

## Predictors of Adherence to a 26-Week Viniyoga Intervention Among Post-Treatment Breast Cancer Survivors

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### Abstract

**Objectives:** This study aimed to identify demographic, psychological, health-related, and geographic predictors of adherence to home-based and supervised components of a yoga intervention in breast cancer survivors.

**Methods:** Participants were the 32 post-treatment breast cancer survivors who were randomized to the Viniyoga intervention arm of a controlled trial. Participants were asked to practice yoga 5 times per week for 6 months, including at least one weekly facility-based session. Adherence was monitored using sign-in sheets and logs. Height and weight were measured; other potential predictors of adherence were obtained from baseline questionnaires.

**Results:** Participants attended  $19.6 \pm 13.0$  yoga classes and performed  $55.8 \pm 32.8$  home-based yoga sessions. Participants adhered to 58% of the overall yoga practice goal (75% of the goal for yoga classes and 54% of the goal for home based-sessions). Higher class attendance and home practice were predicted by greater self-efficacy for yoga ( $p=0.004$  and  $0.06$ , respectively). Additionally, employment outside the home was associated with greater class attendance ( $p=0.004$ ), while higher waist circumference was marginally associated with lower adherence to home-based yoga ( $p=0.05$ ).

**Conclusions:** High levels of facility- and home-based yoga practice were achieved. Breast cancer survivors who have lower self-efficacy for yoga or who have a higher waist circumference may benefit from additional support or intervention tailoring. Adherence may also be improved by ensuring that class times are convenient to both working and nonworking women.

### Introduction

THE UNITED STATES IS HOME to 2.4 million breast cancer survivors,<sup>1</sup> many of whom experience long-lasting effects of diagnosis and treatment, including fatigue,<sup>2</sup> anxiety, depression,<sup>3</sup> weight gain,<sup>4</sup> and lymphedema.<sup>5</sup> Lifestyle interventions involving yoga are a potential way to help breast cancer survivors manage lingering pain and treatment side-effects. Yoga has been found to reduce fatigue and depression and to improve sleep and overall quality of life among healthy older adults and cancer survivors.<sup>6–8</sup> Among breast cancer survivors, yoga has been associated with reduced arthralgia pain,<sup>9</sup> reduced fatigue and salivary cortisol levels,<sup>10,11</sup> and improved emotional functioning<sup>12</sup> and quality of life.<sup>13–15</sup>

Trials involving lifestyle interventions often achieve lower adherence than trials involving medications, in part because they require extended motivation and effort on the part of participants.<sup>16</sup> When adherence is lower than expected, participants may receive an insufficient dose of the intervention, biasing the study results toward the null hypothesis. Consequently, understanding predictors of adherence itself is important to study for yoga and other lifestyle interventions. While most studies of lifestyle interventions report basic adherence statistics, few provide detailed information about adherence rates and predictors of adherence.

Previous studies among breast cancer survivors have found that yoga interventions are generally feasible and safe.<sup>7,12,17</sup> Only a few studies have examined adherence to combined facility- and home-based interventions; these have

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generally reported moderate-to-good adherence. Carson et al. investigated effects of an 8-week trial of the Yoga of Awareness program (a comprehensive program that draws strongly on the Kripalu school of yoga, in which postures are complemented by meditation techniques, breathing exercises, didactic presentations, and group discussions) versus wait-list control in adult survivors (>2 years postdiagnosis) of early-stage (stages IA-IIB) breast cancer with no signs of active breast cancer but  $\geq 1$  hot flash/day on  $\geq 4$  days per week. In this study, the authors reported that participants ( $n=17$  in the yoga intervention group) attended, on average, six of the eight weekly classes and performed 30 minutes per day of home practice.<sup>18</sup> Poorer adherence was observed in a 12-week trial of weekly Hatha yoga classes plus home practice versus wait-list control in a multiethnic, urban sample of patients with breast cancer, in which 31% of intervention group participants did not attend a single class.<sup>19</sup> Among those who did attend classes, however, mean attendance was 7.0 (standard deviation [SD]=3.8) of 12 classes. Although low in absolute terms, the adherence rates in this study are encouraging considering that this well-conducted study focused on an underserved and understudied population, who were on average only 1 year postdiagnosis (range: 2 weeks to 5 years), whereas most other studies report on highly selected samples that had subjects who are likely to be more adherent.

