EXERCISE PARTICIPATION AFTER DIAGNOSIS OF BREAST CANCER: TRENDS AND EFFECTS ON MOOD AND QUALITY OF LIFE

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SUMMARY

Individuals treated for cancer often experience higher levels of emotional distress than the general population. Previous research has shown that exercise can have an ameliorating effect on these problems. This 12-month prospective longitudinal study investigated mood, quality of life, cancer-related symptoms, and exercise behavior of 69 women who had completed treatment for Stage 0–2 breast cancer. We studied the natural progression of exercise participation after cancer treatment. Effects on mood, quality of life, and cancer-related symptoms were assessed after controlling for demographic variables, disease variables, social support, and baseline values to test the hypothesis that women who exercised were more likely to report better mood, higher quality of life, and fewer cancer-related symptoms. Results indicated that women did not increase their exercise participation over time and that overall mean minutes of exercise participation were below recommended levels. Baseline demographic predictors of exercise participation included younger age, having a spouse or partner, increased time since diagnosis, higher social support, and higher depression. Exercise participation was associated with improved physical functioning, but not overall mood or cancer-related symptoms. We discuss implications of these findings towards the well-being of breast cancer survivors. Copyright © 2002 John Wiley & Sons, Ltd.

INTRODUCTION

Clinical and research data indicate that cancer patients frequently experience considerable psychological distress as a result of being diagnosed with and treated for cancer (Derogatis, 1986). The Psychological Aspects of Breast Cancer Study Group (1987) found that early-stage breast cancer patients had statistically significant levels of somatic distress, depreciation of self, poor body image, psychosocial impairment, and physical complaints such as fatigue, weight gain, and sleep disturbances. The distress that patients experience is long lasting, as longitudinal studies have found persistent psychological distress among patients a year or more following diagnosis, often despite improvements in physical functioning (Holzner et al., 2001; Saleeba et al., 1996; Vinokur et al., 1990). Bleiker et al. (2000) found that almost 2 years after diagnosis, 16% of women diagnosed with early-stage breast cancer still experienced a high level of psychological distress as measured by the Impact of Events Scale. However, psychosocial interventions offered in attempts to improve emotional and functional adjustment among those treated for cancer have provided beneficial effects (see review by Meyer and Mark, 1995).

As an adjuvant psychosocial treatment, exercise may ameliorate both physical and emotional symptoms associated with cancer (see reviews by Courneya and Friedenreich, 1999; Pinto et al., 2000; Pinto and Maruyama, 1999). Cross-sectional studies and those offering exercise programs suggest that exercise participation after a cancer diagnosis may help to improve mood and quality
of life. Collectively, research demonstrates that breast cancer patients can participate in exercise programs during treatment, which may help attenuate various symptoms and side effects of cancer and its treatment (MacVicar and Winningham, 1986; MacVicar et al., 1989; Mock et al., 1994, 1997; Winningham et al., 1989). Additionally, our review of the effects of exercise participation on mood among those diagnosed with cancer suggests that exercise can contribute to benefits similar to those reported by ‘healthy’ exercisers such as improved mood (Pinto and Maruyama, 1999).

A few studies have examined quality of life in specific groups of cancer patients (see Courneya and Friedenreich, 1999). Courneya and colleagues found that breast and colorectal cancer patients reported reductions in exercise during cancer treatment and an increase in exercise levels thereafter (Courneya and Friedenreich, 1997a,b). Among the breast cancer patients, exercise during active treatment, as well as maintenance of exercise afterwards, was associated with higher quality of life and satisfaction with life. However, these studies used a retrospective approach with limitations imposed by recall bias (Courneya and Friedenreich, 1997a).

This paper presents data on exercise behavior collected during assessments in a longitudinal, prospective study examining affective distress and coping in early-stage breast cancer patients recruited within a year of diagnosis. Women were recruited into the study after completion of medical treatment. No treatment or intervention was offered to the respondents. Hence, we examined reports of exercise participation prospectively in the absence of any intervention. There were three primary aims in examining self-reports of exercise participation after cancer diagnosis: First, we examined the trends in exercise participation over the 1 year following cancer diagnosis and treatment. Our hypothesis was that exercise participation would increase over the 12-month assessment. That is, as physical sequelae from cancer treatment (e.g. pain from surgery, fatigue) abate over time, women may resume activity or adopt exercise.

