Race/Ethnicity, Physical Activity, and Quality of Life in Breast Cancer Survivors

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Abstract

Purpose: **To examine associations between recreational physical activity and quality of life (QOL) in a multiethnic cohort of breast cancer survivors, specifically testing whether associations are consistent across racial/ethnic groups after accounting for relevant medical and demographic factors that might explain disparities in QOL outcomes.**
Methods: **Data were collected from a population-based cohort of non-Hispanic White ($n = 448$), Black ($n = 197$), and Hispanic ($n = 84$) breast cancer survivors (stage 0-IIIa) in the Health, Eating, Activity, and Lifestyle Study. Physical activity was assessed ~2.5 years after breast cancer diagnosis, with QOL assessed on average 6 to 12 months later. We used structural equation modeling to examine relationships between meeting recommended levels of physical activity and QOL, stratifying by race/ethnicity and adjusting for other demographic, comorbidity, and treatment effects.**

Results: **Structural equation modeling indicated that meeting recommended levels of physical activity had significant positive associations with QOL for Black and non-Hispanic White women ($P < 0.05$). Fewer Black women reported meeting recommended physical activity levels ($P < 0.001$), but meeting recommendations was associated with better QOL. Post hoc tests showed that meeting physical activity recommendations was specifically associated with better vitality, social functioning, emotional roles, and global QOL ($P < 0.05$ for all).**
Conclusions: **These results suggest that meeting recommended levels of physical activity is associated with better QOL in non-Hispanic White and Black breast cancer survivors. Findings may help support future interventions among breast cancer survivors and promote supportive care that includes physical activity, although more research is needed to determine these relationships among Hispanic and other ethnic minority women.** (Cancer Epidemiol Biomarkers Prev 2009;18(2):656–63)

Introduction

More than 2.3 million women are living with breast cancer in the United States (1). Whereas breast cancer patients are living longer, they may not be symptom-free. Survivors report psychosocial distress and physical symptoms such as fatigue, hormonal symptoms, and decrements in physical functioning, both in the short term and over time (2, 3). Importantly, evidence suggests that lifestyle behaviors, such as physical activity (PA), may improve breast cancer prognosis (4-6), can have beneficial effects on quality of life (QOL; ref. 7), and, therefore, may be an important part of supportive care. The relationship between PA and breast cancer survivors' QOL has been examined in a number of cross-sectional, prospective, and intervention studies (8, 9); however, most studies are

based on small, homogenous groups, with little evidence available on ethnically or economically diverse populations. Research suggests that Black and Hispanic breast cancer survivors report poorer QOL than their White counterparts (10, 11), but no information is available on the relationship between PA and QOL among ethnic minority women. It is also not known whether the level of PA in current public health recommendations (12, 13) is associated with better QOL among cancer survivors. To determine whether PA recommendations should be included as part of supportive care for breast cancer survivors, it is important to understand these relationships across various ethnic groups.

The current project examines associations between self-reported recreational PA and QOL in an ethnically diverse, population-based, prospective observational cohort study of breast cancer survivors. We first describe the prevalence of meeting PA recommendations of 30 minutes of moderate to vigorous activity on most days of the week (12, 13) ~2.5 years after a breast cancer diagnosis. We then test the hypothesis that women who meet current public health PA recommendations report better QOL than women who do not meet these recommendations. We specifically examine whether this

association is the same or varies among Black, Hispanic, and non-Hispanic White breast cancer survivors.

Materials and Methods

Study Design. Participants in this study are women enrolled in the Health, Eating, Activity, and Lifestyle (HEAL) Study, a multicenter, multiethnic, prospective study of women diagnosed with *in situ* or stage I to IIIA breast cancer. In this observational cohort study, women were assessed at multiple time points and informed consent was obtained from participants at each assessment. No intervention was administered. Study protocols were approved by the Institutional Review Board at each participating center, in accordance with an assurance filed with and approved by the United States Department of Health and Human Services.

