on evidence in the literature on their roles in this regard.^{37–39} Each analysis consisted of estimating two simultaneous linear equations, the first equation regressing outcome as a function of exposure, mediator, and confounders (age at diagnosis, stage, BMI), including potential interactions between exposure and mediator, and the second regressing the mediator as a function of the exposure and confounders. The total, natural direct, and indirect effects were estimated with SAS system v9.4 macros for mediation analyses.

Results

From a population total of 600 cases enrolled in AACES, 473 (78.8%) were eligible for an annual follow-up interview (Fig. 1). A total of 287 participants completed a follow-up questionnaire, of these 229 (79.4%) had a first follow-up survey period within 18 months of diagnosis. After excluding cases with missing data on the SF-8 MCS PCS scores, an analytical sample of 215 (75.3% of the study sample) was obtained. Compared with the total AACES participant population, HRQL study cases were less likely to be diagnosed at stage IV (4.8% vs. 10.7%; $p=0.04$) and were older age (median age of 59.1 years vs. 57.4 years, $p=0.01$). The median length of time from date of diagnosis to the initial survey was 5.5 months with a range of 1–18 months.

Table 2 presents descriptive data for the demographic, clinical, and multilevel HRQL input variables, and cross-classifies the major social and societal inputs with individual dispositional factors and HRQL outcomes. Approximately 58% had a diagnosis of advanced-stage EOC (III or IV), the median age was approximately 58 years, and the majority (60%) had one or no major comorbidity excluding their ovarian cancer diagnosis. More than half (58.9%) of the participants were found to have a BMI greater than 30, with a median leisure physical activity level of approximately 265 MET-min/week. Mean for individual-level cognitive and emotional dispositional factors were 71.6 for optimism and 63.4 for trait anxiety. Scale mean for the HRQL indices (SF-8 component scores) were 43.7 for the PCS and 50.1 for the MCS. For the social and societal characteristics, approximately 43% of the

FIG. 1. Flow chart of case selection for quality-of-life analysis.

study sample had “low” (5%) or moderate levels of social support, versus “high” (57%); nearly 45% of the sample reported family income of less than \$25,000; and approximately 46% reported one or more instances of perceived discrimination or unfair treatment. Clustering among the hypothesized HRQL input variables as shown in the cross-classified data is presented in Table 2. Women with lower income or lower education and more comorbid conditions reported lower optimism and lower HRQL than women with higher levels of these SES indicators. Having lower social support was associated with significantly lower optimism, higher anxiety, and lower PCS and MCS scores. Finally, women with more MET-minutes of physical activity, greater educational attainment, and higher levels of social support reported higher optimism and higher physical health-related HRQL.

Multivariate analysis of linear trends in HRQL scores is presented in Table 3. For the major individual-level factors of interest (*i.e.*, optimism, anxiety, and symptoms), a 1 U decrease in the standardized trait anxiety score results in approximately 3.6 and 3.0 higher units of mental and physical health, respectively, and displayed a similar pattern across most SF-8 subscale domains. Likewise, a unit increase in optimism is associated with approximately 4.2 and 5.6 U of higher of mental and physical HRQL. At the level of social and behavioral characteristics, each unit of greater social support was associated with 4.8 and 5.6 higher units of mental and physical HRQL, and this effect was consistent across all SF-8 subdomains. Leisure physical activity (MET-min/week) during the initial interview was not related to

HRQL in our sample; however, physical activity at the follow-up interview was broadly associated with mental and physical HRQL and all SF-8 subdomains. Lastly, variables, modeled as societal-level factors of perceived discrimination and family income, were found to be associated with HRQL status. Specifically, a 1 U increase in the standardized perceived discrimination score was associated with a 1.40 and 1.3 U decrease in mental and physical HRQL, respectively; whereas an increase in family income resulted in a 2.6 and 3.1 U increase on these measures.