The short duration of most yoga studies limits the ability to predict adherence to programs of longer duration, which may be necessary to achieve long-term, sustainable benefits. Of the 10 studies included in a recent systematic review of yoga for patients with cancer,<sup>20</sup> six featured interventions lasting  $\leq 8$  weeks, one used a 12-week intervention, and three did not report the duration of the intervention. While these studies provide valuable information regarding short-term adherence to yoga, for outcomes such as weight, longer-duration interventions are needed and therefore more information is needed regarding the feasibility of long-term yoga practice.

Similarly, only a few studies<sup>13,19,21</sup> have evaluated the demographic and psychosocial factors that may affect adherence of breast cancer survivors to yoga intervention. In one study of Iyengar yoga among post-treatment survivors, demographics were not predictive of 12-week adherence, but participants with more advanced tumors or a history of previous cancer adhered better, as did those reporting less fatigue and more happiness at baseline. Other studies have identified fatigue, age, radiation therapy, and hormonal treatment as relevant to adherence.<sup>12,19</sup>

In this article, detailed adherence data are presented from the intervention arm of a two-arm randomized trial with the longest-duration yoga trial yet reported among breast cancer survivors. The overall aims of the parent trial<sup>22</sup> were to obtain estimates of the time to recruit the sample, levels of retention and adherence, and the efficacy of the yoga intervention on fatigue, quality of life, and weight change. The parent trial found that the yoga intervention was feasible and well accepted among breast cancer survivors. Quality of life and fatigue improved to a greater extent in women in the yoga group compared to the control group, although these differences did not meet statistical significance in the small sample in this study. Waist circumference decreased more among yoga group participants than among those in the control group. No between-group difference in weight

change was observed. Full results are reported separately.<sup>22</sup> The 26-week intervention consisted of facility- and home-based Viniyoga, a gentle form of Hatha yoga. Demographic, psychologic, health-related, and geographic predictors of adherence are also examined. This study extends the literature by providing new evidence that regular, long-term yoga practice is feasible in this population and addresses issues relevant to maximizing adherence.

## Materials and Methods

### Participants

Participants were 32 breast cancer survivors aged 47–74 years who were randomized to a 26-week Viniyoga intervention as part of a randomized controlled trial. All participants had a diagnosis of Stage 0–III breast cancer, had completed adjuvant therapy at least 3 months prior to enrollment (continued use of hormonal or biologic therapies was allowed), and had no physical or psychologic conditions that would contraindicate participation in the program. Eligible women had a body mass index (BMI)  $\geq 24.0$  kg/m<sup>2</sup> ( $\geq 23.0$  kg/m<sup>2</sup> for Asian-American women). This BMI criterion was chosen to facilitate recruitment while targeting only those women who were overweight/obese or at risk for overweight. Women were excluded if they had practiced yoga more than once per month during the past 6 months, were pregnant or planned to become pregnant, were diabetic, or had experienced a myocardial infarction or stroke in the past 6 months.

### Recruitment

Study participants were recruited between May 2007 and April 2008 using media placements, flyers, direct mailings, a study website, and referrals. A preliminary eligibility screening was conducted by telephone, after which interested individuals attended an information session and a clinic visit and completed questionnaires. Participants were block randomized to the yoga intervention or a wait-list control group on tumor stage, age, and BMI. Only women randomized to the yoga intervention are included in the current analyses. Written informed consent was obtained following the requirements of the Fred Hutchinson Cancer Research Center Institutional Review Board. Additional details are available elsewhere.<sup>22</sup>

### Assessment of predictor variables

Potential demographic, geographic, cancer-related, psychosocial, and anthropometric predictors of adherence were assessed at baseline. The majority of predictors were collected via self-report on the baseline questionnaire. Height, weight, and waist circumference were measured directly by study staff.

