

Randomized Controlled Trial of Yoga Among a Multiethnic Sample of Breast Cancer Patients: Effects on Quality of Life

Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Melanie S. Harris, Sapana R. Patel, Charles B. Hall, and Joseph A. Sparano

ABSTRACT

Purpose

This study examines the impact of yoga, including physical poses, breathing, and meditation exercises, on quality of life (QOL), fatigue, distressed mood, and spiritual well-being among a multiethnic sample of breast cancer patients.

Patients and Methods

One hundred twenty-eight patients (42% African American, 31% Hispanic) recruited from an urban cancer center were randomly assigned (2:1 ratio) to a 12-week yoga intervention ($n = 84$) or a 12-week waitlist control group ($n = 44$). Changes in QOL (eg, Functional Assessment of Cancer Therapy) from before random assignment (T1) to the 3-month follow-up (T3) were examined; predictors of adherence were also assessed. Nearly half of all patients were receiving medical treatment.

Results

Regression analyses indicated that the control group had a greater decrease in social well-being compared with the intervention group after controlling for baseline social well-being and covariates ($P < .0001$). Secondary analyses of 71 patients not receiving chemotherapy during the intervention period indicated favorable outcomes for the intervention group compared with the control group in overall QOL ($P < .008$), emotional well-being ($P < .015$), social well-being ($P < .004$), spiritual well-being ($P < .009$), and distressed mood ($P < .031$). Sixty-nine percent of intervention participants attended classes (mean number of classes attended by active class participants = 7.00 ± 3.80), with lower adherence associated with increased fatigue ($P < .001$), radiotherapy ($P < .0001$), younger age ($P < .008$), and no antiestrogen therapy ($P < .02$).

Conclusion

Despite limited adherence, this intent-to-treat analysis suggests that yoga is associated with beneficial effects on social functioning among a medically diverse sample of breast cancer survivors. Among patients not receiving chemotherapy, yoga appears to enhance emotional well-being and mood and may serve to buffer deterioration in both overall and specific domains of QOL.

J Clin Oncol 25:4387-4395. © 2007 by American Society of Clinical Oncology

INTRODUCTION

The quality of life (QOL) outcomes of breast cancer patients have been widely documented, indicating that impairment in physical, emotional, social, and spiritual well-being may affect both newly diagnosed and long-term survivors.¹⁻¹⁷ Fatigue is one of the most highly prevalent QOL concerns, affecting 30% to 70% of breast cancer survivors.¹⁸⁻²³ There is growing evidence that ethnic minority and underserved breast cancer survivors may be at even greater risk for QOL impairment than white cancer survivors.^{14,18,24-32} Ethnic minority cancer survivors have also reported more needs for support in addressing spiritual and existential issues.¹⁷

The Office of Cancer Complementary and Alternative Medicine within the National Cancer Institute posits that complementary and alternative medicine offers promise in the management of QOL and treatment-related adverse effects and calls for more research in this area.^{33,34} Mind-body interventions are one category of complementary and alternative medicine that encompass a variety of techniques (eg, support groups, relaxation, exercise) aimed at enhancing the mind's capacity to improve physical functioning and well-being.³⁵ Among African American and Hispanic breast cancer survivors, the most frequently used mind-body techniques reported include spiritual healing and prayer (57% and 26%, respectively), meditation/imagery

From the Albert Einstein College of Medicine; Montefiore Medical Center, Bronx; Columbia University, New York State Psychiatric Institute, New York, NY; and Private Oncology Practice, Ahmedabad, India.

Submitted March 13, 2006; accepted June 4, 2007; published online ahead of print at www.jco.org on September 4, 2007.

Supported by Grant No. R03 CA88598-01A1 from the National Cancer Institute and by the Langeloth Foundation (Clinical Trials Registry No. NCT00179348).

Presented in part at the 39th Annual Meeting of the American Society of Clinical Oncology, May 31-June 3, 2003, Chicago, IL; 24th Annual Meeting of the Society of Behavioral Medicine, March 19-22, 2004, Salt Lake City, UT; 7th World Congress of the International Psycho-Oncology Society, August 25-28, 2004, Copenhagen, Denmark; and 4th Annual Meeting of the American Psychosocial Oncology Society, March 1-4, 2007, Austin, TX.

Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

Address reprint requests to Alyson B. Moadel, PhD, Albert Einstein College of Medicine, Department of Epidemiology and Population Health, 1300 Morris Park Ave, Bronx, NY 10461; e-mail: moadel@aecom.yu.edu.

© 2007 by American Society of Clinical Oncology

0732-183X/07/2528-4387/\$20.00

DOI: 10.1200/JCO.2006.06.6027

(39% and 24%, respectively), and support groups (30% and 24%, respectively).^{36,37}

Yoga, an ancient Eastern spiritual discipline, is one of the most widely used mind-body therapies among Americans today,³⁸ a finding mirrored among one cohort of cancer patients.³⁹ Yoga is based in the practice of physical postures, breathing techniques, and meditation. Philosophically, yoga is aimed towards increasing mastery of the body and breath to achieve mastery of the mind, with the ultimate goal of developing deeper spiritual awareness and connection. A growing body of randomized controlled research on yoga⁴⁰ suggests that yoga may exert physical and psychological benefits in both healthy and chronically ill individuals.⁴¹⁻⁴⁶ Recent research conducted with cancer patients indicates that yoga is associated with improvements in overall QOL, emotional well-being, physical symptoms, and distress.⁴⁷⁻⁵³

Although meditative interventions such as yoga have been shown to be well-received by groups of varying educational and ethnic backgrounds, including inner-city minority and bilingual populations,⁵⁴⁻⁵⁷ there are no known studies of yoga among ethnic minority or underserved cancer patients. Given yoga's potential benefits for QOL, its widespread popularity, and its unique spiritual and meditative dimensions, its applicability to the underserved and ethnic minority cancer patient is the focus of this study. Specifically, this study examines the impact of yoga on overall QOL, fatigue, psychological distress, and spiritual well-being among an ethnically diverse sample of breast cancer patients from the underserved urban community of Bronx, NY.

PATIENTS AND METHODS

Study Overview

This article describes a clinical trial of yoga for breast cancer patients funded by the National Cancer Institute and Langeloth Foundation and approved by the Committee of Clinical Investigations at the Albert Einstein College of Medicine, Bronx, NY, in accordance with and approved by the Department of Health and Human Services. The aim of the study was to determine whether yoga could promote and/or preserve patient QOL better than standard care based on standardized QOL measures. This study uses a randomized waitlist control design with QOL outcome examined across the following four assessment points: T1 (baseline), T2 (1 month), T3 (3 months), and T4 (6 months). Random assignment was in a 2:1 ratio to intervention or control after stratification by treatment (chemotherapy or antiestrogen therapy). Data from T1 and T3 (the primary follow-up assessment) are presented.