The effects of first-line chemotherapy on patients' HRQL mean were examined among 172 of 215 with nonmissing data. Neither treatment with neoadjuvant therapy ($N=43$), adjuvant chemotherapy ($N=147$), or combined ($N=156$) was significantly associated with HRQL status mean ($p>0.05$), and thus not included as covariates in the adjusted model displayed in Table 3. A comparison of HRQL scores between missing and nonmissing cases did not result in statistically significant findings ($p>0.05$) and sensitivity tests assigning all cases with missing chemotherapy to either chemotherapy category did not result in statistically significant comparisons ($p>0.05$).

Results of mediation analyses that decomposed total effects into direct effect and indirect effect components for the hypothesized mediators are shown in Table 4. Interactions between the exposure and mediator were not statistically significant and therefore, interaction terms were not included in the final mediation models. Results reveal that physical activity and social support (after diagnosis) mediate effects of family income on HRQL. Specifically, in the presence of physical activity, the total effect of family income on HRQL (*i.e.*, the association of higher family income with better HRQL) includes indirect effects from increased physical activity; a similar mediation effects for poverty (*i.e.*, low family income) and HRQL is evident for level of social support. The proportion mediated (indirect effect/total effect), which measures the importance of the mediating pathway in explaining the total effect of exposure on outcome, ranged from 30% to 35% for social support and physical activity as mediators of the association between family income and HRQL. Finally, no statistical evidence was found to suggest that social support or physical activity mediated levels of trait anxiety or HRQL in our sample.

Discussion

We examined multilevel correlates of HRQL, short-term after diagnosis, in a sample of AA women at high risk for poor outcomes diagnosed with EOC by examining effects of individual, social, and societal factors assessed near time of diagnosis. In one of the first and largest studies to date on HRQL in AA women with this disease, we found, on average, a somewhat lower physical wellbeing (SF-8 PCS), approximately 8% (4.4 points) lower than general population norms (43.6 vs. 48.0 for women aged 55–59, respectively) but did not exceed $\frac{1}{2}$ standard deviation unit for this measure. The mean for mental wellbeing (SF-8 MCS) was highly similar to the norm for this age population (50.8 vs. 50.7, respectively).²² With the exception of an apparent small effect on physical wellbeing, our findings were similar to a report by Zhou et al.,⁹ who found no differences in PCS and MCS at 1 and 2 years postdiagnosis among ovarian cancer survivors in