**Demographic predictors.** The following demographic variables were examined as potential predictors of adherence: age, educational attainment (high school, some college, college graduate, postgraduate degree), and work status (employed outside the home versus not).

**Geographic factors.** Driving distance (kilometers) and estimated drive time (minutes) from each participant's home

address to the facility were calculated using Google's mapping function (<http://maps.google.com/>).

**Physical activity.** Baseline leisure-time physical activity (summarized as total metabolic equivalent in minutes/week<sup>23</sup>) over the past 12 months was assessed using a self-administered version of the Modifiable Activity Questionnaire.<sup>24</sup> Twenty-nine (29) activities were listed (e.g., walking at a moderate pace, bicycling, jogging, and *t'ai chi*) and space for activities not listed was also included.<sup>22</sup>

**Cancer characteristics.** Cancer-related predictors included tumor stage at diagnosis (Stage 0, I, II, or III) and years since diagnosis (calculated as years from diagnosis date to randomization).

**Psychosocial factors.** Sleep was assessed using the following item from the Pittsburgh Sleep Quality Index<sup>25</sup>: "During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)".

Stress was measured using Cohen's 10-item Perceived Stress Scale,<sup>26</sup> a reduction of the original 14-item version<sup>27</sup> that retains good psychometric properties.<sup>26</sup> Potential scores range from 0 to 40, with higher scores reflecting greater perceived stress. Fatigue was assessed using the 13-item Functional Assessment of Chronic Illness Therapy fatigue subscale.<sup>28</sup> This measure has a potential score range of 0–160; higher scores reflect less fatigue (i.e. better functioning). The 20-item Centers for Epidemiological Studies Depression Scale<sup>29</sup> was used to evaluate depressive symptoms; the range of potential scores is 0–60 with higher scores indicating more depressive symptoms. Social support was assessed using the 12-item version of the Interpersonal Support Evaluation List. This measure produces a score range of 0–36, with high scores reflecting a greater availability of social support.

Self-efficacy for yoga was evaluated using a 6-item modified version of Bandura's Exercise Self-Efficacy Scale.<sup>30</sup> The items assessed the participant's confidence in her ability to perform yoga despite specific barriers (e.g., when too busy, tired, in a bad mood, on vacation, experiencing cancer-related pain/symptoms). Participants responded on an 11-point Likert scale (0=not at all confident, 10=very confident); item scores were then averaged to produce a total score ranging from 0 to 10.

**Anthropometrics.** Height, weight, and waist circumference were measured by study staff at the baseline clinic visit. Height without shoes was measured twice to the nearest 0.1 cm on a stadiometer; the two measures were averaged. Weight was measured to the nearest 0.1 kg on a balance beam scale. BMI was calculated as kg/m<sup>2</sup>. Waist circumference was measured twice at the end of normal expiration at the narrowest location on the torso, to the nearest 0.1 cm; the two measures were averaged.

### Intervention

The facility- and home-based intervention consisted of Viniyoga, a gentle, therapeutic style of Hatha yoga that is appropriate for various fitness and skill levels, including overweight and obese individuals. Viniyoga involves phys-

ical stretches and poses, breath control, and meditation and emphasizes individualization of postures to meet the abilities and needs of the individual. As a consequence, it is well suited for use in therapeutic settings. Viniyoga is characterized by the use of repetition into and out of postures in addition to holding postures. Gary Kraftsow evolved this approach to yoga from the teachings transmitted by T. Krishnamacharya and T.K.V. Desikachar of Madras, India.<sup>31</sup>