Sample

Oncology outpatients were recruited among oncology clinics from a university medical center and private clinics from 2001 to 2005. Eligibility included age \geq 18 years, new/recurrent breast cancer (stages I to III) diagnosis within previous 5 years, high performance status (Eastern Cooperative Oncology Group performance status of $<$ 3), ability to speak English or Spanish, and not actively practicing yoga. Figure 1 provides a flow diagram of enrollment and attrition.

Although it was not possible to closely track refusal rates because of multiple sources of referral, there was an 85% enrollment rate among the 193 patients who spoke with research staff about the study. Reasons for refusal included not interested (55%), too busy (14%), and practical barriers (13%; eg, transportation). There were no differences in ethnicity or language between participants and refusals. Of the 164 women who consented to participate, 128 (78%) completed the baseline and main follow-up (3-month) assessments.

The primary reason for attrition was lost to follow-up (15%), with attrition similar between intervention (22%) and control (21%) groups. Those who dropped out were more likely to be younger ($F = 7.37$; $P < .007$); mean

age for completing participants and dropouts was 54.81 ± 9.95 and 49.33 ± 13.07 years, respectively. The final sample for analysis was 84 intervention and 44 waitlist control participants.

Procedure

Patients were recruited through clinic-based flyers or medical staff referral. After acquisition of written informed consent and the baseline assessment, patients were randomly assigned to start classes either immediately or in 3 months. The baseline assessment was conducted in person, with the follow-up assessments conducted by telephone on a day when participants did not attend a yoga class previous to the assessment. Questionnaires were administered in interview format.

Yoga Intervention

The yoga intervention consisted of 12 1.5-hour weekly classes that were available at three locations within the cancer center. The number of sessions chosen was based on the number found to be efficacious in other similar interventions.^{58,59} Participants were permitted to attend more than one class per week, with such activity documented. The yoga intervention was developed for use with breast cancer patients by one of the coauthors (C.S.), an oncologist and certified yoga instructor, in consultation with experts in India and the United States. Based on Hatha yoga techniques, the intervention incorporated the following three major yoga components: physical stretches and poses; breathing exercises; and meditation. All exercises were done in a seated or reclined position. Mats, blankets, and blocks were used for support. Patients were asked to practice yoga at home daily and given an audiotape/compact disk for guidance.

Measures

This article presents the findings from the study as originally designed using the following measures. The Functional Assessment of Cancer Therapy (FACT⁶⁰) was used to measure patients' subjective reports of QOL in physical, social, emotional, and functional well-being, as well as overall QOL (FACT-General), which is composed of the sum of the subscale scores. The FACT has been administered successfully in an interview format⁶¹ and has been shown to have high reliability, validity, and sensitivity to change.^{60,62-64} The Functional Assessment of Chronic Illness Therapy-Fatigue⁶⁵ was used to assess limitations in daily activity and energy level. This scale exhibits high test-retest reliability ($r = 0.90$), internal consistency ($\alpha = .94$), and convergent and discriminant validity.⁶⁵

The Functional Assessment of Chronic Illness Therapy-Spiritual⁶⁶ was used to assess spiritual and existential well-being (eg, purpose in life). The Functional Assessment of Chronic Illness Therapy-Spiritual has demonstrated high internal consistency ($\alpha = .87$) and strong predictive and convergent validity with cancer patients.⁶⁶

A Distressed Mood Index was developed using 19 feeling-state descriptive adjectives from the Profile of Mood States,⁶⁷ which were factor analyzed resulting in the following three domains of mood (factor loadings = 0.46 to 0.81): anxious/sad (eg, tense, discouraged), irritable (eg, annoyed, bad tempered), and confused (eg, forgetful, bewildered). Cronbach's α ranged from .82 to .95 for each mood domain and the total index.

Adherence was documented via attendance records recorded by the yoga instructor at each intervention session. Self-reported home practice and satisfaction were assessed at T3.

Data Analysis

Preliminary analyses included descriptive and bivariate analyses (ie, analyses of variance and χ^2) to examine comparability between groups on sociodemographic, medical, and baseline QOL characteristics. Next, using an intent-to-treat approach, hierarchical regression analyses were conducted to examine study arm as a predictor of each T3 QOL variable after controlling for the corresponding baseline QOL variable and covariates (ie, education and antiestrogen therapy). This linear regression approach has been used in similar studies.^{48,68} Power calculations based on the 2:1 random assignment ratio indicate that there was 80% power to detect a 0.30 standard deviation unit change in QOL scores from baseline to T3 based on a repeated measures correlation of 0.75.⁶⁰ Given the variability in chemotherapy status across the intervention period and its significant association with medical and QOL

