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## Correlates of quality of life in overweight or obese breast cancer survivors at enrollment into a weight loss trial

Bilg  Pakiz<sup>1,\*</sup>, Patricia A. Ganz<sup>2</sup>, Rebecca L. Sedjo<sup>3</sup>, Shirley W. Flatt<sup>1</sup>, Wendy Demark-Wahnefried<sup>4</sup>, Jingxia Liu<sup>5</sup>, Kathleen Y. Wolin<sup>6</sup>, and Cheryl L. Rock<sup>1</sup>

<sup>1</sup> Department of Family and Preventive Medicine, and UC San Diego Moores Cancer Center, University of California, San Diego, La Jolla, California, USA

<sup>2</sup> School of Medicine, and Jonsson Comprehensive Cancer Center, University of California, Los Angeles, California, USA

<sup>3</sup> Department of Community and Behavioral Health, Colorado School of Public Health, University of Colorado Denver, Aurora, Colorado, USA

<sup>4</sup> Department of Nutritional Sciences, and University of Alabama at Birmingham Comprehensive Cancer Center, Birmingham, Alabama, USA

<sup>5</sup> Division of Biostatistics, Washington University School of Medicine, St. Louis, Missouri, USA

<sup>6</sup> Department of Surgery, Loyola University Chicago Stritch School of Medicine, Maywood, Illinois, USA

### Abstract

**Objective**—To examine the correlates of the physical and psychosocial domains of quality of life (QOL) in a cohort of breast cancer survivors participating in a weight loss intervention trial. Available data included information on weight and physical activity, as well as demographic and medical characteristics.

**Methods**—Correlates of QOL and psychosocial functioning were examined in 692 overweight/obese breast cancer survivors at entry into a weight loss trial. QOL was explored with three measures: Short-form 36 (SF-36); Impact of Cancer Scale (IOCv2); and the Breast Cancer Prevention Trial (BCPT) Symptom Scales. Bivariate and multivariate analyses were used to identify correlates and associations adjusted for other characteristics.

**Results**—In multivariate analysis, younger age was associated with higher negative impact scores ( $p < 0.01$ ). Hispanic, African-American and Asian women had higher IOC positive impact scores compared to white non-Hispanic women ( $p < 0.01$ ). Higher education was associated with lower scores on mental QOL and the IOC positive impact scale ( $p < 0.01$ ). BMI was not independently associated with QOL measures. Physical activity was directly associated with

\* Correspondence to: Bilge Pakiz, EdD, UC San Diego Moores Cancer Center, 3855 Health Sciences Dr., Office 3076, La Jolla, California, USA 92093-0901; Telephone: 858-822-6160; Fax 858-822-6166; bpakiz@ucsd.edu.

Conflict of Interest

The authors declare that they have no conflicts of interest.

physical and mental QOL and IOC positive impact, and inversely related to IOC negative impact and BCPT symptom scales.

**Conclusions**—QOL measures in breast cancer survivors are differentially associated with demographic and other characteristics. When adjusted for these characteristics, degree of adiposity among overweight/obese women does not appear to be independently associated with QOL. Among overweight/obese breast cancer survivors, higher level of physical activity is associated with higher QOL across various scales and dimensions.

### Keywords

breast cancer; quality of life; overweight; physical activity; oncology psychological measures

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### Introduction

Breast cancer diagnosis and treatment is associated with adverse health effects in physical and psychosocial domains, and thus, can have a negative impact on quality of life (QOL) [1]. Although most symptoms show improvement over time [2], some may be long-term, lasting for up to 10 years after surgery and completion of treatment [3]. Among psychosocial correlates, depression and anxiety are often associated with poorer QOL either as indicators [4] or determinants. Sleep problems and fatigue have also been identified as being associated with poorer QOL [5], as well as weight gain after treatment [6], and often these symptoms are interrelated [7].