**Classes.** Participants were asked to attend at least one of three weekly Viniyoga classes at the study site (Fred Hutchinson Cancer Research Center, Seattle, WA). The Instructor Manual is part of Supplementary Data (Supplementary Data are available online at [www.liebertpub.com/acm](http://www.liebertpub.com/acm)). These 75-minute classes, developed specifically for the intervention, were designed to be easily modified for differing levels of ability and physical function. Each yoga practice opened with a 5–10-minute "check-in" period to allow participants to introduce themselves, discuss their current status, ask questions, or share concerns about their home practice or physical pain/tightness that instructors could address during the class. After sounding three *oms*, 5–8 minutes was allotted for breathing and body awareness exercises, including cultivating an intention for their practice. During this time, the teacher instructed the participants to focus on abdominal breathing and drew their attention to their breath. Next, instructors led the students through a total of 11–16 postures, including a mixture of supine, prone, quadruped, and standing poses. Each pose was repeated 6–8 times, alternating sides. The class was structured to gradually prepare students for the pinnacle pose or poses (e.g., triangle, lunge/warrior variations, standing forward bend, and standing twists) with preparatory poses (e.g., cat/cow, cobra, *chakravakasana*, wide leg-forward bends). Following the pinnacle pose, counter poses were performed that were specific to the pinnacle pose(s) (e.g., child's pose, bow/locust, lunge/warrior variations, *apanasana*, bridge, knee circles, and bound angle pose [*baddha konasana*]). Next, approximately 5 minutes was allotted for corpse pose (*savasana*). To conclude the practice, instructors led the participants in a seated silent meditation for approximately 5 minutes. They encouraged students to repeat the following mantra (Inhale "I calm my body"; Exhale "I smile, cultivating [fill in the blank] in this moment"). Participants were instructed to fill in the blank with a word (e.g., peace, healing, wholeness, etc.) that held meaning for them. All participants received a yoga mat and strap; blankets, blocks, and chairs were available in class. The classes were taught by local yoga instructors who had previous experience leading yoga classes for populations with special needs (e.g., cancer, multiple sclerosis). A manual with detailed class guidelines and descriptions of how poses are performed and can be modified was developed to standardize delivery of the intervention and is available by contacting the corresponding author.

**Home practice.** In addition to attending facility-based yoga classes, participants were also asked to perform 15–30-minute sessions of yoga at home, to achieve a total goal of 5 days per week (e.g., one class + four home sessions; two classes + three home sessions). Each participant received a DVD containing four different yoga practices as well as a

yoga booklet with descriptions and photographs depicting each of the poses used in the DVD. The Home Practice Guide is part of Supplementary Data (Supplementary Data are available online at [www.liebertpub.com/acm](http://www.liebertpub.com/acm)).

The DVDs were developed specifically for the study, and included instruction and modeling of poses by the class instructors. These practices mirrored the facility-based classes in both content and style, with fewer poses and breathing exercises in order to keep the practice to less than 30 minutes.

**Overall goal.** Participants were asked to attend at least one facility-based yoga class per week, supplemented by home-based yoga practice to meet an overall goal of five sessions per week. Thus, there were various ways to meet the goal (e.g., one class plus four home-based sessions; two classes plus three home-based sessions).

**Monitoring of adherence.** Adherence to facility-based yoga classes was tracked by attendance sign-in sheets collected by instructors at each class. Adherence to home-based yoga practice was determined from paper log sheets completed by participants and turned in to yoga instructors each week. Telephone counseling was used to encourage adherence and help participants navigate specific barriers. A participant received a call if she (1) failed to attend class for 2 consecutive weeks, (2) failed to meet the overall goal of five yoga sessions/week for 2 consecutive weeks, and/or (3) fell behind on returning her weekly logs.

#### Outcome measures

Given that the factors that influence attendance at yoga classes may be very different from those that predict at-home yoga, two adherence variables were calculated and separate analyses were conducted for them: (1) total number of facility-based classes attended during the 26-week intervention, and (2) total number of home yoga sessions performed during the intervention as assessed from weekly logs. If no log was turned in, it was assumed that the participant did not practice yoga that week.