Second, we hypothesized that women who exercised are likely to report better mood, higher quality of life, and fewer cancer-related symptoms. After controlling for other variables, we examined the contributions of exercise to mood, quality of life, and cancer symptoms reported at each assessment. Researchers have not examined the role of exercise in mood and quality of life after controlling for demographic, disease/treatment-related factors, and social support, which are known to affect mood and quality of life (Ferrell et al., 1995; Lichtman et al., 1987).

Finally, we were interested in identifying demographic and other variables associated with exercise participation (e.g. medical treatment, social support) so as to identify the subgroups that would be more amenable to increasing exercise behavior. Studies in non-cancer populations have identified multiple factors associated with sedentary behavior (see Blair et al., 1993; Jones et al., 1998; King et al., 1992), as well as barriers to increasing physical activity among women (see Marcus et al., 1995; Pinto et al., 1996). Among women who have been treated for cancer, disease-related factors such as stage of disease and type of treatment may also affect subsequent exercise participation. Previous research has not examined the role of these factors in exercise behavior among those diagnosed with cancer. Hence, we assessed the association of selected biopsychosocial variables including demographic, disease, and phychosocial variables with exercise participation among women treated for early-stage breast cancer.

METHOD

Subjects

Sixty-nine women with early stage (Stages 0, 1 and 2) breast cancer were recruited from local hospitals to participate in a longitudinal study of adjustment to breast cancer. The study was approved by the Institutional Review Boards at the Miriam Hospital and Roger Williams Medical Center. Tumor registry records were reviewed to identify women (age ≥ 18 years) who had been diagnosed with Stages 0–2 breast cancer in the past year. Letters describing the study were mailed to eligible women, followed by a telephone call to determine interest in participation. Eligibility criteria included: diagnosis of Stage 0–2 breast cancer over the past year, age ≥ 18 years, and ability to complete questionnaires. Mean age of the sample was 57.5 years, 16% were diagnosed with Stage 0, 52% with Stage I, and 32% with Stage II breast cancer. Eighteen subjects (25%)
reported previous treatment for a psychological difficulty. See Table 1 for demographic characteristics of the sample.

Written informed consent was obtained at the initial meeting and the baseline assessments were completed.

**Procedure**

Patients who were interested in participating were asked to attend an interview session at one of the two local hospitals. Patients agreed to provide data at the initial interview and at four follow-up interviews at 3-month intervals. Written informed consent was obtained at the initial meeting and the baseline assessments were completed.

**Measures**

Demographic information was obtained at baseline. Disease variables, cancer treatments, and Karnofsky ratings were obtained through review of tumor registry records and medical records. The Karnofsky Performance Status Scale

<table>
<thead>
<tr>
<th>Table 1. Demographic characteristics of the sample (n = 69)</th>
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<tbody>
<tr>
<td>Demographic factors</td>
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<tr>
<td>Age</td>
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<tr>
<td>Days since diagnosis</td>
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<tr>
<td>Mean Karnofsky scores</td>
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<tr>
<td>Race: White</td>
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<tr>
<td>Marital status</td>
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<td>Single/widowed/separated/divorced</td>
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<tr>
<td>Married/living with partner</td>
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<tr>
<td>High school</td>
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<td>College</td>
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<td>Employment type (n = 68)</td>
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<td>Unemployed/student/disabled/retired</td>
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<td>Part-time</td>
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<td>Full-time</td>
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<td>2</td>
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<tr>
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<td>Mastectomy*</td>
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<td>Axillary node dissection</td>
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<td>Reconstruction</td>
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<td>Chemotherapy</td>
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<td>Radiation therapy</td>
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<td>Hormonal therapy</td>
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<tr>
<td>Past psychological treatment (n = 68)</td>
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</tbody>
</table>

*Ten patients had both a lumpectomy and a mastectomy.
is a well-known health profession-rated performance status scale that rates a patient’s ability to carry on normal activity (Karnofsky and Burchenal, 1949). Karnofsky ratings were obtained at baseline. In addition, subjects completed the following measures assessing mood, quality of life, cancer-related symptoms, exercise behavior, and related variables at each assessment:

1. Profile of Mood States—Short Form (POMS-SF, McNair, et al., 1992). This is a 30-item short form of the original 65-item POMS (McNair et al., 1971). The POMS Short Form taps a variety of mood states including anger, tension, depression, vigor, fatigue, confusion, and total mood disturbance. The subscales on the Short Form are strongly correlated with the subscales on the original POMS (r’s > 0.95, Engebretson et al., 1999). Reliability estimates range from 0.75 to 0.90 (McNair et al., 1992). The Total Mood Disturbance score and the scores on the Vigor subscale (the only positive mood scale within the POMS) were used as outcomes in this paper. The baseline Depression subscale score was used as a predictor variable for exercise participation because data suggested that cancer patients who experience more depressive symptoms are more likely to seek alternative and complementary therapies (Burstein et al., 1999).