TABLE 2. DISTRIBUTION OF PATIENT CHARACTERISTICS AND ADJUSTED MEAN FOR KEY PATIENT-REPORTED OUTCOMES

All	N (%) 215 (100)	Symptoms ^a 43.37	Optimism ^b 71.64	Anxiety ^b 63.41	PCS ^b 43.66	MCS ^b 50.08
Individual-level inputs						
Stage		ns	ns	ns	ns	ns
I	58 (27.0)	43.20	70.95	62.84	44.34	49.77
II	22 (10.2)	47.73	71.59	67.17	44.20	50.42
III	116 (54.0)	43.71	71.94	63.98	43.10	50.08
IV	10 (4.7)	35.00	66.67	50.00	42.34	47.27
Unstaged	9 (4.2)	38.89	77.78	65.43	46.67	54.36
Age at diagnosis		*	ns	*	ns	ns
Q1 (≤51)	36 (16.7)	42.09	74.09	66.67	46.04	50.43
Q2 (51–≤58)	67 (31.2)	49.35	70.94	54.30	42.66	48.14
Q3 (58–≤66)	50 (23.3)	43.57	74.40	66.67	43.77	52.93
Q4 (66>)	62 (28.8)	37.50	67.84	67.86	42.93	49.14
Comorbidity ^a		ns	**	ns	***	*
0,1	130 (60.5)	42.66	74.59	66.07	45.65	50.87
2	30 (14.0)	43.67	72.67	63.70	42.48	52.86
3+	55 (25.6)	44.91	64.09	56.97	39.61	46.71
BMI ^a		ns	ns	ns	**	ns
<25	35 (16.4)	41.30	71.79	69.84	47.13	52.05
25–<30	53 (24.8)	42.83	71.54	64.36	45.58	51.16
≥30	126 (58.9)	44.29	71.61	61.02	41.86	49.03
Physical activity, MET-min/week ^a		ns	ns	***	*	ns
Q1 (0)	74 (34.4)	46.76	68.10	50.60	41.31	47.75
Q2 (0–≤265)	34 (15.8)	45.59	73.90	64.71	43.71	50.08
Q3 (265–≤720)	62 (28.8)	40.97	71.05	69.18	43.71	52.13
Q4 (>720)	45 (20.9)	39.46	76.56	75.56	47.43	51.10
Social/societal-level inputs						
Social support ^a		ns	***	*	**	**
Low (≤3)	10 (4.7)	46.00	50.42	48.89	33.25	41.46
Moderate (3–<4)	81 (38.4)	43.33	69.05	59.81	43.07	49.01
High (>4)	120 (56.9)	43.05	74.93	66.30	44.77	51.36
SES: Family income		ns	***	***	*	ns
<10 K	40 (18.9)	45.50	63.17	46.11	40.48	47.98
10k–<25k	55 (25.9)	39.45	68.02	64.65	41.83	48.34
25k–<50k	56 (26.4)	46.71	75.76	66.47	43.97	49.95
50k–<75k	32 (15.1)	48.13	75.26	68.06	47.03	52.98
≥75k	29 (13.7)	36.21	78.16	71.65	47.21	53.24
SES: education		ns	***	***	ns	ns
<HS	35 (16.3)	34.86	63.26	51.75	41.69	46.73
HS	58 (27.0)	45.96	66.65	57.47	42.71	49.08
Some college	58 (27.0)	45.34	78.45	67.24	43.19	51.75
≥4 years college	64 (29.8)	43.91	74.56	71.70	46.03	51.31
Perceived discrimination ^b		*	ns	ns	ns	ns
0 (None)	115 (53.5)	39.83	71.22	65.12	44.38	50.52
>0 (Any)	100 (46.5)	47.46	72.12	61.44	42.84	49.58
Any chemotherapy		ns	ns	ns	ns	ns
No	17 (9.8)	40.59	76.23	73.86	42.10	51.49
Yes	156 (90.1)	44.33	70.65	64.96	44.08	49.98

^aInitial interview scores.^bFollow-up interview scores.

ns = Comparisons not statistically significant.

p*-value <0.05.*p*-value <0.01.****p*-value <0.001.

the American Cancer Society's Study of Cancer Survivors-I cohort.

While the global averages for HRQL were nondistinct from general population samples, we found evidence of multilevel inputs in HRQL involving individual, social, and

societal factors. In addition, these factors were clustered in patients with the lowest HRQL. Patients who reported low income or education, low social support, more exposure to discrimination, more pessimism, and higher anxiety had PCS and MCS scores of 40.7 and 44.8, respectively (data not