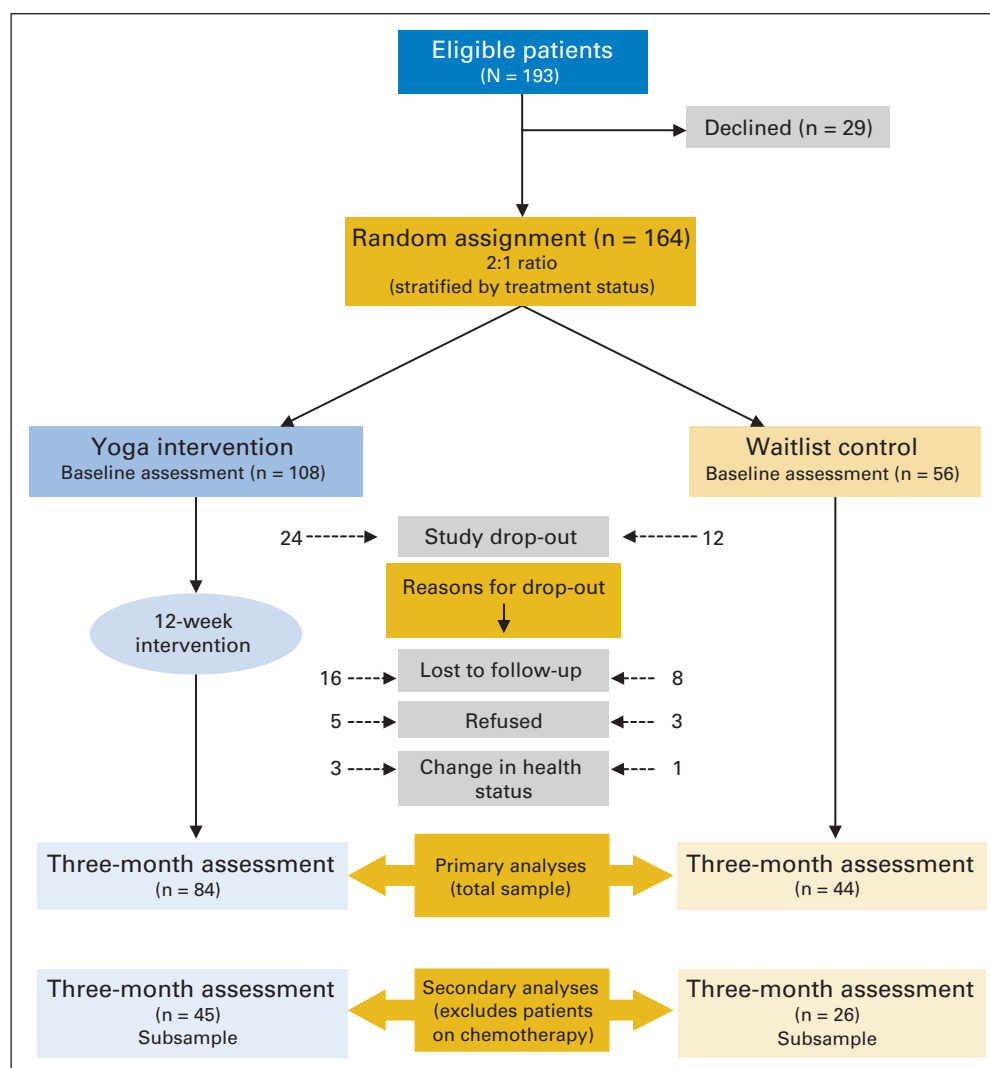


Fig 1. Flow diagram of patient enrollment and attrition.

variables, secondary regression analyses were conducted on a subsample ($n = 71$) of patients not on chemotherapy at T1/T3. Descriptive analyses examine patients' adherence to and evaluation of the intervention, with stepwise regression analyses used to identify potential barriers to adherence. An adherence analysis using analysis of covariance was conducted to examine changes in QOL by class attendance. Original analyses planned an exploration of responses at the 1-month (T2) time point, but given the highly variable levels of yoga exposure that emerged, it was not included in data analyses. Data were analyzed using SPSS version 13.0 software (SPSS Inc, Chicago, IL).

RESULTS

The characteristics of the sample are listed in Table 1. Participants had primarily early-stage breast cancer (81%) and were diagnosed from 2 weeks to 5 years (mean = 1.09 years) previously. Although 48% of participants were receiving medical treatment throughout the study, 31% experienced a change in treatment status. Participants were 42% African American, 31% Hispanic, and 23% white; the mean age was 54.81 years, and 69% of patients were not currently married. Thirty-four percent of the sample grew up outside the United States; the majority of patients were from Latin America ($n = 25$) or a Caribbean island ($n = 14$). Three quarters of the sample earned up to, but no

greater than, a high school degree. A larger proportion of intervention participants had a college/graduate school degree ($P < .01$), and more control group patients were receiving antiestrogen therapy at baseline ($P < .04$). Therefore, education and antiestrogen therapy were used as covariates in subsequent analyses. Four patients with stage IV cancer accrued to the trial before initiation of a competing protocol were retained in analyses given that their QOL scores were within one standard deviation of the mean for the total sample.

Primary Analyses

Table 2 provides an overview of the baseline and adjusted 3-month QOL scores for the total sample ($n = 128$), including effect sizes and 95% CIs. Regression analyses indicate that study arm was a significant predictor of change in social well-being, with the control group experiencing a greater decrease in score compared with the intervention group ($t = -2.40$; $P < .018$). No other differences reached statistical significance, although the means were in the expected direction.

Secondary Analyses

As seen in Table 3, regression analyses of patients not on chemotherapy indicated that study arm was a significant predictor of overall

Table 1. Sociodemographic and Medical Characteristics of Breast Cancer Patient Participants

Characteristic	% of Patients			P
	Total Sample (N = 128)	Intervention Group (n = 84)	Waitlist Control Group (n = 44)	
Age, years				NS
Mean	54.81	55.11	54.23	
Standard deviation	9.95	10.07	9.81	
Range	28-75	32-75	28-71	
Race/ethnicity				NS
African American	42	42	43	
Hispanic	31	30	34	
Non-Hispanic white	23	22	23	
Other	4	6	0	
Education				.01
High school or less	76	69	89	
College/graduate	24	31	11	
Marital status				NS
Married	31	35	25	
Other	69	65	75	
Language				NS
English	83	82	86	
Spanish	16	18	14	
Stage of disease				NS
I	45	42	50	
II	36	36	38	
III	15	17	12	
IV	3	5	0	
Years since diagnosis				NS
Mean	1.09	1.15	0.98	
Standard deviation	1.13	1.14	1.13	
Range	0.03-4.96	0.06-4.96	0.03-4.70	
Surgery				NS
Mastectomy	31	35	23	
Lumpectomy	53	52	55	
Both	11	8	19	
None	5	5	3	
Chemotherapy				NS
T1	27	30	23	
T3	33	36	27	
Antiestrogen therapy				.04
T1	30	24	41	
T3	41	36	50	
Radiation treatment				NS
T1	10	8	14	
T3	10	10	11	

Abbreviations: NS, not significant; T1, baseline; T3, 3 months.

QOL (FACT-G), with intervention participants experiencing a slight increase and control patients a moderate decrease in scores ($t = -2.72$; $P < .008$). Study arm also predicted emotional well-being ($t = -2.50$; $P < .015$), social well-being ($t = -2.99$; $P < .004$), spiritual well-being ($t = -2.67$; $P < .009$), distressed mood ($t = 2.21$; $P < .031$), anxiety/sadness ($t = 2.04$; $P < .046$), and irritability ($t = 2.26$; $P < .027$), with notable improvements for the intervention group in emotional well-being and distress and marked deterioration for the control group in social well-being, spiritual well-being, and distress.