2. Memorial Symptom Assessment Scale (MSAS, Portenoy et al., 1994b) is a patient-rated instrument for the severity, frequency, and distress associated with physical and psychological symptoms of cancer. The MSAS has been found to be reliable and valid. It yields three subscales: Physical Symptoms, Psychological Symptoms, and a Global Distress Index (GDI). The GDI scale is believed to be the most clinically useful subscale (Portenoy et al., 1994b) and was therefore used in analyses. Higher GDI scores indicate greater symptom-related distress.

3. Duke-UNC Functional Social Support Questionnaire (Broadhead et al., 1988) is an eight-item instrument that assesses the respondent’s perception of the degree of social support received. It produces two subscales measuring confidant support (e.g. chances to talk about problems, invitations for social activities) and affective support (love and affection, and caring). The subscales are reliable (alpha coefficients for confidant support = 0.62, and affective support = 0.76), and the scores have been reported to be negatively associated with health care utilization (Broadhead et al., 1989).

4. MOS Short Form Health Survey (SF-36). The SF-36 was constructed for use in the Medical Outcomes Study (MOS) and was designed for use in clinical practice and research (Ware and Sherbourne, 1992). The SF-36 assesses eight health concepts focusing on limitations in physical, social and role activities, bodily pain, energy/fatigue, and general health perception. Reliability coefficients range from 0.78 to 0.93 (McHorney et al., 1992). Higher scores indicate higher QOL. Prior research indicated that exercise may affect certain dimensions of quality of life (Pinto et al., 1997) and hence, for this study, scores on the Physical Functioning, Physical Role Functioning, Vitality, and Pain subscales were examined.

5. COPE (Carver et al., 1989) is a multi-dimensional coping inventory with 14 scales and has two versions: dispositional and situational coping. We used the dispositional coping inventory. Only the Active Coping subscale was used in the regression analyses on exercise participation because our previous data showed that exercisers were more likely to report active coping than sedentary women (Pinto et al., 1998). Active Coping is the process of taking active steps to remove or circumvent a stressor or ameliorate its effects and is similar to problem-focused coping. Higher scores on the subscale indicate greater use of active coping. Test–retest reliability of the Active Coping subscale is 0.69 and internal consistency is 0.62 (Carver et al., 1989).

6. Exercise participation. Participation in vigorous (e.g. running, jogging) and moderate-intensity exercise (e.g. brisk walking) was examined separately by asking subjects to report how often they exercised, the average duration of an exercise session, how long they had participated in such exercise, and the type of exercise activity (e.g. running, aerobics). Subjects were also queried as to whether they intended to increase, decrease, or not change their exercise participation over the next 3 months.

Analyses

To examine changes in exercise behavior over time, repeated measures ANOVAs were conducted on the reported minutes (mean duration x mean frequency) of vigorous- and moderate-intensity exercise per week at each assessment. Proportions of the sample meeting exercise recommendations (vigorous- or moderate-intensity) were determined.
To identify baseline predictors of exercise participation, after removing outliers, log transformations were applied to the response variables to make them as close to normality as possible. A generalized estimating equation model (Liang and Zeger, 1986) was fitted for minutes of exercise participation (vigorous- and moderate-intensity exercise separately) with the following baseline biopsychosocial variables: demographics (age, BMI, marital status [married/living together vs other], disease variables (stage of disease, time since diagnosis, chemotherapy treatment [yes/no]), and Karnofsky scores), social support (confidant and affective), coping (Active Coping subscale of the COPE), depression (Depression subscale of the POMS), and intention to exercise. The software package Stata was used for these analyses.