#### Statistical analyses

The distributions of each potential predictor variable were examined to identify outliers and to determine appropriate measures for categorization and/or transformation. Variables for age, BMI, waist circumference, baseline physical activity, sleep, perceived stress, self-efficacy, driving time to class site, and distance to class site were left in their original form. For years since diagnosis, depressive symptoms, fatigue, and social support, a transformation was applied to reduce the impact of outliers on the correlation coefficients. The authors log transformed years since diagnosis and depressive symptoms and used a square root transformation for fatigue. Because neither of these transformations led to a normal distribution, the authors categorized social support as high (>25) versus low (<25). Due to outliers in the adherence outcomes, a log transformation was applied to both number of classes attended and number of home yoga sessions performed.

Associations between baseline variables and each of the adherence measures were next assessed using Pearson correlations (for continuous predictors) and regression (for categorical predictors). Variables that were univariately associated with an adherence measure based on having a

$p$ -value < 0.10 were then entered in a multiple regression model. In cases where two or more correlated measures with overlapping constructs (e.g., BMI and waist circumference) met the  $p$  < 0.10 criterion, only one was chosen for entry into the model. All participants were included in adherence analyses, regardless of whether they completed the study. Data analyses were performed using SAS 9.1 (SAS Institute Inc., Cary, NC) and all tests were two-sided.

## Results

### Sample characteristics

Participants were, on average, 60.3 (SD=7.2) years of age with a BMI of 29.8 kg/m<sup>2</sup> (SD=4.0, Table 1). Ninety-four

TABLE 1. BASELINE CHARACTERISTICS OF PARTICIPANTS (N=32)

	% or Mean (SD) (range)
Age (yrs)	60.3 (7.2) (47–74)
Non-Hispanic white	91%
Postgraduate degree	41%
Employed	56%
Weight (kg)	82.4 (13.6) (63.5–119.4)
BMI (kg/m <sup>2</sup> )	29.8 (4.0) (24.7–41.3)
Waist circumference (cm)	93.6 (7.4) (85.0–112.8)
Perceived stress <sup>a</sup>	13.5 (5.9) (0.0–30.0)
Depressive symptoms <sup>b,c</sup>	
<7	38%
7–10	28%
11+	34%
Fatigue <sup>c,d</sup>	
<124	31%
124–137	31%
137+	38%
Sleep (hours/night)	6.8 (1.0) (4.0–9.0)
Social support <sup>c,e</sup>	
Low (<29)	38%
High (≥29)	62%
Self-efficacy for yoga <sup>f</sup>	8.2 (1.3) (5.7–10.0)
Total physical activity (MET-hours/week)	23.6 (24.0) (0.0–120.4)
Tumor stage	
0 ( <i>in situ</i> )	44%
I	22%
II–IIIA	34%
Years since diagnosis <sup>c</sup>	
0.6–<3	31%
3–6	38%
7–18	31%
Distance to facility (km)	10.3 (7.7) (1.6–34.3)
Drive time to facility (min)	14.0 (6.5) (3.0–34.0)

<sup>a</sup>Assessed by the Perceived Stress Scale, score range 0–40.

<sup>b</sup>Assessed by the Centers for Epidemiologic Diseases Depression Scale, score range 0–40.

<sup>c</sup>Categories presented because variable distribution was skewed.

<sup>d</sup>Assessed by the Functional Assessment of Chronic Illness Therapy Fatigue, score range 0–160.

<sup>e</sup>Assessed by the Interpersonal Support Evaluation, score range 0–36.

<sup>f</sup>Assessed by a modified version of Bandura's Exercise Self-Efficacy scale, score range 0–10.

SD, standard deviation; BMI, body-mass index; MET, metabolic equivalent task.