Eligibility and Recruitment. Details of the study aims, design, and recruitment have been published previously (14, 15). Briefly, breast cancer patients were recruited from the Surveillance Epidemiology and End Results registries in three geographic regions of the United States: New Mexico, Western Washington, and Los Angeles County. Eligible participants were diagnosed with stage 0 to IIIa breast cancer during a defined time frame, were able to participate in an interview within a 12-mo period after diagnosis, and had no prior breast cancer diagnosis. A total of 1,183 women completed the baseline interview; 944 (80%) participated in a second interview ~24 mo after the baseline survey; and 858 (73%) participated in a QOL assessment ~6 mo after the 24-mo assessment. For the current analysis, we excluded 53 women who were diagnosed with a recurrence or a new primary breast cancer by the date of the QOL assessment, 24 women who reported their race as ''other,'' and 52 women with incomplete data. The final sample size for analyses was 729: Black (n = 197), non-Hispanic White (n = 448), and Hispanic (n = 84) survivors.

Measures

Background Variables. Data are derived from the three assessments, medical record abstraction, and Surveillance Epidemiology and End Results registry records. A baseline in-person interview or self-administered questionnaire, conducted on average 6.1 mo after diagnosis, provided data on age, education, and race/ethnicity. Marital status, menopausal status, smoking, and weight were collected at a second in-person interview or self-administered questionnaire, conducted, on average, 24.4 mo after the baseline interview. Height was measured in the clinic at two centers (Washington and New Mexico) and was self-reported in Los Angeles. Body mass index was calculated based on weight (in kilograms) divided by measured or self-reported height (in square meters). At the 24-mo interview, participants reported whether they had been diagnosed by a physician with any of 18 chronic medical conditions (e.g., angina, arthritis, osteoporosis, chronic lung disease, diabetes, other cancers) and, if yes, whether such condition limited their current activities of daily living. Medical comorbidity was calculated as the number of conditions that participants' reported as limiting their current activities of daily living. Participants also reported the name, dose, and frequency of any medications used at time of the 24-mo interview.

Diagnosis, Stage of Breast Cancer, and Treatment. Diagnosis date and stage of disease were assessed using Surveillance Epidemiology and End Results data. Treatment data (surgeries, radiation therapy, and chemotherapy) were abstracted from medical records and Surveillance Epidemiology and End Results registry records. Tamoxifen use was collected by medical abstraction and was self-reported during the 24-mo interview.

Physical Activity. Recreational PA was measured at the 24-mo assessment using a modified version of the *Modifiable Activity Questionnaire* (16), and the type, duration, and frequency of 20 activities (e.g., walking, jogging, aerobics, tennis) during the past year were assessed. The intensity of each activity was classified as light, moderate, or vigorous based on its rating in the Compendium of Physical Activities (17). Hours per week of moderate to vigorous sports and recreational PA were combined into a total score and then categorized based on that score according to criteria set by the American College of Sports Medicine, the American Heart Association, and the American Cancer Society PA recommendations of 30 min of moderate to vigorous activity on most days of the week (12, 13). Occupational and household activities were not covered in this score. Participants were categorized as sedentary (0 h/wk), low active (<2.5 h/wk), or met recommendations (≥2.5 h/wk).

Quality of Life. QOL was assessed at the third assessment (on average 34.5 mo following the baseline interview). Health-related QOL was assessed using the Medical Outcomes Study short form 36 (SF-36; refs. 18, 19). Raw scores from the four psychosocial subscales, Vitality, Social Functioning, Role-Emotional and Mental Health, were used in the present study [a companion article assesses the effect of PA on the physical subscales (20)]. We measured the psychosocial effect of cancer using the Social/Emotional subscale of the Brief Cancer Impact Assessment (21). This subscale (Cronbach's α = 0.75) assesses the effect of cancer on family plans, love life, emotional or psychological needs, social life, and living arrangements. Global QOL was assessed using the widely used (22) Ladder of Life (23), on a 10-point scale from 1 (the worst possible life) to 10 (the best possible life).

Data Analysis. Data were analyzed using Mplus, version 4.21 (24) and SPSS for Windows, version 12. We used a structural equation model (SEM) framework to examine relationships between PA and QOL by race/ethnicity, accounting for relevant demographic and clinical covariates. Analyzing the data with SEM allowed us to reduce the number of comparisons we were modeling because QOL was conceptualized as one ''latent'' variable made up of six measured QOL scales. Latent variables are not directly observed but are inferred from measured variables or scores (e.g., socioeconomic status is inferred from education and income). The benefits of SEM over standard multiple regression modeling are that it can handle complex models estimating effects of multiple independent variables on multiple dependent variables; it tests multiple regressions

among continuous latent variables while accounting for correlations among predictors and outcomes; and it can account for continuous or categorical variables. Estimated associations among variables account for measurement error; the error is estimated and removed, leaving only common variance. A SEM approach maximizes power to detect associations; in this case, it maximized power to determine whether there were significant relationships between PA and QOL after accounting for multiple covariates.