Adherence

Within the total intervention group ($n = 108$), there was considerable variability in adherence to the 12-week intervention, with a

range of zero to 19 classes attended, as shown in Table 4. Nearly three quarters of study dropouts did not participate in the intervention at all. Although 26 study completers (31%) did not attend classes, eight of these patients reported practicing yoga at home at least a few times per week. The mean number of classes attended by active class participants was 7.00 ± 3.80 classes. On the basis of available self-report data ($n = 59$), 61% practiced yoga at home at least a few times per week. A larger proportion of Hispanic (56%) women, compared with African American (26%) and white (17%) women, did not attend classes ($\chi^2 = 9.82$; $P < .007$).

In Figure 2, an adherence analysis depicting change in QOL by class attendance is presented. Patients with high adherence (> six classes; $n = 33$), low adherence (one to six classes; $n = 24$), and no adherence (zero classes; $n = 27$) were compared. Analysis of covariance indicated that T3 scores differed by adherence level on fatigue ($F = 6.86$; $P < .002$), physical well-being ($F = 5.89$; $P < .004$), and distress ($F = 3.35$; $P < .04$), controlling for T1 scores and covariates (chemotherapy, age, and race). Although no significant T1 differences emerged, high adherers had higher T3 energy and T3 physical well-being than low adherers ($P < .037$ and $P < .017$, respectively) and nonadherers ($P < .0001$ and $P < .002$, respectively) and lower T3 distress than nonadherers ($P < .003$). There was a significant interaction effect between adherence and baseline distress ($F = 5.73$; $P < .005$), with those at lowest levels of T1 distress more likely to experience increased distress with no adherence and decreased distress with high adherence.

As shown in Table 5, a stepwise multiple regression was conducted to identify predictors of class attendance based on sociodemographic, medical, and QOL change score variables. Fatigue, radiation, age, and hormonal treatment accounted for an adjusted 40% of the variance in attendance. Patients who attended fewer classes tended to have increasing fatigue ($t = 3.50$; $P < .001$), radiotherapy ($t = -3.70$; $P < .0001$), younger age ($t = 2.76$; $P < .008$), and no antiestrogen therapy ($t = 2.39$; $P < .02$).

Program evaluation was very positive among the 59 active intervention participants. As shown in Appendix Table A1 (online only), all aspects of the intervention received a mean rating greater than 3 on a scale from 1 (liked least) to 5 (liked most).

DISCUSSION

The results of this study suggest that a yoga intervention is associated with beneficial QOL outcomes among an ethnically diverse, urban population of breast cancer patients. Findings revealed the greatest impact on social functioning. Among the sample as a whole, women in the control group experienced a greater decrease in social well-being than women in the intervention group (13% v 2%, respectively). Although yoga did not improve social well-being, it may have served to promote a sense of social support and connection that may be more vulnerable in this predominantly unmarried population. Furthermore, the decline in social functioning may be particularly relevant to socioeconomically burdened and ethnic minority populations for whom social needs are particularly salient.²⁹ African American and Hispanic patients may be uniquely responsive to social interventions given that social networks are highly valued and integrally woven into the fabric of these cultures.^{25,69} The importance of social support is

Randomized Controlled Trial of Yoga Among Breast Cancer Patients

Table 2. Mean Baseline and Follow-Up QOL Scores by Group (N = 128)

Measure*	Intervention Group (n = 84)				Waitlist Control Group (n = 44)				Effect Size	95% CI
	Baseline†		3-Month Follow-Up		Baseline†		3-Month Follow-Up			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Overall QOL: FACT-G	76.46	18.47	75.20	18.96	74.40	23.24	69.94	19.39	-0.09	-8.05 to 2.63
Physical well-being	20.72	5.55	19.60	6.65	19.75	7.30	19.26	6.35	0.07	-1.29 to 3.05
Functional well-being	18.34	6.70	17.45	6.86	17.32	7.50	15.68	6.56	-0.06	-3.29 to 1.60
Emotional well-being	16.51	5.05	17.76	5.06	15.89	6.21	16.32	5.61	-0.07	-2.33 to 0.99
Social well-being‡	20.89	5.99	20.38	5.57	21.45	6.14	18.67	6.28	-0.22	-3.78 to -0.36
Fatigue: FACIT-Fatigue	35.65	11.67	34.37	11.26	34.93	13.62	33.82	12.97	-0.02	-3.90 to 3.11
Spiritual well-being: FACIT-Spiritual	38.17	9.38	37.40	9.09	35.77	9.95	33.55	11.34	-0.09	-3.67 to 1.32
Distressed Mood	20.30	17.00	17.16	16.57	21.73	17.07	21.88	18.85	0.08	-3.35 to 8.23
Anxiety/sadness	9.70	8.11	8.10	7.64	10.50	8.74	10.26	8.08	0.03	-2.39 to 3.34
Irritability	6.56	6.36	5.23	6.07	6.95	6.25	7.07	7.19	0.11	-0.95 to 3.87
Confusion	3.40	3.56	3.17	3.77	3.16	3.35	3.60	3.88	0.11	-0.49 to 1.83

NOTE. Adjusted estimates are given for 3-month follow-up means, change score effect sizes, and 95% CIs. Covariates used for the adjusted score included education and antiestrogen therapy. CIs including zero are not significant.

Abbreviations: QOL, quality of life; SD, standard deviation; FACT-G, Functional Assessment of Cancer Therapy-General; FACIT, Functional Assessment of Chronic Illness Therapy.

*Higher scores signify better functioning for all FACT/FACIT measures and poorer functioning for the Distressed Mood Index.

†There were no statistically significant differences between groups on any baseline QOL measure.

‡P < .018 for adjusted change score.

noteworthy because it, in itself, has been associated with promoting QOL,⁷⁰⁻⁷³ preventive health behavior,⁶⁹ and even cancer survival.^{74,75}

Program evaluation ratings reflect the importance of the social support/connection benefits of the intervention, which was under-scored by the relative disinclination towards home practice. However, it is unlikely to be the only therapeutic element of the intervention given that 71% of participants reported practicing yoga at home once per week or more and two primary components of yoga (ie, breathing exercises and meditation) were rated even more highly than the social connection benefits.

Although no other effects of yoga were found in the overall sample, one can speculate that robust effects of the intervention may have been obscured by the relatively impaired QOL of the participants. Our sample reported notably poorer functioning (one-half standard deviation below the mean) on overall QOL and fatigue compared with normative data on 400 breast cancer patients and 113 nonanemic cancer patients.^{76,77} In our study, examination of a more medically stable subsample that excluded patients receiving chemotherapy during the intervention period supports this speculation by showing clear physical and psychological benefits for those in the intervention group.