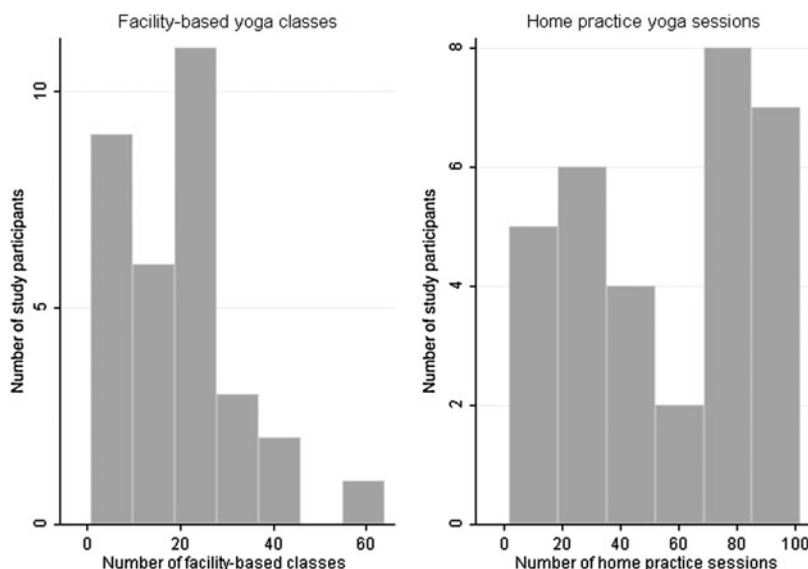


FIG. 1. Distribution of facility-based and home-based yoga practice.

percent (94%) were overweight or obese ( $BMI \geq 25.0 \text{ kg/m}^2$ ). Ninety-one percent (91%) were non-Hispanic white, 41% had a postgraduate degree, and 56% were employed outside the home. Participants reported low-to-moderate perceived stress and depressive symptoms, sleeping just under 7 hours per night on average, and moderate-to-high levels of social support. The majority was diagnosed at an early stage of breast cancer (44% at Stage 0, 22% at Stage I, and 34% at Stage II–III). Time since breast cancer diagnosis ranged from 0.6 to 18.1 years; 31% had been diagnosed in the previous 3 years. They lived, on average, 10.3 km ( $SD=7.7$ ) from the facility with an estimated mean drive time of 14 minutes ( $SD=6.5$ ).

#### Overall adherence

Over the 26-week intervention, participants attended, on average, 19.6 yoga classes ( $SD=13.0$ ; range 1–61) and completed 55.8 home yoga sessions ( $SD=32.8$ ; range 2–102). A more detailed breakdown of the distribution of facility- and home-based practice is shown in Figure 1. Participants were asked to practice yoga 5 times per week, including at least one facility-based session. Overall, participants adhered to 58% of that goal (75% of the goal for yoga classes and 54% of home-based sessions based on a conservative criterion of 4 home-based sessions per week) (Table 2). Fifty-nine percent (59%) of women achieved at least half the total number of goal sessions across the 26-week intervention; 72% of women achieved at least half of the goal for yoga classes and 53% achieved at least half of the goal for home-based practice.

#### Predictors of adherence

Associations between various factors and facility-based attendance and home practice are shown in Table 3. The number of facility-based yoga classes attended during the 6-month intervention was inversely associated with BMI ( $p=0.09$ ) and waist circumference ( $p=0.04$ ) and positively associated with self-efficacy ( $p=0.06$ ), being employed ( $p=0.07$ ), and tumor stage ( $p=0.02$ ). Home yoga practice was inversely associated with BMI ( $p=0.03$ ) and waist circumference ( $p=0.01$ ) and positively associated with self-

efficacy ( $p=0.01$ ). Because waist circumference and BMI were highly intercorrelated ( $r=0.61$ ,  $p=0.002$ ), only waist circumference was entered in the multivariable models as it had a stronger correlation with the outcomes than did BMI. Perceived stress, depressive symptoms, fatigue, and sleep were not statistically significantly associated with either facility-based or home-based yoga practice.

Results of the multivariable models are shown in Table 4, including all variables that were entered. In the final model for facility-based yoga practice, higher yoga self-efficacy ( $p=0.004$ ) and employment outside the home ( $p=0.004$ ) were associated with greater class attendance. In the model for home-based yoga, higher waist circumference was marginally associated with less home yoga practice ( $p=0.05$ ) and higher self-efficacy was marginally associated with more home practice ( $p=0.06$ ).