Using SEM, we ran a multiple group multiple-indicator/multiple-cause model to examine whether the relationship between PA and QOL varied based on race/ethnic group (Black, non-Hispanic White, or Hispanic). Standard SEM models that include a race variable can only

determine if QOL is different by racial group and if race is related to PA, but they cannot examine if PA is differentially associated with QOL depending on racial group. Multiple group multiple-indicator/multiple-cause models allow us to determine if PA (or any other covariate in the model) has a differential influence on QOL based on race/ethnicity. With this technique, we were able to evaluate (*a*) if PA has an influence on QOL and (*b*) if that relationship varied based on racial/ethnic group.

To test these, we used a step-by-step nested model design. We compared a fully constrained model (i.e., one that assumes that the structural relationship among PA, its covariates, and the QOL variable are equivalent with respect to racial/ethnic group) to a model that allows the relationships between PA (and

Table 1. Demographics and health indices 2.5 y after breast cancer diagnosis by race/ethnicity

	Black	Non-Hispanic White	Hispanic	P*
		n (%)		
Total	197 (27.0)	448 (61.5)	85 (11.5)	
Age (y), mean ± SD	53.7 ± 7.9	58.9 ± 10.4	58.0 ± 11.4	<0.001
Physical activity level				
Sedentary	52 (26.4)	77 (17.2)	12 (14.3)	0.004
Low active	97 (49.2)	204 (45.5)	38 (45.2)	
Met recommendations	48 (24.4)	167 (37.3)	34 (40.5)	
Site				
Western Washington	1 (0.5)	132 (29.5)	2 (2.4)	<0.001
New Mexico	0 (0.0)	316 (70.5)	82 (97.6)	
Los Angeles	196 (99.5)	0 (0.0)	0 (0.0)	
Education				
High school or less	71 (36.0)	76 (17.0)	36 (42.9)	<0.001
Some college	86 (43.7)	159 (35.5)	30 (35.7)	
College grad	23 (11.7)	107 (23.9)	9 (10.7)	
Grad school	17 (8.6)	106 (23.7)	9 (10.7)	
Marital status				
Married or partnered	82 (41.6)	292 (65.2)	48 (57.1)	<0.001
Single	115 (58.4)	156 (34.8)	36 (42.9)	
Stage				
In situ	41 (20.9)	102 (22.5)	17 (20.0)	0.001
Local	92 (46.9)	272 (59.9)	53 (62.4)	
Regional	63 (32.1)	80 (17.6)	15 (17.6)	
Months since diagnosis				
Mean ± SD	33.4 ± 4.7	29.7 ± 2.6	28.9 ± 2.4	<0.001
Treatment				
Surgery only	71 (36.0)	133 (29.7)	29 (34.5)	<0.001
Radiation	47 (23.9)	191 (42.6)	30 (35.7)	
Chemotherapy	34 (17.3)	31 (6.9)	5 (6.0)	
Radiation + chemotherapy	45 (22.8)	93 (20.8)	20 (23.8)	
Tamoxifen				
No	116 (58.9)	238 (53.1)	46 (54.8)	0.40
Yes	81 (41.1)	210 (46.9)	38 (45.2)	
Body mass index, mean ± SD	31.0 ± 7.3	26.9 ± 5.6	27.6 ± 5.0	<0.001
Smoking status				
Never	95 (48.2)	213 (47.5)	47 (56.0)	0.15
Former	72 (36.5)	189 (42.2)	26 (31.0)	
Current	30 (15.2)	46 (10.3)	11 (13.1)	
Menopausal status				
Premenopausal	36 (18.3)	80 (17.9)	18 (21.4)	0.42
Postmenopausal	146 (74.1)	349 (77.9)	61 (72.6)	
Unknown	15 (7.6)	19 (4.2)	5 (6.0)	
Current antidepressant use				
No	186 (94.4)	364 (81.3)	73 (86.9)	<0.001
Yes	11 (5.6)	84 (18.7)	11 (13.1)	
Comorbidity limitations				
None	140 (71.1)	341 (76.1)	61 (72.6)	0.18
1 condition	34 (17.3)	80 (17.9)	15 (17.9)	
2 or more	23 (11.7)	27 (6.0)	8 (9.5)	