In a systematic review, Chopra and Kamal [8] concluded that age, ethnicity, and type of treatment influence different aspects of QOL. Similarly, differential effects of treatment on QOL have been noted for race/ethnicity, and age [9-12]. Based on a comprehensive literature review, Yanez et al. [13] concluded that Latina survivors experience worse QOL than non-Latina whites, but White et al. [14] caution that racial differences may be better explained by the variance in levels of engagement in healthy behaviors. Concerns and adverse effects may be particularly notable for younger survivors who report more adverse psychosocial and health outcomes [3, 15]. Premature menopause is thought to exacerbate the effects of treatment among these younger women [16]. Obesity and weight gain, as indicated by high body mass index (BMI), has been associated with worse QOL among breast cancer survivors [15, 17]. Post-diagnosis physical activity has been identified as a protective factor that may mitigate common side effects such as fatigue and weight gain [18] and improve overall QOL [19]. In a large randomized clinical trial of breast cancer survivors, participants who exercised at least 150 minutes/week of moderate-paced walking reported significantly higher levels of QOL independent of race/ethnicity [11].

The purpose of this analysis was to examine the correlates of QOL and psychosocial functioning in overweight or obese breast cancer survivors using data collected upon entry into a weight loss intervention trial. Different aspects of QOL were explored with three measures: the Short-form 36 (SF-36) [20] as a general measure of physical and mental QOL; Impact of Cancer Scale (IOCv2) to assess QOL and both positive and negative aspects of cancer survivorship [10]; and the Breast Cancer Prevention Trial (BCPT) Symptom Scales to evaluate side effects of treatment [21]. Differential associations between QOL and

sociodemographic characteristics (age, BMI, race/ethnicity, education), medical factors (cancer stage and treatment, time since diagnosis, hospitalizations, co-morbidities and medications), as well as physical activity and psychosocial correlates (depressive symptoms) were explored in this analysis.

## Methods

### Participants and study procedures

A total of 692 overweight or obese breast cancer survivors were enrolled into a randomized controlled trial of a weight loss intervention, the Exercise to Enhance Recovery and Good Health for You (ENERGY) trial, at four sites (San Diego, CA; Denver, CO; St. Louis, MO; and Birmingham, AL). Inclusion criteria were: age  $\geq$  21 years; a history of breast cancer (stages I [  $\geq$  1 cm], II, or III) diagnosed within the previous five years; completion of initial therapies not including endocrine therapy; BMI 25-45 kg/m<sup>2</sup>; and ability to comply with study procedures. Exclusion criteria included: history of malignancies other than initial breast cancer with the exception of non-melanoma skin cancer, serious psychiatric illness, and any medical condition substantially limiting moderate physical activity, such as severe orthopedic conditions. The study was reviewed and approved by the Institutional Review Boards of all sites, and participants provided written informed consent. A detailed description of the study procedures and intervention has been published previously [22].

## Measures

### Demographic and other characteristics

Data included self-reported age, race/ethnicity, education level, marital status, menopausal status, medical history (including co-morbidities), and current medications. Anthropometric measurements (height, weight) were conducted by trained study staff using standard procedures and were used to calculate BMI [23]. Medical record review was conducted to obtain information on breast cancer diagnosis including stage and date of diagnosis and treatment and to verify eligibility.

Physical activity was measured using the modified Godin Leisure-Time Exercise Questionnaire (GLTEQ) which has been validated previously in cancer research [24]. The modified GLTEQ consists of three questions regarding the frequency and duration of mild, moderate, and strenuous exercise performed during free time in a typical week. Risk for depression was measured with the Center for Epidemiologic Studies Depression Scale (CES-D). The CES-D is comprised of 20 items and assesses risk for depression in the general population [21]. Measures of internal consistency are high in the general population (0.85) and in psychiatric samples (0.90). Test-retest correlations are reported to be in the moderate range (0.45-0.70). Validity has been established with other self-report measures, correlations with clinical ratings of depression, and by construct validity [25]. It has also been used in other studies of cancer survivors [26]. We developed a questionnaire modeled after the Self-Administered Co-morbidity Questionnaire [27], to collect self-reported information on co-morbidities that were ever seen by a health provider, or required hospitalization or an emergency room visit within the last year, the current medications being taken for these co-morbidities, and those that limited daily activities.