We also examined the contributions of exercise participation and other biopsychosocial variables to mood (Total Mood Disturbance and Vigor), quality of life (Physical Functioning, Physical Role Functioning, Pain, and Vitality), and cancer-related symptoms. Each of these models was fit to data from the four follow-up points while controlling for baseline value of the outcome. Generalized estimating equation models were used for Total Mood Disturbance and Vigor subscales of the POMS, Global Distress Index of the MSAS, and the Pain, Vitality, and Physical Functioning subscales of the SF-36, after applying log transformations or power transformations to render these outcomes approximately normal. Ordinal logistic regressions (Agresti, 1990) were used for the Physical Role Functioning of the SF-36, as this outcome could not be approximately normalized. Exercise participation at each assessment was categorized into four levels: no exercise participation, exercising below recommendations for either vigorous- or moderate-intensity exercise, exercising at recommended levels for moderate-intensity exercise only [exercising for \( \geq 30 \text{ min on } \geq 5 \text{ days/week} \) (Pate et al., 1995)], and exercising at recommended levels for vigorous-intensity exercise exercising for \( \geq 20 \text{ min on } \geq 3 \text{ days/week} \) (American College of Sports Medicine [ACSM], 1990). Level of exercise from the previous time point was entered as a predictor variable. Other predictor variables included: demographics (age, BMI, marital status [married/living together vs other]), disease variables (stage of disease [0,1,2], time since diagnosis, chemotherapy [yes/no], Karnofsky rating), and social support at baseline, 3, 6, 9, and 12 months (confidant and affective support subscales of the FSSQ). While it is difficult to draw causal inferences due to the single-group design of this study, the fact that baseline outcome was controlled allows us to cautiously attribute causal impact to those covariates found to be significant.

Normally, in order to test our hypotheses regarding the effects of exercise on the multiple outcomes studied, a Bonferroni correction would be appropriate. However, rather than focusing entirely on the effects of exercise, we were attempting to find the best available model for each of the outcomes, rendering the Bonferroni correction unnecessary. Nevertheless, any model with \( p \)-values greater than 0.01 should be interpreted with caution due to the multiplicity of outcomes studied.

RESULTS

Demographic variables

Respondents were Caucasian, middle-aged (mean age = 57.5, S.D. 13.2), and highly educated (68% had attended college). Approximately half the sample was married (57%), the same proportion was Catholic, and 40% were working full time. Over half the sample had been diagnosed with Stage I breast cancer (52%) with treatments of radiation (54%), chemotherapy (32%), hormonal therapy (52%), and mastectomy (55%). Subjects completed baseline assessments on an average of 247 days since diagnosis (S.D. = 106, range = 27–483) (see Table 1). Mean scores on mood, cancer symptoms, and quality of life can be seen in Table 2.

Changes in exercise participation over 12 months

A number of women reported no exercise at the assessments, leading to a skewed distribution. There was a small increase in the reported participation in vigorous-intensity exercise (mean minutes) over the five assessments: 33.1 min (baseline), 42.1 min (3 months), 49.0 min (6 months), 47.3 min (9 months), and 37.3 min (12 months), but the increase was non-significant. The number reporting participation in vigorous-intensity exercise increased over time: 9 (baseline), 13 (3 months), 18 (6 months), 18 (9 months), and 20 (12 months). Only one participant met guidelines for
vigorous exercise participation (ACSM, 1990) at each of the five assessments, and 58% \((n = 40)\) of the sample did not meet these recommendations at any assessment. Nine percent \((n = 6)\) met recommendations for vigorous-intensity exercise at baseline, and the percent increased over time: 16% \((n = 11)\) at 3 months, 17% \((n = 12)\) at 6 months, 22% \((n = 15)\) at 9 months, and 16% \((n = 11)\) at 12 months. There were no significant changes in the proportion of women exercising at recommended levels (vigorous-intensity exercise) over time.

There was an increase in mean minutes of moderate-intensity exercise across the 12 months: 65.4 min at baseline \((S.D. = 111.7)\), 84.6 min at 3 months \((S.D. = 196.3)\), 88.0 min at 6 months \((S.D. = 160.4)\), 77.9 min at 9 months \((S.D. = 154.0)\), and 103.2 min at 12 months \((S.D. = 205.0)\), but again the increase was non-significant. As with participation in vigorous-intensity exercise, there was an increase in the number of women reporting moderate-intensity exercise participation from baseline to 12-month follow-up: 29 (baseline), 27 (3 months), 32 (6 months), 20 (9 months), and 37 (12 months). Only one woman met guidelines for moderate-intensity exercise participation across the five assessments. A minority of the sample met recommendations for moderate-intensity exercise at each assessment: 10% \((n = 7)\) at baseline, 10% \((n = 7)\) at 3 months, 16% \((n = 11)\) at 6 months, 14% \((n = 10)\) at 9 months, and 16% \((n = 11)\) at 12 months. There were no significant changes in the proportion of women exercising at recommended levels (moderate-intensity exercise) over time.