*P value derived from either ANOVA comparing mean values or χ^2 tests comparing distributions of characteristics by race/ethnicity.
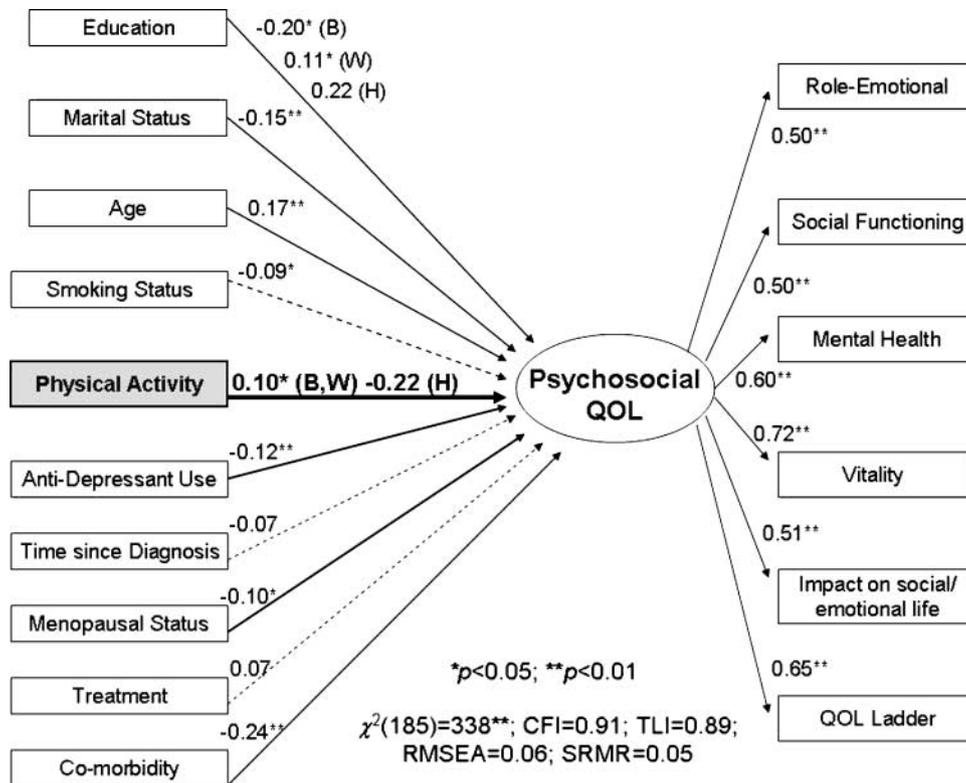
Figure 1. A multigroup multiple-indicator/multiple-cause SEM testing the association between PA and QOL. $\chi^2 = 388.36$; degrees of freedom, 185; $P < 0.001$; comparative fit index = 0.91; Tucker-Lewis index = 0.89; root mean square error of approximation = 0.06; standardized root mean square residual = 0.05. *Solid lines,* represent significant paths; *B,* Black; *W,* non-Hispanic White; *H,* Hispanic. **$P < 0.01$; *$P < 0.05$. Paths (γ coefficients) between observed measures (in rectangles) on the left side and the latent outcome variable (in the oval) show the influence of PA and the covariates on QOL. The paths (λ coefficients) from the latent variable to the observed measures on the right side indicate that QOL is measured by six scales or subscales. When the relationship between PA (or a covariate) and QOL varied by race/ethnicity, path coefficients are provided for each racial/ethnic group.

covariates) and QOL to vary by race/ethnicity. Because these are nested models, we used the χ^2 statistic to evaluate the change in model fit based on freeing up the parameters of interest.

Covariates in the SEM included age, education, marital status, smoking status, time since diagnosis, menopausal status, treatment, comorbidity status, and antidepressant use. Stage of disease and treatment history were both considered, but stage was excluded due to significant collinearity with treatment. A similar decision was made to exclude study site because it was closely associated with race. To develop a more parsimonious model, variables that were not associated with QOL and did not add significantly to the SEM (body mass index and tamoxifen use) were excluded from the final model. Marital status was coded dichotomously (married/partnered relationship versus single/widowed/divorced).