TABLE 3. ADJUSTED LINEAR TRENDS OF HEALTH-RELATED QUALITY OF LIFE INDICES AND THEORETICAL PREDICTORS^{a,b}

	Health rating (95% CI)	Physical activity (95% CI)	Daily work (95% CI)	Bodily pain (95% CI)	Energy (vital) (95% CI)	Social activity (95% CI)	Emotional problems (95% CI)	Mental (95% CI)	MCS (95% CI)	PCS (95% CI)
Anxiety (higher → lower)	1.04 (-0.11 to 2.20)	2.94 (1.08-4.80)	2.63 (0.84-4.42)	3.23 (1.62-4.84)	2.26 (0.57-3.95)	2.94 (1.17-4.70)	3.19 (1.64-4.74)	3.15 (1.57-4.73)	3.62 (1.88-5.37)	2.97 (1.33-4.61)
Optimism (negative → positive)	2.32 (0.94-3.71)	0.98 (-1.32 to 3.29)	1.72 (-0.48 to 3.93)	2.36 (0.35-4.37)	2.40 (0.34-4.47)	4.16 (2.02-6.29)	4.17 (2.29-6.05)	4.19 (2.28-6.10)	5.64 (3.57-7.71)	1.64 (-0.40 to 3.68)
Average social support (initial interview) (lower → higher)	1.92 (0.78-3.06)	1.82 (-0.07 to 3.70)	3.10 (1.32-4.88)	1.51 (-0.17 to 3.14)	1.98 (0.27-3.69)	2.25 (0.45-4.05)	2.36 (0.77-3.95)	2.45 (0.84-4.07)	2.80 (1.02-4.59)	2.58 (0.92-4.24)
Average social support (follow-up) (lower → higher)	2.01 (0.72-3.29)	3.42 (1.30-5.54)	4.12 (2.11-6.12)	2.77 (0.95-4.59)	3.05 (1.11-5.00)	3.76 (1.75-5.78)	5.24 (3.54-6.93)	4.76 (3.05-6.46)	5.64 (3.75-7.53)	3.57 (1.73-5.42)
Physical activity, MET-min/week (initial interview) (lower → higher)	0.87 (-0.10 to 1.84)	1.32 (-0.26 to 2.89)	1.06 (-0.46 to 2.58)	0.45 (-0.95 to 1.84)	-0.01 (-1.45 to 1.43)	1.08 (-0.43 to 2.59)	-0.10 (-1.44 to 1.25)	0.77 (-0.59 to 2.14)	0.33 (-1.18 to 1.85)	1.03 (-0.37 to 2.44)
Physical activity, MET-min/week (follow-up)	1.54 (0.84-2.25)	1.63 (0.45-2.81)	1.40 (0.27-2.53)	1.54 (0.51-2.57)	1.41 (0.35-2.48)	1.60 (0.47-2.72)	1.01 (0.00-2.01)	1.12 (0.10-2.14)	1.36 (0.23-2.48)	1.89 (0.86-2.93)
Mean symptoms (initial interview)	-0.51 (-2.03 to 1.01)	-1.48 (-3.95 to 0.98)	-1.61 (-3.98 to 0.76)	-1.38 (-3.55 to 0.79)	-1.64 (-3.87 to 0.59)	-0.96 (-3.32 to 1.39)	-0.87 (-2.96 to 1.22)	-1.15 (-3.27 to 0.97)	-1.21 (-3.56 to 1.15)	-1.70 (-3.88 to 0.49)
Family income ^b	2.29 (1.06-3.53)	2.58 (0.57-4.59)	3.04 (1.11-4.97)	2.25 (0.48-4.02)	2.23 (0.41-4.05)	1.76 (-0.15 to 3.68)	2.34 (0.64-4.05)	2.48 (0.75-4.21)	2.63 (0.71-4.55)	3.12 (1.34-4.91)
Perceived Discrimination (lower → higher)	-0.24 (-1.09 to 0.61)	-1.18 (-2.55 to 0.19)	-1.12 (-2.44 to 0.20)	-1.10 (-2.30 to 0.11)	-1.20 (-2.44 to 0.04)	-0.93 (-2.24 to 0.38)	-1.99 (-3.13 to -0.86)	-0.80 (-1.98 to 0.38)	-1.40 (-2.70 to -0.10)	-1.31 (-2.52 to -0.09)

^aPredictors are scaled by interquartile range. Adjusted for age at interview comorbidity, body mass index (BMI), tumor stage, and family income (for all except b).

^bBolded values are significantly different from 0 at $\alpha = .05$, for these values, their 95% CI's do not overlap zero. MCS, mental component summary; PCS, physical component summary; MET, metabolic equivalent of task.