## Psychosocial QOL measures

The SF-36 is a multi-purpose, brief health survey, which is used as a general measure of physical and mental QOL [20, 28]. It is comprised of an 8-scale profile of functional health and well-being scores as well as psychometrically-based physical and mental health summary measures. There is considerable evidence for the reliability of the SF-36 (Cronbach's  $\alpha > 0.85$ , reliability coefficient  $> 0.75$ ) [28, 29]. It has been used extensively with breast cancer survivors [5, 6, 26].

The BCPT Symptom Scales have been used to measure concurrent and late side effects of medical interventions to prevent and treat breast cancer [21]. Factor analysis with this instrument [21] has revealed eight symptom clusters corresponding to physical symptoms associated with cancer treatment, chemoprevention, menopause, and normal aging: hot flashes, nausea, bladder control, vaginal problems, musculoskeletal pain, cognitive problems, weight problems, and arm problems.

The IOC has been used to measure the impact of cancer on aspects of QOL [10]. Analysis of this instrument in breast cancer survivors has yielded a factor structure relating IOC items to psychosocial impact domains that exhibited high factor loadings (factor-item correlations of 0.59-0.94) and high internal consistency (Cronbach's  $\alpha = 0.76-0.89$ ). The scales consist of a Positive Impact Summary Scale with four subscales (altruism and empathy, health awareness, meaning of cancer, and positive self-evaluation), a Negative Impact Summary Scale with four subscales (appearance concerns, body change concerns, life interferences, and worry), and subscales for Employment and Relationship Concerns.

## Statistical analysis

Number of reported co-morbidities (e.g., heart disease, high blood pressure, lung disease, diabetes, ulcer or stomach disease, kidney disease, liver disease, anemia, depression, osteoarthritis, back pain, rheumatoid arthritis, or other) were summed. Current prescription medications were summed over acid reflux, allergy, anxiety, arthritis, asthma, cholesterol, hormone, depression, diabetes, heart, hypertension, osteoporosis, pain, insomnia, and thyroid, and excluded any drugs for breast cancer treatment. Hospitalizations and emergency room visits in the previous year were summed.

For the five overall QOL outcome measures (summary scores for physical and mental QOL, IOC positive and negative impact scales, and mean severity averaged across all 18 symptoms on the BCPT questionnaire) bivariate analysis was used to examine associations with demographic, medical, and other factors. Continuous variables (age, years since cancer diagnosis, number of hospitalizations or emergency room visits, co-morbidities, number of prescription medications, BMI, weekly hours of moderate/vigorous activity, and CES-D score) were modeled in continuous ANOVA. Categorical variables (race/ethnicity, education, marital status, cancer stage, chemotherapy and endocrine therapy) were compared using categorical ANOVA where the first category was the referent. Implementing a conservative strategy, we used a significance level of  $\alpha = 0.01$  for the bivariate models, and  $p = 0.05$  in the multivariate model, without further adjustment for multiple comparisons. All tests were two-sided.

Multivariate models for four of the main outcomes (physical and mental QOL and IOC positive and negative impact scale) used regression models to examine relationships between all predictors jointly and outcomes. The multivariate analyses included all variables that were significant in any of the bivariate analyses, as well as the 8 BCPT symptom clusters. Dependent variables were log transformed to reduce skew in their distributions.

We also evaluated the four subscales each from the IOC Positive and Negative Impact Scales separately. We set significance at  $p < 0.01$  for the subscale analyses. Analyses were conducted using SAS version 9.3 (Cary, NC).

## Results

### Study sample

Participants were 692 overweight or obese breast cancer survivors with a mean (SD) age of 56 (9) years at enrollment. The majority of the sample was non-Hispanic white, and BMI at study entry was 31.4 (4.7) kg/m<sup>2</sup>. On average, time since diagnosis was 2.7 years (range 0.1-5.8 years). A majority of the women had been diagnosed with stage II cancer (52%), and 30% and 18% had stage I and stage III cancer, respectively.

### Bivariate associations

Responses on the QOL measures were differentially distributed across categories of demographic characteristics, as shown in Table 1. QOL measures differed across age, BMI, race/ethnicity, education and marital status categories. Compared to white, non-Hispanic participants, Hispanic, African-American and Asian participants all reported higher scores on the IOC positive impact scale ( $p < 0.01$ ). Menopausal status was not associated significantly with any of the QOL outcomes (data not shown).