Overall model fit was evaluated using the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR), with recommended criteria for good fit being comparative fit index >0.90, TLI >0.90, RMSEA <0.08, and SRMR <0.08 (25-27). Each goodness of fit index has strengths and weaknesses depending on the data characteristics. The group of indices as a whole was used to determine model fit. After identifying meaningful associations within the larger SEM, we followed up with targeted (post hoc) tests to better describe the effects of PA on individual QOL outcomes. We examined least squares means of each QOL outcome stratified by race/ethnicity. Pairwise comparisons were examined for each outcome adjusting for the same covariates as used in the SEM modeling.

Results

Sample Characteristics. These analyses included 736 women, ages 31 to 88 years (mean, 57 years). Overall, 34% of this sample reported an amount of PA that met public health recommendations, 47% were classified as low active, and 19% were sedentary. Black women were less likely to meet recommended PA levels than all other women, and Hispanic women were more likely to meet recommended levels than non-Hispanic White women. Table 1 presents demographic and health-related indices by race/ethnicity. Compared with Hispanic and non-Hispanic White participants, Black women tended to be younger, heavier, less likely to be married, less likely to have taken tamoxifen, and diagnosed with more advanced disease, and all were recruited from Los Angeles. Hispanic women were less educated, more

likely to meet PA recommendations than non-Hispanic White women, and were recruited primarily from New Mexico. Non-Hispanic White women reported more antidepressant medication use and reported fewer comorbidities that limited their activities.

PA and QOL by Race/Ethnicity. The SEM multiple group multiple-indicator/multiple-cause model depicting the relationship between PA and QOL is illustrated in Fig. 1. Because four of the observed subscales come from one instrument (SF-36), the associated errors were correlated in the SEM but not presented in Fig. 1. Overall model fit was good across the different indices: comparative fit index (0.91), Tucker-Lewis index (0.89), root mean square error of approximation (0.06), and standardized root mean square residual (0.05).

The association between PA and QOL was similar for Black and non-Hispanic White women but statistically different for Hispanic women [$\chi^2(1) = 3.99$, $P < 0.05$] in hierarchically nested models that accounted for the effects of covariates. Higher PA levels for both Black and non-Hispanic White women were positively associated with QOL ($\gamma = 0.10$; $P = 0.03$). Among Hispanic women, a negative but not statistically significant relationship between PA and QOL was observed ($\gamma = -0.22$; $P = 0.08$).

Post hoc Tests of PA and QOL Scales. After performing the omnibus test of PA and the QOL latent factor in the SEM, post hoc tests were used to investigate relationships between PA and each individual QOL outcome stratified by race/ethnicity to describe the effects of PA on specific aspects of QOL. Consistent with the SEM, associations between PA and QOL scales showed similar, positive patterns, with PA levels increased among Black and non-Hispanic White women, whereas for Hispanic women relationships between PA and QOL subscales showed a distinctly different pattern,

appearing flat or negative (see Figs. 2 and 3). Pairwise comparisons of adjusted means are presented in Table 2. Both Black and non-Hispanic White women who met the recommended levels of PA had higher Vitality and Social Functioning scores and higher overall QOL on the Ladder of Life. Higher scores on Emotional Roles were also found for non-Hispanic White women meeting the recommended levels.