TABLE 4. ANALYSES OF HYPOTHESIZED MEDIATORS ON HEALTH-RELATED QUALITY OF LIFE LEVEL

	<i>Outcome</i>					
	<i>PCS</i>			<i>MCS</i>		
	<i>Effect^a</i>	<i>95% CI</i>	<i>PM</i>	<i>Effect^a</i>	<i>95% CI</i>	<i>PM</i>
Family income ^b and HRQL						
Physical activity (MET/min-week)						
Natural direct effect (family income)	2.28	(0.15–4.40)	33%	1.94	(–0.38 to 4.25)	30%
Indirect effect (physical activity)	1.17	(0.37–1.98)		0.82	(0.03–1.61)	
Total effect (Natural direct + indirect)	3.45	(1.26–5.65)		2.76	(0.41–5.12)	
Social support						
Natural direct effect (family income)	1.93	(–0.15 to 4.02)	30%	2.21	(0.08–4.35)	35%
Indirect effect (social support)	0.86	(0.19–1.53)		1.21	(0.37–2.06)	
Total effect (Natural direct + indirect)	2.79	(0.79–4.80)		3.43	(1.22–5.63)	
Anxiety and HRQL						
Physical activity (MET/min-week)						
Natural direct effect (anxiety)	3.20	(1.30–5.10)	16%	2.09	(0.83–3.35)	0%
Indirect effect (physical activity)	0.59	(–0.77 to 1.94)		0.01	(–0.09 to 0.11)	
Total effect (Natural direct + indirect)	3.79	(0.96–6.62)		2.10	(0.86–3.34)	
Social support						
Natural direct effect (anxiety)	3.24	(1.40–5.09)	14%	3.84	(1.84–5.83)	20%
Indirect effect (social support)	0.52	(–0.47 to 1.51)		0.98	(–0.50 to 2.46)	
Total effect (Natural direct + indirect)	3.76	(1.34–6.18)		4.82	(1.78–7.86)	

^aAdjusted for age at diagnosis, stage, comorbidities, BMI.

^bFamily income is scaled by IQR.

PM, proportion mediated. PM=(Indirect effect/Total effect).

shown) versus 47.3 and 55.2 for those with the highest or best level of these correlates (*t*-test comparison *p*-values <0.0001). In addition, women who recalled having a high level of leisure physical activity for the period before EOC diagnosis had the highest levels of physical wellbeing (PCS) postdiagnosis. AACES data also suggest that physical activity after EOC diagnosis may be associated with better survival in comparison to women who did not engage in any recreational physical activity after their diagnosis.⁴⁰ In contrast to this strong pattern of findings for psychosocial variables, clinical variables such as tumor stage, histology, and treatment with neoadjuvant or adjuvant chemotherapy had little input on HRQL in the data collection period. A similar result was found for patient symptoms recalled for the period before diagnosis. These findings suggest that in a period when treatment is complete or largely completed, or acute effects, such as toxicities may have subsided, coping and social support resources have more influence on HRQL status than tumor stage at the time of diagnosis or treatment modality. Research is needed to examine whether multilevel factors comprising the concept of reserve capacity, or similar concepts, also have a role in survival with ovarian cancer.

Our framework for this study was that ovarian cancer is a major life stressor, physically, socially, and emotionally, and we examined the concept in health psychology of “reserve capacity” in this regard by testing individual-, social-, and societal-level inputs in thriving after a diagnosis of EOC, measured as HRQL status. In stress theory, a related concept is “allostatic load,”⁴² which is the idea that multiple sources of life stressors may accumulate to a threshold that overwhelms the individual’s ability to resist or restore balance. We hypothesized that a patient’s “reserve capacity” to ad-

dress these stressors stem from multiple factors and are carried into the context of EOC to shape the patient’s HRQL response. Our finding that the success with which EOC patients cope with their diagnosis and treatment depends, in part, on prediagnosis exposures, experiences, and social resources consistent with a larger literature that coping resources,⁴³ financial resources, and poverty^{35–37,44} are critical in meeting family and self-care. In this regard, a notable finding of our study was that the deleterious effects of lower income on patients’ reported HRQL could be buffered by social support and physical activity. This suggests that societal exposures, such as poverty, are not immutable risks and that interventions intended to increase social resources and physical activity may be effective in reducing patients’ “background” risks for poor outcomes with cancer.