Responses on the QOL measures also were differentially distributed across categories of medical and cancer-related factors, as shown in Table 2. Physical and mental QOL appear to be better with greater time since diagnosis, as participants with longer time since diagnosis had higher scores in these domains ( $p < 0.01$ ). Hospitalization or an emergency room visit in the past year, as well as having more co-morbidities, was associated with lower physical and mental QOL scores ( $p < 0.01$ ).

Differential responses on the QOL measures across physical activity and CES-D score categories are shown in Table 3. Being moderately active, as is recommended for weight management [30], was associated with better scores on the physical and mental QOL scales ( $p < 0.01$ ), and a dose-response effect was observed. Higher level of physical activity was associated with lower scores on the IOC negative impact scale ( $p < 0.01$ ) and with lower scores on the BCPT symptoms scales ( $p < 0.01$ ). The reverse was true for those who had higher scores (  $\geq 16$ ) on the CES-D. Those at higher risk for depression had lower scores on physical and mental QOL and higher scores on the BCPT symptom scales ( $p < 0.01$ ).

### Multivariate analysis

Table 4 shows the significant associations when adjusted for other influencing variables in the multivariate models. Younger age was associated with higher IOC negative impact scale

( $p < 0.01$ ). As was evident in the bivariate analysis, Hispanic, African-American and Asian women had higher scores on the IOC positive impact scale compared to white, non-Hispanic women, and African-American women scored lower on the IOC negative impact scale ( $p < 0.01$ ). Higher education was associated with lower scores on mental QOL and the IOC positive impact scale ( $p < 0.01$ ). Hospitalizations, emergency room visits, number of comorbidities, number of prescription medications, and several BCPT symptom clusters were associated with lower physical QOL ( $p < 0.01$ ), when adjusted for other variables.

BMI was not independently associated with any of the QOL measures in the multivariate models. Level of physical activity was associated with physical and mental QOL. Women with higher levels of depressive symptoms on the CES-D had significantly lower physical QOL, lower IOC positive impact and higher negative impact scores ( $p < 0.001$  for all).

As shown in Table 4, the BCPT symptom cluster for nausea was inversely associated with both physical and mental QOL ( $p < 0.01$ ). The BCPT cluster for bladder control was inversely associated with mental QOL, and the musculoskeletal pain cluster was inversely associated with physical QOL. Cognitive problems were inversely associated with mental QOL, and directly associated with both IOC positive and negative impact scores. The BCPT symptom cluster for weight problems was inversely associated with mental QOL and directly associated with the IOC negative impact scores ( $p < 0.001$ ). The BCPT arm problems cluster was inversely associated with physical QOL scores, meaning lower severity of arm problems was associated with better physical QOL scores, and directly associated with the IOC negative impact scale. Two of the symptom clusters (hot flashes and vaginal problems) were not significantly associated with any of the QOL outcomes.

Associations with the subscales of the IOC negative and positive impact score also were examined (data not shown), and cancer stage and number of prescription medications were directly associated with scores for each negative impact subscale ( $p < 0.01$ ). In contrast, age and African-American ethnicity were inversely associated with every subscale score. Age was inversely associated with altruism and meaning of cancer subscale scores. African-American, Asian and Hispanic race/ethnicity were all directly associated with health awareness and positive self-concerns subscales. In addition, being African-American was associated with greater meaning of cancer, while being Asian was associated with altruism. Chemotherapy was directly associated with scores for all four IOC positive impact subscales ( $p < 0.01$  for all).

## Discussion

We found that various dimensions and measures of QOL in breast cancer survivors are differentially associated with demographic and medical characteristics. After adjusting for these characteristics, contrary to our hypotheses, adiposity had no relationship to any of the QOL outcomes in the multivariable models, although BMI was inversely associated with physical (but not mental) QOL when unadjusted for other influencing variables. However, we found that among overweight or obese breast cancer survivors, higher level of physical activity correlates with higher mental and physical QOL and does so in a dose-dependent manner.