#### Discussion

This pilot study provides detailed adherence data from a 6-month randomized trial of yoga among breast cancer survivors and includes a quantitative analysis of predictors

TABLE 2. PERCENT OF YOGA GOAL ACHIEVED

	Total yoga	Facility-based yoga classes	Home-based yoga sessions
Percent of goal sessions completed <sup>a</sup>			
Mean	58%	75%	54%
Range	4–119%	4–235%	2–98%
Percent of participants adhering to criterion:			
≥90% of goal	16%	31%	13%
≥75% of goal	41%	53%	41%
≥50% of goal	59%	72%	53%
≥25% of goal	78%	78%	75%

<sup>a</sup>Participants were asked to complete one yoga class plus four home-based sessions per week, or an equivalent combination totaling 5 days of yoga (e.g., two classes and three home sessions). Percents for home-based yoga are conservatively based on the maximum goal of four home-based sessions.

TABLE 3. ASSOCIATIONS BETWEEN DEMOGRAPHIC, ANTHROPOMETRIC, CANCER, HEALTH, AND GEOGRAPHIC FACTORS AND ADHERENCE TO SUPERVISED YOGA CLASSES AND HOME-BASED YOGA OVER 6 MONTHS (N=32)

	Facility-based yoga classes <sup>a</sup>	Home-based yoga <sup>b</sup>
<i>Continuous variables</i>	<i>Correlation<sup>c</sup></i> (p-value)	<i>Correlation<sup>c</sup></i> (p-value)
Age (years)	-0.15 (0.41)	-0.06 (0.74)
BMI (kg/m <sup>2</sup> )	<b>-0.31 (0.09)</b>	<b>-0.38 (0.03)</b>
Waist circumference (cm)	<b>-0.37 (0.04)</b>	<b>-0.44 (0.01)</b>
Perceived stress	-0.03 (0.88)	-0.007 (0.97)
Depressive symptoms <sup>d</sup>	0.02 (0.90)	-0.005 (0.98)
Fatigue <sup>e</sup>	0.13 (0.46)	0.09 (0.62)
Sleep (typical h/night)	0.17 (0.36)	0.22 (0.23)
Self-efficacy	<b>0.34 (0.06)</b>	<b>0.42 (0.01)</b>
Baseline physical activity (MET-h/week)	0.12 (0.52)	0.14 (0.44)
Years since diagnosis <sup>d</sup>	-0.11 (0.57)	0.07 (0.69)
Driving time to facility (min)	-0.21 (0.24)	-0.00 (0.98)
Distance to facility (km)	-0.19 (0.29)	-0.01 (0.95)
<i>Categorical variables</i>	<i>β<sup>f</sup> (p-value)</i>	<i>β<sup>f</sup> (p-value)</i>
Postgraduate degree vs. college degree or less	1.55 (0.18)	0.91 (0.81)
Employed vs. not employed	<b>1.80 (0.07)</b>	1.77 (.21)
Tumor stage I-III A vs. 0	<b>2.05 (0.02)</b>	1.67 (0.17)
High vs. low social support	1.07 (0.85)	1.23 (0.60)

Bolded values have a  $p < 0.1$ .

<sup>a</sup>Number of yoga classes attended, as recorded on attendance sheets.

<sup>b</sup>Number of home-based yoga sessions, as recorded on participant logs.

<sup>c</sup>Pearson's  $r$ .

<sup>d</sup>Log transformed to reduce effect of outliers on the correlation analysis.

<sup>e</sup>Square-root transformed to reduce effect of outliers on the correlation analysis.

<sup>f</sup>Outcome variables were log-transformed for all analyses. Beta values have been back-transformed.

of adherence. The trial was notable both for the duration of the intervention, which is longer than those previously reported in this population, as well as the large amount of yoga that participants were asked to perform (5 days of yoga practice per week, including at least one facility-based class).