To our knowledge, our study is the first to examine the influence of past experiences with discrimination or inequity on HRQL in cancer patients. Our premise was that discrimination is a societal-level input to HRQL by adding to underlying stress or demoralization and could be a salient risk for women especially those from vulnerable or historically marginalized groups such as African American race. The concept of demoralization was originally advanced by Frank⁴⁵ in the 1970’s as a generalized state of feeling impotent, isolated, and despair; later Schildkraut et al.⁴⁶ defined it as a loss of self-efficacy and is a known risk factor for anxiety and depression.³⁴ We found that while perceived discrimination scores in this sample were low overall, nearly one-half of patients in AACES reported prior exposure to discrimination or inequity. Exposure to discrimination was significantly associated with poorer mental wellbeing (MCS), suggesting that perceived discrimination may significantly

contribute to a patient's stress burden and HRQL. Other investigators have observed significant differences in health status by levels of perceived discrimination, such as self-reported ill health and bed days.¹⁵

A practical application of our study findings, although from correlational data, is that individual, social, and societal factors that can be readily assessed around the time of diagnosis offers a means to stratify patients on initial risk for lower HRQL, along with other more conventional risk factors. For example, higher optimism after diagnosis was associated with better HRQL and consistent with its conceptual meaning as a favorable expectancy for the future⁴⁷ and evidence in better outcomes with stress⁴⁸ and anxiety among cancer survivors.^{49,50} In this regard, measuring and monitoring patient optimism might offer cancer patient support programs an earlier means to detect risk for depression or distress compared with current recommended practices that rely solely on measuring distress occurrence. Cancer survivorship teams may be an ideal source to educate and provide psychological support to patients, as well as to facilitate the mobilization of social resources available from family members or other informal caregivers that offer protection from diminished wellbeing. Future studies are needed to ascertain the generalizability of our findings to other patient populations and whether our findings are applicable to predicting changes in HRQL, such as pre/post diagnosis of EOC or months to years following treatment.

The strength of this study was our ability to separate effects of individual trait-like characteristics of anxiety and optimism/pessimism from interpersonal processes, such as social support, and from perceived discrimination on HRQL. Models of psychosocial inputs in health outcomes, such as social support are conceptually complex, as personality traits may interact with social support or perceptions of the social environment making it difficult to isolate effects on health.⁴¹ We found that all three levels of effect independently contribute to the ability to thrive after a diagnosis of EOC. A limitation of our study is that subsequent annual follow-up surveys were incomplete (due to loss to follow-up) for most patients and not assessed in this analysis, since it would not be representative of the patient population in this study. Our HRQL items were collected at single assessment points rather than by repeated assessment, and therefore our analyses cannot account for changes in HRQL over time. However, including time since diagnosis in our analysis had only minor effects on our point estimates and was not statistically significant, and suggests that there were no obvious time trends during the study period. Data related to chemotherapy toxicities were not available in this study population and we were unable to directly assess the impact of these negative treatment side effects on HRQL. Another limitation of our findings on the psychosocial needs of women recently treated for EOC is that our study was not designed to describe unique effects of EOC on HRQL, which would have required a control comparison. Finally, because our analysis was limited to patients who survived at least 18 months from the date of their diagnosis, our findings may not reflect the HRQL of those patients with more aggressive disease who died shortly after diagnosis. These limitations, notwithstanding the value of this study, are its sole focus on HRQL experiences of AA women diagnosed and treated for EOC, which has not been evaluated in this minority population, to date.

Conclusion

Optimism, trait anxiety, social support, poverty, and past perceived discrimination were significantly associated with HRQL following diagnosis of EOC and are important to assess after cancer diagnosis. Interventions may be needed to assist patients with low resources to buffer stress from EOC diagnosis and treatment.

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Disclosure Statement

The authors declare that they have no conflicts of interest.

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