Table 3. Mean Baseline and Follow-Up QOL Scores by Group Among Patients Not on Chemotherapy (n = 71)

Measure*	Intervention Group (n = 45)				Waitlist Control Group (n = 26)				Effect Size	95% CI
	Baseline†		3-Month Follow-Up		Baseline†		3-Month Follow-Up			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Overall QOL: FACT-G§	76.53	17.98	78.07	17.17	77.54	24.45	70.38	22.75	-0.29	-13.33 to -2.05
Physical well-being	20.87	5.28	21.03	6.05	20.73	7.03	19.91	6.30	-0.12	-3.23 to 0.99
Functional well-being	18.33	6.38	18.17	6.74	18.19	7.72	16.21	7.34	-0.15	-4.73 to 0.81
Emotional well-being‡	16.36	4.77	18.19	4.18	16.50	5.94	16.09	5.71	-0.26	-3.77 to -0.42
Social well-being§	20.98	6.23	20.68	5.19	22.12	6.22	18.17	6.59	-0.31	-4.18 to -0.84
Fatigue: FACIT-Fatigue	34.27	12.31	36.56	10.85	35.88	14.42	34.77	13.58	-0.11	-5.18 to 1.60
Spiritual well-being: FACIT-Spiritual§	37.87	9.24	36.85	8.23	34.58	11.06	32.75	12.96	-0.30	-7.16 to -1.04
Distressed Mood‡	23.64	18.12	18.26	16.26	19.85	16.20	26.57	21.41	0.24	0.81 to 15.81
Anxiety/sadness‡	10.67	8.49	8.79	7.54	9.77	7.90	12.23	8.91	0.22	0.07 to 6.82
Irritability‡	7.52	6.49	5.29	5.84	6.07	5.84	8.65	8.12	0.25	0.39 to 6.32
Confusion	4.00	3.87	2.92	3.86	2.81	2.93	4.35	4.03	0.20	-0.152 to 3.01

NOTE. Adjusted estimates are given for 3-month follow-up means, change score effect sizes, 95% CIs, and P values after adjusting for baseline QOL score. CIs including zero are not significant.

Abbreviations: QOL, quality of life; SD, standard deviation; FACT-G, Functional Assessment of Cancer Therapy-General; FACIT, Functional Assessment of Chronic Illness Therapy.

*Higher scores signify better functioning for all FACT/FACIT measures and poorer functioning for the Distressed Mood Index.

†There were no statistically significant differences between groups on any baseline measure.

‡P < .05.

§P < .01.

Table 4. Level of Adherence Within the Intervention Group (n = 108)

Adherence	% of Participants With Baseline and 3-Month Follow-Up Data (n = 84)	% of Participants With Baseline Data Only (n = 24)
No. of yoga classes attended		
0	32	71
1	5	8
2	5	13
3	7	8
4	5	0
5	2	0
6	5	0
7	7	0
8	10	0
9	6	0
10	7	0
11	2	0
12	2	0
13-19*	5	0
Frequency of self-reported home practice, n = 59†		
Never	19	—
Once per month	5	—
Few times per month	7	—
Weekly	9	—
Few times per week	51	—
Daily	10	—

*Participants were requested to attend classes once per week but were permitted to attend more often if they liked.

†Missing data is the result of self-reported home practice being added to the 3-month follow-up (T3) assessment battery some time after study initiation to replace daily calendars originally designed to collect this data.

Similar to previous research,^{48,51,52} improvement in emotional well-being and decreased distress after 3 months were reported by the intervention group among this subsample not on chemotherapy. Whereas other QOL indices remained stable in the intervention group, the control group experienced marked deterioration in overall QOL, social well-being, and distressed mood. This pattern of QOL deterioration, mirrored in prospective observational studies of white and ethnic minority breast cancer survivors,^{6,7,78} suggests that yoga may provide a buffering effect on QOL.

Adherence to the weekly class was, in absolute terms, low, with nearly one third of intervention participants not attending a single class, the majority of whom were Hispanic. However, among active participants, the average attendance was nearly seven of the proscribed 12 sessions, a high number relative to other yoga trials.⁴⁹ This is underscored by the fact that this rate reflects natural adherence, which is nonreliant on compensation for participation or travel.

Patients with low and high class attendance reported a similar pattern of improvement or stability in QOL. However, those who did not attend class demonstrated deterioration across physical and emotional outcomes. Interestingly, attending the intervention at any level was related to improved mood regardless of one's initial distress level, whereas not attending among those with low distress was related to worsening mood. This suggests that yoga may have both protective and promoting effects on psychological well-being. It is important to note that QOL impairment may present both an incentive and barrier to participating in a yoga intervention. Although directionality of