Consistent with a report of a 6-month yoga intervention among healthy older adults,<sup>32</sup> it was found that demographic characteristics did not predict adherence. Perceived

stress, fatigue, and social support were also not predictive of adherence. However, several easy-to-assess factors, including self-efficacy, waist circumference, and work status were predictive of class attendance and/or home practice.

The finding that self-efficacy for yoga was a significant or near-significant predictor of adherence to both supervised and home-based practice is supportive of similar results reported by Speed-Andrews et al.<sup>21</sup> and lends credence to the utility of self-efficacy in the study of yoga adoption. The current results showing a nearly significant inverse association of waist circumference and adherence to home-based yoga are consistent with observational data showing that higher levels of obesity are associated with lower uptake of yoga among breast cancer survivors.<sup>33</sup> Although the unadjusted association between higher waist circumference and lower class attendance was significant, waist circumference was not found to be predictive of class attendance in the final multivariable model.

The observation that employment outside the home was associated with better class attendance is likely due to the fact that two of the three classes were scheduled either early in the morning or early in the evening on a weekday. While convenient for women who worked outside the home, many retired or nonworking women found these times to be difficult as they required navigating rush-hour traffic. The associations reported in this study require replication in a larger and more diverse sample. They do, however, provide an initial guide for maximizing adherence in future studies. For example, programs could facilitate attendance by using self-efficacy assessments to identify those participants who may benefit from additional support and/or including specific intervention modules focused on improving self-efficacy. The lower observed adherence to home-based yoga among women with larger waist circumference is an interesting finding that may be related to physiologic factors (e.g., higher levels of joint pain from excess weight) and/or psychological factors (e.g., more difficulty with self-directed practice). Additional research is needed to better understand and address the specific issues related to yoga participation among obese women.

In contrast to others' findings,<sup>12,19,21</sup> higher levels of fatigue were not associated with poorer adherence to either facility- or home-based yoga in our study. This may be due to differences in fatigue measure used, the type of yoga intervention, the study population, or other factors. Similar to the findings in the study by Speed-Andrews and colleagues, class attendance was associated with advanced tumor stage; however, this association weakened and was no longer statistically significant, after controlling for waist circumference, self-efficacy, and work status.

TABLE 4. RESULTS OF MULTIVARIABLE REGRESSION TO PREDICT ADHERENCE TO YOGA (N=32)

	Variable	β <sup>a</sup> (95% CI)	p
Class attendance <sup>a</sup>	Waist circumference (1-cm increase)	-1.49 (0.80, 2.75)	0.62
	Self-efficacy (1-pt change)	1.34 (1.04, 1.74)	0.004
	Work status (employed vs. not employed)	1.94 (0.97, 3.88)	0.004
	Tumor stage (0 vs. I-III A)	0.99 (0.95, 1.03)	0.20
Home practice <sup>a</sup>	Waist circumference (cm)	-0.95 (0.91, 1.00)	0.05
	Self-efficacy (1-pt change)	1.29 (0.99, 1.69)	0.06

<sup>a</sup>Outcome variables were log-transformed for all analyses. Beta values have been back-transformed. CI, confidence interval.

Strengths of this pilot study include the use and assessment of both supervised and home-based yoga, detailed adherence tracking including class sign-in sheets and daily logs of home practice, and an intervention that is longer than those previously reported in this population. The study also had several limitations. Similar to most other trials in this area, the current study had a relatively small sample size, limiting statistical power. Additionally, a relatively large number of factors were examined, so it is possible that some statistically significant associations were observed due to chance. The use of self-report logs to assess adherence to home-based yoga is subject to participant error or misrepresentation of the frequency of yoga practice. Finally, this sample was homogeneous in terms of ethnicity and education level, which reduced our ability to examine these factors as predictors of adherence.

### Conclusions

Our study confirms and extends previous findings showing that both class-based and home-based yoga is feasible and well accepted among survivors of breast cancer. Useful topics for future study include adherence in interventions longer than 6 months, comparison of adherence to different types of yoga, and the use of larger samples to enable more powerful analyses of correlates of adherence.

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No competing financial interests exist.

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