Discussion

The aim of this investigation was to determine whether recreational PA 2 years after a breast cancer diagnosis is associated with better QOL in a diverse, population-based cohort. The secondary aim was to evaluate whether these relationships were consistent across racial/ethnic groups. Findings suggest that meeting general public health recommendations for PA is associated with better psychosocial outcomes among Black and non-Hispanic White women, particularly in terms of vitality, social functioning, and global QOL. In contrast, among Hispanic survivors, PA was not associated with better QOL and even seemed to have negative relationships, although associations did not reach statistical significance. Although fewer Black women reported meeting PA recommendations than did non-Hispanic White or Hispanic women (24% compared with 37% and 41%, respectively), those who did meet recommendations reported better QOL than their less physically active counterparts. These findings have important implications, particularly because Black cancer survivors often report worse QOL than other women (10, 11). Results from this study suggest that PA may be a relevant part of supportive care for Black women and may be influential in encouraging Black women to be more active. To our knowledge, this is the first study to examine associations between PA and QOL in a large, multiethnic sample of breast cancer survivors in the
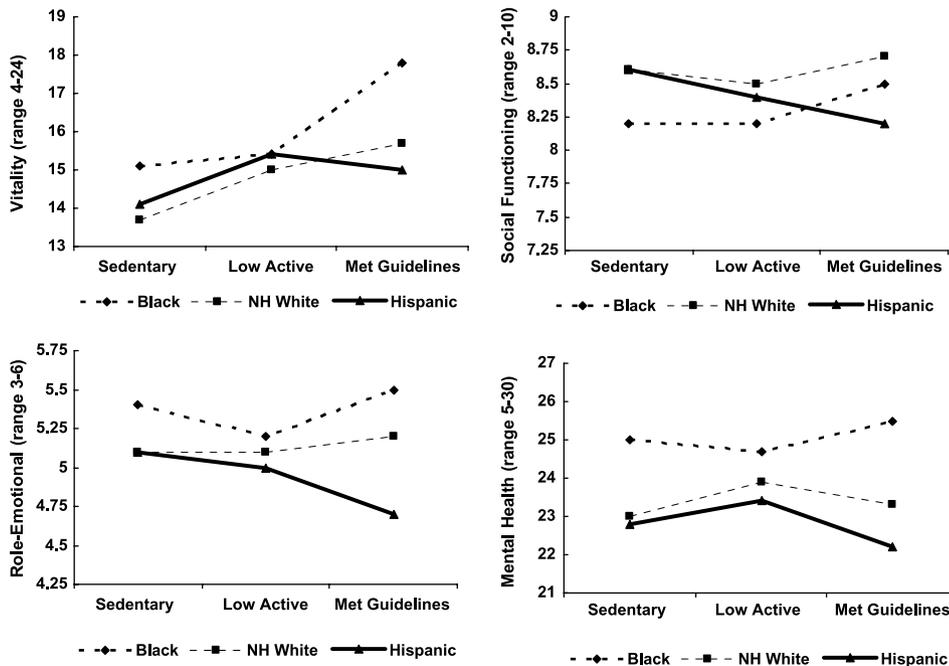

Figure 2. Least squares mean values of SF-36 subscales within PA and race/ethnicity categories.
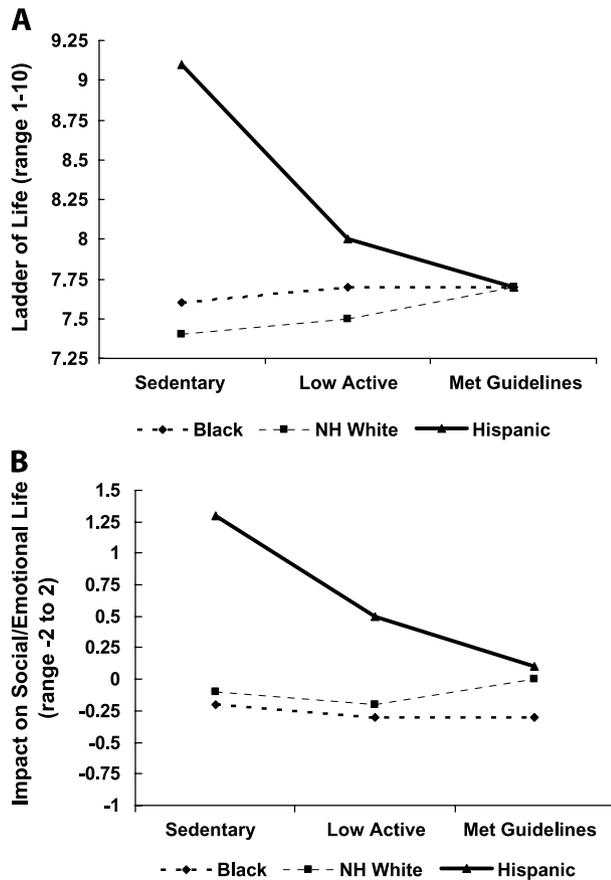
Figure 3. Least squares mean values of Ladder of Life (**A**) and Impact on Social/Emotional Life scales (**B**) within PA and race/ethnicity categories.

United States. Our study provides an important addition to the growing body of literature on PA and QOL in cancer survivors among understudied racial/ethnic groups.