This analysis presents a multifaceted approach to examining QOL in a large and geographically-diverse sample of overweight or obese breast cancer survivors. By utilizing several different measurement constructs, this study provides a global examination of the psychosocial and physical QOL associations in this target population. In addition to the large sample, the diversity of the sample also allowed analysis of findings for various subgroups, such as older versus younger survivors or those with different racial/ethnicity and cancer characteristics.

Overall, the variables that impact QOL and the scores obtained in the current study is fairly similar to those reported in other studies with breast cancer survivors. Using the SF-36, Bowen et al. [9] concluded that participants in the HEAL study were doing relatively well two years after diagnosis, even though some racial/ethnic and socioeconomic differences were identified as important determinants of QOL. Similarly, utilizing the BCPT Symptom Scale, Ganz et al. [1] noted that even though overall functioning improved after breast cancer treatment, those who received chemotherapy reported more severe physical symptoms such as vaginal and weight problems.

In this study, age at diagnosis, non-white race/ethnicity (Hispanic, African-American or Asian), and education level, were identified as independently associated with QOL in breast cancer survivors. Although younger participants noted some positive outcomes from their experience on the IOC measure (i.e., becoming more health aware, valuing their relationships more), our results suggest that their overall outlook on body changes was more negative, and they reported more health-related worries and treatment-related symptoms. This observation held true in IOC subscale analysis as well. In another sample of breast cancer survivors, Crespi et al. [11] also found younger women to have somewhat higher scores on both positive and negative IOC scores, and results from previous studies indicate that survivors <50 years of age report concerns about premature menopause and infertility, physiologic symptoms such as night sweats and hot flashes, weight gain, and adverse psychosocial outcomes, such as depressive symptoms [15, 16]. Future studies that focus on identifying effective strategies to improve QOL in this vulnerable group of survivors are clearly warranted.

Racial/ethnic minority participants reported higher IOC positive and negative impact scores which may indicate willingness to see cancer as a positive life challenge, such as having more health awareness and positive self-concerns as identified by IOC subscale analysis. Other studies have noted greater meaning and personal growth among African-American breast cancer survivors [31, 32], and better QOL. Different levels of QOL for survivors with diverse racial and ethnic backgrounds have been identified in prior studies [13].

The association between lower BMI and better physical QOL in the bivariate analysis did not remain significant in the multivariate model, perhaps because at enrollment in this study, none of the participants was in the healthy weight range. In another sample of breast cancer survivors, higher BMI was associated with higher IOC negative impact and subscales [11], but that observation was not adjusted for other influencing factors as in the present study. There is evidence in the literature that maintaining a healthy weight is an independent factor for better prognosis of breast cancer [33, 34], as well as for better overall physical

functioning and management of treatment side effects such as sleep and mood problems [6]. However, results of this analysis suggest that in overweight or obese women, co-morbidities and other factors are crucial determinants of QOL.

Notably, increased time from diagnosis was associated with improved QOL in our sample. Similarly, Ashing-Giwa and Lim [35] found that more time since diagnosis, lower cancer stage and having fewer co-morbidities were related to better mental and physical QOL in a diverse group of breast cancer survivors. Ganz et al. [1] found that even though physical and social functioning improves after treatment, physical symptoms persist for those who have received chemotherapy for up to a year. Similarly, in the current study, participants indicated experiencing lower mental and physical QOL in association with a myriad of symptoms such as nausea, bladder control issues, and musculoskeletal and arm problems. That these factors are contributing to lower mental and physical QOL is an important finding, and attention to symptom control could be important for improving QOL outcomes.

Multivariate models in this study revealed that more physical activity in these overweight or obese women was related to better overall QOL, having a more positive outlook on life, as well as having fewer health-related worries and treatment-related symptoms. In fact, our observations suggest that any amount of exercise is better than none. In contrast, higher depressive symptomatology scores were associated with lower physical QOL scores, as well as lower positive impact and higher negative impact IOC scores, as previously observed in this target population [11]. Although this analysis uses cross-sectional data that cannot imply causality, previous interventions have shown that exercise has positive impact on overall QOL [36] and also depressive symptoms [37, 38] and fatigue [39]. Regular physical activity after breast cancer diagnosis and treatment also may mitigate common side effects of adjuvant therapy, such as weight gain and fatigue [36], depression, reduced quality of life, as well as decreased muscular strength [40].