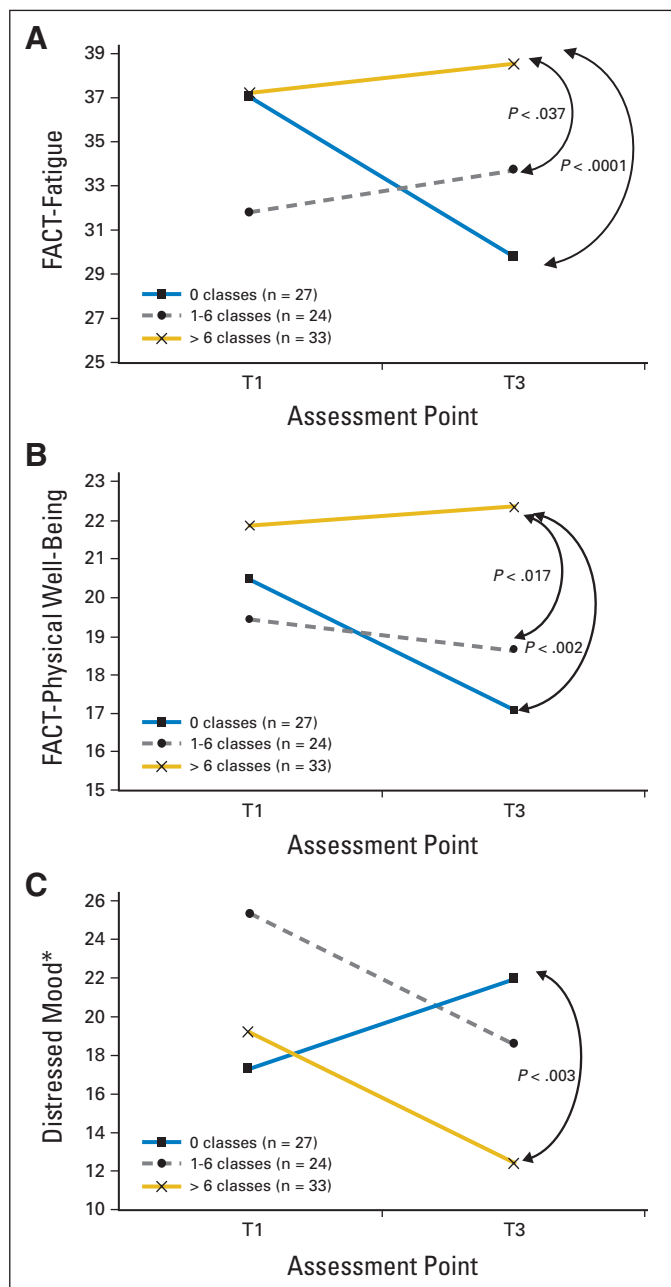


Fig 2. Changes in quality of life (QOL) by level of adherence in the intervention arm (n = 84). Adjusted means are displayed, controlling for baseline QOL, chemotherapy, age, and race. Groups do not differ on T1 (baseline) scores. Interaction effect between baseline distress and adherence was significant ($P < .005$). For clarity, Functional Assessment of Cancer Therapy (FACT) Fatigue is descriptively represented as Energy, reflecting that higher scores indicate better functioning.

effect cannot be clearly determined, our study suggests that fatigue posed a barrier to adherence. Although physical activity has been shown to help cancer patients manage fatigue,⁷⁹ the fatigue itself may pose the greatest challenge to initiation and maintenance of such activity. Future research might examine the impact of a yoga intervention initiated immediately after diagnosis and before treatment (ie, surgery) on the prevention/minimization of treatment-related fatigue. Focus groups with Hispanic and younger breast cancer

Table 5. Stepwise Regression of Sociodemographic, Medical, and QOL Variables on Yoga Class Attendance (n = 69)

Step No.	Variable*	R	R ²	Adjusted R ²	SE	B	β	t	P
1	Chemotherapy	0.45	0.20	0.19	4.01	-3.98	-0.45	-4.10	.0001
2	Fatigue change score	0.52	0.27	0.25	3.85	0.15	0.36	3.50	.001
3	Radiation therapy	0.59	0.34	0.31	3.69	-3.85	-0.35	-3.70	.0001
4	Age	0.64	0.41	0.37	3.54	0.12	0.27	2.76	.008
5	Chemotherapy removed from model	0.62	0.39	0.36	3.57	—	—	—	—
6	Antiestrogen treatment	0.66	0.44	0.40	3.44	2.23	0.25	2.39	.02

Abbreviation: QOL, quality of life.

*Variables excluded from the model at step 1 were QOL change scores (Functional Assessment of Cancer Therapy and Distressed Mood Index), disease stage, and race.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The author(s) indicated no potential conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design: Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Joseph A. Sparano

Financial support: Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Joseph A. Sparano

Administrative support: Alyson B. Moadel, Melanie S. Harris, Sapana R. Patel

Provision of study materials or patients: Alyson B. Moadel, Melanie S. Harris, Sapana R. Patel, Joseph A. Sparano

Collection and assembly of data: Judith Wylie-Rosett, Melanie S. Harris, Sapana R. Patel

Data analysis and interpretation: Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Melanie S. Harris, Charles B. Hall, Joseph A. Sparano

Manuscript writing: Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Melanie S. Harris, Charles B. Hall

Final approval of manuscript: Alyson B. Moadel, Chirag Shah, Judith Wylie-Rosett, Melanie S. Harris, Sapana R. Patel, Charles B. Hall, Joseph A. Sparano

patients may help identify specific barriers to and preferences for QOL intervention.

Although this study uses a randomized stratified design and an intent-to-treat analysis to control for biases, the heterogeneity in treatment characteristics of this sample may have inhibited strong intervention effects. In an effort to address this issue, the investigators are currently conducting a follow-up accrual study to examine treatment-specific (eg, chemotherapy, antiestrogen therapy) subgroups. The current study is also not able to discern the therapeutic factors operating in yoga, such as social support, physical poses, or meditation. The inclusion of appropriate comparison groups (eg, support group, exercise group) may help tease apart these factors. The current findings are limited to the short-term effects of yoga, and further research is recommended to determine long-term QOL outcome and adherence.

Given the paucity of research on QOL intervention among ethnic minorities, we hope this research sheds light on the receptivity and response to a mind-body intervention among this vulnerable population. It is noteworthy that the most common reasons for cancer patients to use complementary medicine include a desire to feel hopeful (73%), the belief that it is nontoxic (49%), and wanting more control over one's medical care (44%).³⁴ With the minimal costs involved, the potential impact of mind-body programs on QOL among underserved and ethnic minority populations should not be ignored.

REFERENCES

- Kornblith A, Ligibel J: Psychosocial and sexual functioning of survivors of breast cancer. *Semin Oncol* 30:799-813, 2003
- Shapiro SL, Lopez AM, Schwartz GE, et al: Quality of life and breast cancer: Relationship to psychosocial variables. *J Clin Psychol* 57:501-519, 2001
- Mols F, Vingerhoets AJ, Coebergh JW, et al: Quality of life among long-term breast cancer survivors: A systematic review. *Eur J Cancer* 41:2613-2619, 2005
- Arndt V, Merx H, Sturmer T, et al: Age-specific detriments to quality of life among breast cancer patients one year after diagnosis. *Eur J Cancer* 40:673-680, 2004
- Fallowfield L, Cella D, Cuzick J, et al: Quality of life of postmenopausal women in the Arimidex, Tamoxifen, Alone or in Combination (ATAC) adjuvant breast cancer trial. *J Clin Oncol* 22:4261-4271, 2004
- Vacek PM, Winstead-Fry P, Secker-Walker RH, et al: Factors influencing quality of life in breast cancer survivors. *Qual Life Res* 12:527-537, 2003

- Ganz PA, Guadagnoli E, Landrum MB, et al: Breast cancer in older women: Quality life and psychosocial adjustment in the 15 months after diagnosis. *J Clin Oncol* 21:4027-4033, 2003
- Ganz PA, Kwan L, Stanton AL, et al: Quality of life at the end of primary treatment of breast cancer: First results from the Moving Beyond Cancer randomized trial. *J Natl Cancer Inst* 96:376-387, 2004
- Ganz PA, Rowland JH, Meyerowitz BE, et al: Impact of different adjuvant therapy strategies on quality of life in breast cancer survivors. *Recent Results Cancer Res* 152:396-411, 1998
- Dow KH, Ferrell BR, Leigh S, et al: An evaluation of the quality of life among long-term survivors of breast cancer. *Breast Cancer Res Treat* 39:261-273, 1996
- Ferrell BR, Grant M, Funk B, et al: Quality of life in breast cancer. *Cancer Pract* 4:331-340, 1996
- Hurny C, Bernhard J, Coates AS, et al: Impact of adjuvant therapy on quality of life in women with node-positive operable breast cancer: International Breast Cancer Study Group. *Lancet* 347:1279-1284, 1996
- Holzner B, Kemmler G, Kopp M, et al: Quality of life in breast cancer patients: Not enough atten-