Some clinicians are beginning to include PA as part of supportive care for cancer (28), and ultimately, clinicians need ways to motivate their patients to be physically active. Accruing evidence that meeting public health PA recommendations also improves QOL may provide additional incentive for breast cancer survivors to increase their PA and may be a target in interventions. The majority of women in the HEAL Study did not meet recommended levels of PA 2 years after their diagnosis (15), which is comparable to national survey data on PA in cancer survivors (29, 30). At this time, the currently accepted public health recommendations for PA are being evaluated. Comprehensive federal public health guidelines, ''The Physical Activity Guidelines for Americans,'' will be issued in late 2008 by the Department of Health and Human Services[8] and will include evidence on cancer. The current study adds to the evidence suggesting that getting the equivalent of 30 minutes per day, 5 days per week of moderate to vigorous activity is related to better QOL among Black and White breast cancer survivors. Whereas our data provide some evidence

that meeting PA recommendations is associated with better QOL, further research is needed among Hispanic breast cancer survivors.

Interpreting the results for the Hispanic women in this study is difficult, particularly because there is no other published study of PA and QOL among Hispanic breast cancer survivors for comparison. The effect sizes for the PA and QOL associations (represented by the path coefficient in the SEM and the means of the individual QOL subscales) were larger in magnitude for Hispanics than the associations found for Black and non-Hispanic White women. The lack of statistical significance in our models may be due to sample size. However, this does not explain the direction of the relationships. Previous research among Hispanic prostate cancer survivors suggests that poorer QOL is related, in part, to lower levels of PA (31). Further, national data indicate that Hispanic women are less likely to meet PA recommendations than non-Hispanic White women and that they are more comparable to Black women (32, 33). However, in our sample, compared with non-Hispanic White women, Hispanic women were more likely to meet PA recommendations, whereas Black women reported less activity. The negative association among Hispanic women is also not explained by lower overall QOL. Previously published data from the HEAL Study showed no significant differences in QOL reported by Hispanic compared with non-Hispanic White women after accounting for relevant covariates (34). Additionally, PA was associated with better physical functioning in both Hispanic and non-Hispanic White women (20). One explanation of the ethnic group differences may have to do with cultural expectations and linguistic differences in interpreting the meaning of psychosocial QOL items on self-report measures. Research has shown that acculturation, cultural beliefs, family, and religion are significantly associated with QOL (33, 35, 36) and that there may be cultural bias in health surveys and in perceptions and definitions of QOL (37-39). The standard QOL measures used in this study have not been tested for cultural or linguistic equivalence (40). These methodologic considerations represent important areas for future research.

Whereas several intervention studies have shown positive effects of exercise on QOL, most have shown better physical functioning, with fewer studies investigating psychosocial effects (8, 41, 42). There is some evidence that meeting PA recommendations is associated with better QOL in the general population (43) and in breast cancer and other cancer survivors (44-46); however, PA recommendations have not previously been examined with respect to QOL in an ethnically diverse group of breast cancer survivors. Compared with sedentary individuals, meeting recommendations was associated with better QOL on four of the six dimensions measured in non-Hispanic White participants and on three of six dimensions in Black participants. Activity levels below the recommended amount did not seem to be related to QOL. These results suggest that existing public health PA recommendations are important and meaningful predictors of psychosocial outcomes in Black

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[8] http://www.health.gov/PAguidelines/

Table 2. Individual QOL scores by sports/recreational PA and race/ethnic categories