Results of this study present important evidence of symptom burden following treatment in overweight breast cancer survivors. However, this study also has limitations. Even though the large sample size allowed for subgroup analysis, the study sample was nonetheless largely homogeneous and may not be entirely representative of the general population of breast cancer survivors. Thus, it is important to examine these constructs in an even more diverse sample of breast cancer survivors, particularly among those across a range of BMI. Indeed, all of these women were overweight or obese, which may explain why we did not find higher BMI to be independently associated with the QOL measures. Additionally, we have not addressed all potential confounding influences, such as income [35]. Finally, the relationship between depression and QOL is not straightforward. Future research is needed to examine this complex association in cancer survivors to determine if depression is an indicator or determinant of QOL. These baseline findings set the stage for the longitudinal evaluation of QOL outcomes in this study sample. In future analyses we can examine whether increased physical activity and weight loss have a positive impact on QOL and improve long term functionality in this group of overweight or obese breast cancer survivors.



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**Table 1**

Quality of life (QOL) measures within demographic and anthropometric categories (N = 692)<sup>a</sup>

	N	QOL Physical	QOL Mental	IOC Positive Impact Scale	IOC Negative Impact Scale	BCPT Symptom Scales
<b>Age at enrollment (yrs)</b>						
<50	173	70.4 (19.5)	73.4 (19.2)	3.9 (0.5)*	2.9 (0.8)*	2.1 (0.6)*
50-64	372	71.8 (18.4)	76.0 (18.0)	3.8 (0.6)*	2.7 (0.7)*	2.1 (0.5)*
65	147	67.7 (17.8)	77.2 (16.4)	3.7 (0.5)*	2.4 (0.7)*	1.9 (0.5)*
<b>Body mass index (kg/m<sup>2</sup>)</b>						
25-29.99	285	72.3 (17.9)*	75.9 (17.9)	3.8 (0.6)	2.7 (0.7)	2.0 (0.5)
30-34.99	243	70.5 (18.8)*	74.7 (18.5)	3.8 (0.6)	2.6 (0.7)	2.0 (0.5)
35-45	164	67.6 (19.2)*	76.3 (17.5)	3.8 (0.6)	2.6 (0.7)	2.1 (0.6)
<b>Race/ethnicity</b>						
White, non-Hispanic	547	70.8 (17.7)	75.9 (17.3)	3.8 (0.5)	2.7 (0.7)	2.0 (0.5)
Hispanic	46	68.9 (19.2)	70.3 (21.5)	4.0 (0.5)*	2.8 (0.7)	2.1 (0.6)
African-American	71	67.9 (24.3)	75.2 (21.1)	4.0 (0.6)*	2.5 (0.8)	2.2 (0.6)
Asian	11	76.8 (13.9)	82.1 (11.5)	4.3 (0.3)*	2.8 (0.6)	1.7 (0.3)
Mixed/other	15	74.1 (18.4)	76.3 (17.7)	3.9 (0.6)	2.7 (0.7)	1.9 (0.4)
<b>Education</b>						
Not a college graduate	282	70.6 (18.5)	76.0 (17.5)	3.9 (0.5)*	2.6 (0.7)	2.1 (0.5)
College graduate	410	70.5 (18.7)	75.3 (18.3)	3.7 (0.6)*	2.7 (0.7)	2.0 (0.6)
<b>Marital status</b>						
Married/partnered	463	72.0 (17.7)	77.1 (17.5)	3.8 (0.6)	2.7 (0.7)	2.1 (0.5)
Single/separated/divorced	185	66.9 (21.0)*	71.8 (21.2)*	3.8 (0.6)	2.7 (0.8)	2.0 (0.6)
Widowed/other	44	70.3 (15.6)	75.5 (16.4)	3.8 (0.6)	2.5 (0.6)	1.9 (0.4)

<sup>a</sup> Values shown are mean (SD).

\*  $p < 0.01$ ; continuous variables (age and BMI) were modeled in continuous ANOVA, and categorical variables were compared using categorical ANOVA where the first category was the referent.