- tion for long-term survivors? *Psychosomatics* 42: 117-123, 2001
- Baker F, Denniston M, Smith T, et al: Adult cancer survivors: How are they faring? *Cancer* 104: 2565-2576, 2005 (suppl 11)
- Manning-Walsh J: Spiritual struggle: Effect on quality of life and life satisfaction in women with breast cancer. *J Holist Nurs* 23:120-140, 2005
- Bauer-Wu S, Farran CJ: Meaning in life and psycho-spiritual functioning: A comparison of breast cancer survivors and healthy women. *J Holist Nurs* 23:172-190, 2005
- Moadel A, Morgan C, Fatone A, et al: Seeking meaning and hope: Self-reported spiritual and existential needs among and ethnically-diverse cancer patient population. *Psychooncology* 8:378-385, 1999
- Eversley R, Estrin D, Dibble S, et al: Post-treatment symptoms among ethnic minority breast cancer survivors. *Oncol Nurs Forum* 32:250-256, 2005
- Northouse LL, Caffey M, Deichelbohrer L, et al: The quality of life of African American Women with breast cancer. *Res Nurs Health* 22:449-460, 1999

20. Ashing-Giwa KT, Padilla G, Tejero J, et al: Understanding the breast cancer experience of women: A qualitative study of African American, Asian American, Latina and Caucasian cancer survivors. *Psychooncology* 13:408-428, 2004
21. Broeckel J, Jacobsen P, Horton J, et al: Characteristics and correlates of fatigue after adjuvant chemotherapy for breast cancer. *J Clin Oncol* 16:1689-1696, 1998
22. Andrykowski MA, Curran SL, Lightner R: Off-treatment fatigue in breast cancer survivors: A controlled comparison. *J Behav Med* 21:1-18, 1998
23. Bower JE, Ganz PA, Desmond KA, et al: Fatigue in breast cancer survivors: Occurrence, correlates, and impact on quality of life. *J Clin Oncol* 18:743-753, 2000
24. Spencer SM, Love N, Lehman JM, et al: Concerns about breast cancer and relations to psychosocial well-being in a multiethnic sample of early-stage patients. *Health Psychol* 18:159-168, 1999
25. Aziz NM, Rowland JH: Cancer survivorship research among ethnic minority and medically underserved groups. *Oncol Nurs Forum* 29:789-801, 2002
26. Ashing-Giwa KT, Ganz PA, Petersen K: Quality of life of African-American and white long term breast carcinoma survivors. *Cancer* 85:418-426, 1999
27. King MT, Kenny P, Shiell A, et al: Quality of life three months and one year after first treatment for early stage breast cancer: Influence of treatment and patient characteristics. *Qual Life Res* 9:789-800, 2000
28. Bourjolly JN, Kerson TS, Nuamah IF: A comparison of social functioning among black women with breast cancer. *Soc Work Health Care* 28:1-20, 1999
29. Rodrigue JR: An examination of race differences in patients' psychological adjustment to cancer. *J Clin Psychol Medical Settings* 4:271-280, 1997
30. Ashing-Giwa K: Quality of Life and psychosocial outcomes in long-term survivors of breast cancer: A focus on African-American women. *J Psychosoc Oncol* 17:47-62, 1999
31. Moadel A, Perez A, Gharraee Z, et al: Examining quality of life after breast cancer: cultural, treatment, and menstrual factors. *Psychosom Med* 64:106, 2002
32. Culver JL, Arena PL, Wimberly SR, et al: Coping among African-American, Hispanic, and non-Hispanic white women recently treated for early stage breast cancer. *Psychol Health* 19:157-166, 2004
33. White JD: Complementary and alternative medicine research: A National Cancer Institute perspective. *Semin Oncol* 29:546-551, 2002
34. Richardson M, Straus S: Complementary and alternative medicine: Opportunities and challenges for cancer management and research. *Semin Oncol* 29:531-545, 2002
35. National Center for Complementary and Alternative Medicine: What is Complementary and Alternative Medicine (CAM)? National Institutes of Health, 2002. <http://nccam.nih.gov/health/whatis-cam/pdf/whatis-cam.pdf>
36. Alferi SM, Antoni MH, Ironson G, et al: Factors predicting the use of complementary therapies in a multi-ethnic sample of early-stage breast cancer patients. *J Am Med Womens Assoc* 56:120-123, 126, 2001
37. Lee MM, Lin SS, Wrensch MR, et al: Alternative therapies used by women with breast cancer in four ethnic populations. *J Natl Cancer Inst* 92:42-47, 2000
38. Wolsko PM, Eisenberg DM, Davis RB, et al: Use of mind-body medical therapies. *J Gen Intern Med* 19:43-50, 2004
39. Rosenbaum E, Gautier H, Fobair P, et al: Cancer supportive care, improving the quality of life for cancer patients: A program evaluation report. *Support Care Cancer* 12:293-301, 2004
40. Khalsa SBS: Yoga as a therapeutic intervention: A bibliometric analysis of published research studies. *Indian J Physiol Pharmacol* 48:269-285, 2004
41. Monroe R, Ghosh AK, Kalish D: Yoga Research Bibliography, Scientific Studies on Yoga and Meditation. Cambridge, England, Yoga Biomedical Trust, 1989
42. Raub JA: Psychophysiological effects of hatha yoga on musculoskeletal and cardiopulmonary function: A literature review. *J Altern Complement Med* 8:797-812, 2002
43. Kirkwood G, Rampes H, Tuffrey V, et al: Yoga for anxiety: A systematic review of the research evidence. *Br J Sports Med* 39:884-891, 2005
44. Sherman KJ, Cherkin DC, Erro J, et al: Comparing yoga, exercise, and a self-care book for chronic low back pain: A randomized, controlled study. *Ann Intern Med* 143:849-856, 2005
45. Pilkington K, Kirkwood G, Rampes H, et al: Yoga for depression: The research evidence. *J Affect Disord* 89:13-24, 2005
46. Oken BS, Zajdel D, Kishiyama S, et al: Randomized, controlled, six-month trial of yoga in health seniors: Effects on cognition and quality of life. *Altern Ther* 12:40-47, 2006
47. Bower JE, Woolery A, Sternlieb B, et al: Yoga for cancer patients and survivors. *Cancer Control* 12:165-171, 2005
48. Culos-Reed SN, Carlson LE, Daroux LM, et al: A pilot study of yoga for breast cancer survivors: Physical and psychological benefits. *Psychooncology* 15:891-897, 2006