	n	Met recommendations (≥2.5 h/wk)		Low active (<2.5 h/wk)		Sedentary (0 h/wk)	
		n = 250		n = 344		n = 142	
		Mean (SD)	LSM*	Mean (SD)	LSM*	Mean (SD)	LSM*
SF-36 scale							
Vitality (range, 4-24)							
Black	197	18.0 (4.5)	17.8[a]	15.5 (4.4)	15.4[b]	14.7 (4.9)	15.1[b]
Non-Hispanic White	448	16.0 (4.0)	15.7[a]	14.7 (4.3)	14.9[b]	13.5 (4.0)	13.7[b]
Hispanic	84	14.1 (4.8)	14.0	15.5 (3.6)	15.4	13.3 (4.9)	14.1
Social functioning (range, 2-10)							
Black	197	8.7 (2.0)	8.5[a]	8.3 (2.1)	8.2	7.8 (2.4)	8.2[b]
Non-Hispanic White	448	8.9 (1.5)	8.7[a]	8.5 (1.8)	8.5	8.4 (1.9)	8.6[b]
Hispanic	84	8.3 (2.0)	8.2	8.4 (1.8)	8.4	8.3 (1.9)	8.6
Role-emotional (range, 3-6)							
Black	197	5.5 (1.0)	5.5	5.3 (1.2)	5.2	5.3 (1.1)	5.4
Non-Hispanic White	448	5.3 (0.9)	5.2	5.0 (1.1)	5.1	4.9 (1.1)	5.1
Hispanic	84	4.7 (1.2)	4.7	5.0 (1.2)	5.0	4.9 (1.2)	5.1
Mental health (range, 5-30)							
Black	197	25.6 (4.8)	25.5	24.8 (4.2)	24.7	24.7 (4.4)	25.0
Non-Hispanic White	448	23.7 (4.0)	23.3	23.7 (3.9)	23.9	23.0 (4.6)	23.0
Hispanic	84	22.4 (4.9)	22.1	23.0 (4.2)	23.4	23.2 (5.4)	22.8
QOL ladder (range, 1-10)							
Black	197	7.8 (1.9)	7.7	7.8 (1.9)	7.7	7.8 (1.7)	7.6
Non-Hispanic White	448	7.8 (1.5)	7.7[a]	7.4 (1.8)	7.5	7.3 (2.0)	7.4[b]
Hispanic	84	7.8 (1.6)	7.7[a]	7.9 (1.5)	8.0	9.0 (1.2)	9.1[b]
Effect on social/emotional (range, −2 to 2)							
Black	197	−0.3 (2.4)	−0.3	−0.3 (2.4)	−0.3	−0.4 (2.2)	−0.2
Non-Hispanic White	448	0.0 (3.2)	−0.2	−0.2 (2.8)	−0.1	−0.2 (2.8)	−0.1
Hispanic	84	0.1 (3.5)	0.1[a]	0.6 (2.8)	0.5	1.1 (2.7)	1.3[b]

NOTE: Different superscripts across a row indicate activity groups with statistically significant differences in means; $P < 0.05$.

Abbreviation: LSM, least squares means.

*Least squares means are adjusted for age, education, marital status, smoking status, menopausal status, time since diagnosis, breast cancer treatment, comorbidity status, and antidepressant use.

and White breast cancer survivors. However, because Hispanic women did not report better QOL related to their PA levels, it is possible that messages and interventions will need to be structured differently for Hispanic women.

The current investigation had several strengths and limitations. A major strength was the diverse sample and the use of latent variable modeling. Using a SEM approach, we were able to maximize statistical power without increasing the type I error associated with multiple comparisons generated from multiple regression model runs. Further, our model accounted for several covariates, showing that PA is related to QOL over and above the effects of sociodemographic, treatment, and behavioral variables as well as the effects of other medical conditions. With few exceptions (e.g., ref. 47), research on PA and QOL in cancer survivors has not accounted for measures of health-related comorbidities. Of the variables examined in the present study, comorbidity had the strongest association with QOL, suggesting that it should be included in any investigation of PA and QOL.

A limitation of this study is the uneven distribution of race/ethnicity across the study sites; all participants from the Los Angeles site were Black and the majority of Hispanic participants were recruited from New Mexico. Another limitation is that the observational cohort design did not allow us to conclusively determine the direction of the PA and QOL relationships. Because we do not have longitudinal assessments of PA and QOL from diagnosis onward, it is possible that those with better QOL were more likely to engage in PA. However, for most women in the sample, PA was assessed before the QOL assessment, suggesting that PA 2 to 3 years after breast cancer diagnosis is associated with better subsequent QOL.

In conclusion, our results highlight the importance of examining racial/ethnic effects on PA and QOL separately and in combination in future studies. Whereas the number of exercise trials being conducted among cancer survivors is increasing (41), most are focused on White women and they may not generalize to all women. When providing supportive care to cancer patients, it is important to recognize that not all participants may positively respond to PA and tailored interventions may be warranted. Further investigation is needed to elucidate possible QOL differences among different Hispanic populations and to understand the role of cultural expectations and linguistic interpretation of outcome measures. Further study is also needed of Asian and other ethnic minority groups for which research on PA and QOL is also lacking. Ultimately, it is important for clinicians and policy makers to know if public health PA recommendations are useful for interventions to improve QOL for all cancer survivors. Future randomized trials are needed to examine these effects prospectively and to better understand the influence of race/ethnicity and culture on these relationships. The knowledge gained from such studies will help in designing and evaluating culturally sensitive interventions to improve QOL among all breast cancer survivors.

Disclosure of Potential Conflicts of Interest

Acknowledgments

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