**Table 2**

Quality of life (QOL) measures within medical and cancer-related categories (N = 692)<sup>a</sup>

	N	QOL Physical	QOL Mental	IOC Positive Impact Scale	IOC Negative Impact Scale	BCPT Symptom Scales
Time since diagnosis						
<1 year	76	66.1 (21.1)*	70.5 (21.2)*	3.9 (0.6)	2.7 (0.7)	2.1 (0.6)
1-2.9 years	325	69.5 (18.9)*	75.0 (17.6)*	3.8 (0.6)	2.7 (0.7)	2.1 (0.5)
3 years	291	72.9 (17.2)*	77.5 (17.2)*	3.8 (0.6)	2.6 (0.7)	2.0 (0.6)
Cancer stage						
I	210	73.3 (17.5)	77.2 (17.6)	3.7 (0.6)	2.5 (0.7)	2.0 (0.5)
II	358	70.7 (18.8)	75.4 (18.0)	3.8 (0.6)*	3.0 (0.7)*	2.1 (0.6)
III	124	65.4 (18.8)*	73.3 (18.4)	3.9 (0.5)	2.9 (0.7)*	2.1 (0.5)*
Chemotherapy						
No	165	73.5 (17.5)	76.6 (18.3)	3.6 (0.6)	2.5 (0.7)	1.9 (0.5)
Yes	527	69.6 (18.8)	75.3 (17.9)	3.9 (0.5)*	2.7 (0.7)*	2.1 (0.6)*
Endocrine therapy						
None	179	69.0 (19.6)	74.2 (19.3)	3.8(0.6)	2.8 (0.8)	2.0 (0.5)
Anti-estrogen only	147	71.5 (20.4)	75.4 (17.5)	3.9 (0.5)	2.7 (0.7)	2.1 (0.6)
Aromatase inhibitor	366	70.9 (17.3)	76.3 (17.5)	3.8 (0.6)	2.6 (0.7)	2.1 (0.6)
Hospitalizations in the last year						
None	518	72.5 (18.1)	76.3 (17.8)	3.8 (0.6)	2.6 (0.7)	2.0 (0.5)
Any	174	64.6 (19.0)*	73.3 (18.5)*	3.9 (0.5)	2.8 (0.7)*	2.1 (0.6)
Emergency room visits in the last year						
None	586	72.2 (17.5)	76.7 (17.4)	3.8 (0.6)	2.6 (0.7)	2.0 (0.5)
Any	106	61.2 (21.6)*	69.4 (20.0)*	3.9 (0.5)	2.9 (0.8)*	2.2 (0.5)*
Co-morbidities <sup>b</sup>						
None	253	75.7 (16.2)*	78.2 (16.0)*	3.9 (0.5)	2.6 (0.7)	2.0 (0.6)*
1	240	70.5 (18.2)*	76.2 (17.3)*	3.7 (0.6)	2.7 (0.7)	2.0 (0.5)*
2	119	67.5 (18.4)*	74.0 (18.6)*	3.8 (0.6)	2.6 (0.7)	2.9 (0.5)*
3 or more	80	59.0 (21.1)*	67.7 (22.2)*	3.8 (0.6)	2.7 (0.8)	2.2 (0.6)*
Number of prescription medications <sup>c</sup>						
0-1	279	75.4 (17.4)*	78.6 (16.6)*	3.8 (0.6)	2.6 (0.7)*	2.0 (0.5)*

	N	QOL Physical	QOL Mental	IOC Positive Impact Scale	IOC Negative Impact Scale	BCPT Symptom Scales
2-4	329	69.3 (17.5)*	74.6 (17.9)*	3.8 (0.6)	2.7 (0.7)*	2.1 (0.6)*
5 or more	84	59.4 (21.1)*	69.5 (20.8)*	3.7 (0.6)	2.8 (0.8)*	2.2 (0.6)*

\*\* $p < 0.01$ , continuous variables were modeled in continuous ANOVA, and categorical variables (cancer stage, chemotherapy, and endocrine therapy) were compared using categorical ANOVA where the first category was the referent.

<sup>a</sup> Values shown are mean (SD).