49. Cohen L, Warneke C, Fouladi R, et al: Psychological adjustment and sleep quality in a randomized trial of the effects of a Tibetan yoga intervention in patients with lymphoma. *Cancer* 100:2253-2260, 2004
50. Gopinath KS, Rao R, Raghuram N, et al: Evaluation of yoga therapy as a psychotherapeutic intervention in breast cancer patients on conventional combined modality of treatment. *Proc Am Soc Clin Oncol* 22:26, 2003 (abstr 101)
51. Specia M, Carlson LE, Goodey E, et al: A randomized, wait-list controlled clinical trial: The effect of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients. *Psychosom Med* 62:613-622, 2000
52. Carlson LE, Specia M, Patel KD, et al: Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate (DHEAS) and melatonin in breast and prostate cancer outpatients. *Psychoneuroendocrinology* 29:448-474, 2004
53. Carlson LE, Specia M, Patel KD, et al: Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. *Psychosom Med* 65:571-581, 2003
54. Chavis ME: In the eye of the storm: Yoga and meditation are finding a home in America's inner cities. *Yoga J* 65-71, 1998
55. Roth B, Creaser T: Mindfulness meditation-based stress reduction: Experience with a bilingual inner-city program. *Nurse Pract* 22:150-152, 154, 157, 1997
56. Vest GW, Ronnau J, Lopez BR, et al: Alternative health practices in ethnically diverse rural areas: A collaborative research project. *Health Soc Work* 22:95-100, 1997
57. Schneider RH, Alexander CN, Staggers F, et al: A randomized controlled trial of stress reduction in African Americans treated for hypertension for over one year. *Am J Hypertens* 18:88-98, 2005
58. Meyer TJ, Mark MM: Effects of psychosocial interventions with adult cancer patients: A meta-analysis of randomized experiments. *Health Psychol* 14:101-108, 1995
59. Rehse B, Pukrop R: Effects of psychosocial interventions on quality of life in adult cancer patients: Meta analysis of 37 published controlled outcome studies. *Patient Educ Couns* 50:179-186, 2003
60. Cella D, Tulskey D, Gray G, et al: The Functional Assessment of Cancer Therapy scale: Development and validation of the general measure. *J Clin Oncol* 11:570-579, 1993
61. Byrne HA, Hailey BJ, Johnson JT: The use of weighted scores with the Functional Assessment of Cancer Therapy (FACT) scales. *J Psychosoc Oncol* 13:57-77, 1995
62. Brady M, Cella D, Mo F, et al: Reliability and validity of the Functional Assessment of Cancer Therapy-Breast quality-of-life instrument. *J Clin Oncol* 15:974-986, 1997
63. Cella D, Hahn EA, Dineen K: Meaningful change in cancer-specific quality of life scores: Differences between improvement and worsening. *Qual Life Res* 11:207-221, 2002
64. Holzner B, Kemmler G, Cella D, et al: Normative data for Functional Assessment of Cancer Therapy-General scale and its use for the interpretation of quality of life scores in cancer survivors. *Acta Oncol* 43:153-160, 2004
65. Yellen SB, Cella DF, Webster K, et al: Measuring fatigue and other anemia-related symptoms with the Functional Assessment of Cancer Therapy (FACT) measurement system. *J Pain Symptom Manage* 13:63-74, 1997
66. Peterman AH, Fitchett G, Brady MJ, et al: Measuring spiritual well-being in people with cancer: The Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp). *Ann Behav Med* 24:49-58, 2002
67. McNair D, Lorr M, Droppelman L: Profile of Moods States Manual. San Diego, CA, Educational & Industrial Testing Services, 1971
68. Courneya KS, Mackey JR, Bell GJ, et al: Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. *J Clin Oncol* 21:1660-1668, 2003
69. Guidry JJ, Aday LA, Zhang D, et al: The role of informal and formal social support networks for patients with cancer. *Cancer Pract* 5:241-246, 1997
70. Alferi SM, Carver CS, Antoni MH, et al: An exploratory study of social support, distress, and life disruption among low-income Hispanic women under treatment for early stage breast cancer. *Health Psychol* 20:41-46, 2001
71. Beder J: Perceived social support and adjustment to mastectomy in socioeconomically disadvantaged black women. *Soc Work Health Care* 22:55-71, 1995
72. Eil K, Sanchez K, Vourlekis B, et al: Depression, correlates of depression, and receipt of depression care among low-income Hispanic women

with breast or gynecological cancer. *J Clin Oncol* 23:3052-3060, 2005

73. Helgeson VS, Cohen S: Social support and adjustment to cancer: Reconciling descriptive, correlational, and intervention research. *Health Psychol* 15:135-148, 1996

74. Reynolds P, Hurley S, Torres M, et al: Use of coping strategies and breast cancer survival: Results from the Black/White Cancer Survival Study. *Am J Epidemiol* 152:940-949, 2000

75. Bottomley A: Where are we now? Evaluating two decades of group interventions with adult cancer patients. *J Psychiatr Ment Health Nurs* 4:251-265, 1997

76. Brucker P, Yost K, Cashy J, et al: General population and cancer patient norms for the Functional Assessment of Cancer Therapy-General (FACT-G). *Eval Health Prof* 28:192-211, 2005

77. Cella D, Lai JS, Chang CH, et al: Fatigue in cancer patients compared with fatigue in the gen-

eral United States population. *Cancer* 94:528-538, 2002

78. Culver JL, Arena PL, Antoni MH, et al: Coping and distress among women under treatment for early stage breast cancer: Comparing African Americans, Hispanics and non-Hispanic whites. *Psychooncology* 11:495-504, 2002

79. Ahlberg K, Ekman T, Gaston-Johansson F, et al: Assessment and management of cancer-related fatigue in adults. *Lancet* 362:640-650, 2003



Appendix

The Appendix is included in the full-text version of this article, available online at www.jco.org. It is not included in the PDF version (via Adobe® Reader®).