<sup>b</sup> Co-morbidities assessed are current treatment for heart disease, high blood pressure, lung disease, diabetes, ulcer or stomach disease, kidney disease, liver disease, anemia, cancer other than breast, depression, osteoarthritis, back pain, rheumatoid arthritis.

<sup>c</sup> Prescription medication counts exclude drugs for breast cancer treatment.



Quality of life (QOL) measures within strata of behavioral and psychosocial covariates (N = 692)<sup>a</sup>

**Table 3**

	N	QOL Physical	QOL Mental	IOC Positive Impact Scale	IOC Negative Impact Scale	BCPT Symptom Scales
Moderate/vigorous activity, hrs/wk						
None	284	65.9 (19.6)*	72.3 (19.0)*	3.8 (0.6)	2.7 (0.7)*	2.1 (0.5)*
0.1-0.9	70	69.0 (18.8)*	73.8 (17.0)*	3.8 (0.5)	2.9 (0.7)*	2.1 (0.6)*
1-2.9	208	73.6 (16.6)*	77.1 (16.7)*	3.8 (0.6)	2.6 (0.7)*	2.0 (0.5)*
3 or more	130	76.6 (16.8)*	81.3 (16.8)*	3.9 (0.6)	2.6 (0.7)*	1.9 (0.6)*
CES-D score						
Not depressed (0-15)	555	73.9 (16.6)*	81.0 (12.6)*	3.8 (0.6)	2.5 (0.6)*	1.9 (0.5)*
At risk for depression ( 16)	137	57.1 (20.1)*	53.7 (19.8)*	3.8 (0.6)	3.3 (0.8)*	2.5 (0.5)*

<sup>a</sup>Values shown are mean (SD).

\*  $p < 0.01$ .

**Table 4**

Multivariate models for quality of life (QOL) measures in overweight/obese breast cancer survivors (N = 692)<sup>a</sup>

	QOL Physical R <sup>2</sup> =0.47		QOL Mental R <sup>2</sup> =0.33		IOC Positive Impact Scale R <sup>2</sup> =0.14		IOC Negative Impact Scale R <sup>2</sup> =0.40	
	β Coefficient	P Value	β Coefficient	P Value	β Coefficient	P Value	β Coefficient	P Value
Age	-	-	-	-	-	-	-.012	<.0001
Race/ethnicity								
African-American	-	-	-	-	.225	.002	-.366	<.0001
Asian	-	-	-	-	.542	.001	-	-
Hispanic	-	-	-	-	.203	.02	-	-
Education	-	-	-.045	.05	-.159	.0002	-	-
Not married	-	-	-.098	.0003	-	-	-	-
Time since diagnosis	.001	.04	-	-	-	-	-	-
Cancer stage	-	-	-	-	-	-	.257	.0007
Chemotherapy	-	-	-	-	.233	<.0001	-	-
Hospitalizations in last year	-.052	.001	-	-	-	-	-	-
Emergency room visits in last year	-.088	.001	-	-	-	-	-	-
No. of prescription medications	-.022	.001	-	-	-	-	.032	.05
Moderate/vigorous activity	.011	.01	.013	.01	-	-	-	-
CES-D Score <sup>*</sup>	-.008	<.0001	x	x	-.013	.0005	.031	<.0001
BCPT symptom clusters <sup>***</sup>								
Nausea	-.075	.003	-.073	.02	-	-	-	-
Bladder control	-	-	-.032	.03	-	-	-	-
Musculoskeletal pain	-.115	<.001	-	-	-	-	-	-
Cognitive problems	-	-	-.127	<.0001	.081	.004	.069	.02
Weight problems	-	-	-.041	.0007	-	-	.115	<.0001
Arm problems	-.035	.01	-	-	-	-	.082	.01

<sup>a</sup> Values shown are β coefficients and P values for significant associations with each of the four outcomes, when controlled for all variables tabulated. A dash (-) indicates nonsignificant terms in the models. Quality of life outcomes were log transformed. No significant associations were identified for BMI, number of co-morbidities, or endocrine therapy with any of the QOL outcomes.

\* CES-D score was omitted as a predictor for *QOL Mental* because of high correlation between the two (rho = -0.72).

\*\* BCPT symptom clusters for hot flashes and vaginal problems were not associated with any QOL indicators.

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