Almost half the sample reported an intention to increase exercise at each assessment (51% at baseline, 53% at 3 months, 45% at 6 months, 65% at 9 months, and 44% at 12 months). A large group stated that they preferred to maintain their current activity level (42% at baseline, 39% at 3 months, 52% at 6 months, 35% at 9 months, and 50% at 12 months). A minority reported the intention to decrease exercise (7% at baseline, 9% at 3 months, 3% at 6 months, 0% at 9 months, and 6% at 12 months).

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**Table 2. Mean scores on mood, cancer symptoms and quality of life across 12 months**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3 months</th>
<th>6 months</th>
<th>9 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>POMS Total Mood Disturbance</td>
<td>67</td>
<td>11.5</td>
<td>(18.0)</td>
<td>68</td>
<td>11.2</td>
</tr>
<tr>
<td>POMS Vigor</td>
<td>69</td>
<td>9.0</td>
<td>(4.9)</td>
<td>68</td>
<td>9.7</td>
</tr>
<tr>
<td>MSAS Global Distress Index</td>
<td>65</td>
<td>0.7</td>
<td>(0.6)</td>
<td>69</td>
<td>0.8</td>
</tr>
<tr>
<td>SF-36 Physical Functioning</td>
<td>69</td>
<td>72.7</td>
<td>(24.9)</td>
<td>69</td>
<td>72.9</td>
</tr>
<tr>
<td>SF-36 Physical Role Functioning</td>
<td>69</td>
<td>55.8</td>
<td>(41.8)</td>
<td>69</td>
<td>67.0</td>
</tr>
<tr>
<td>SF-36 Pain</td>
<td>69</td>
<td>71.7</td>
<td>(27.2)</td>
<td>69</td>
<td>71.1</td>
</tr>
<tr>
<td>SF-36 Vitality</td>
<td>69</td>
<td>56.2</td>
<td>(21.4)</td>
<td>69</td>
<td>56.1</td>
</tr>
</tbody>
</table>

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Variables predictive of exercise participation

Older age negatively predicted vigorous-intensity exercise participation \((\beta = -0.04, z = -3.87, p \leq 0.01, \text{C.I.} -0.07, -0.02)\). Participation in vigorous-intensity exercise increased with greater time since diagnosis \((\beta = 0.004, z = 2.98, p <0.01, \text{C.I.} +0.001, +0.007)\) and greater confidant support \((\beta = 0.12, z = 2.61, p <0.01, \text{C.I.} +0.03, +0.20)\). Women who lived with a spouse/partner were more likely to report vigorous-intensity exercise \((\beta = 0.79, z = 1.32, p <0.01, \text{C.I.} +0.18, +1.40)\). Higher baseline depression scores predicted greater participation in vigorous-intensity exercise \((\beta = 0.008, z = 0.60, p <0.01, \text{C.I.} +0.22, +0.01)\). No predictor variables for moderate-intensity exercise were identified.

Predictors of mood (Total Mood Disturbance and Vigor)

When examining the GEE model for Total Mood Disturbance, higher affective social support was the significant predictor of lower Total Mood Disturbance \((\chi^2 = 101.3, p \leq 0.0001)\). Exercise participation did not predict overall mood disturbance.

The regression on the Vigor subscale (the only positive mood subscale on the POMS) revealed several significant predictors \((\chi^2 = 95.4, p \leq 0.0001)\). Higher vigor was predicted by higher affective social support \((\beta = 0.32, z = 3.07, p = 0.002, 95\% \text{ C.I.} +0.12, +0.52)\) and longer time since diagnosis was also predictive of higher vigor \((\beta = 0.008, z = 2.26, p = 0.024, 95\% \text{ C.I.} +0.001, +0.02)\). Higher BMI was inversely related to vigor \((\beta = -0.12, z = -0.22, p = 0.03, 95\% \text{ C.I.}, -0.22, -0.01)\).

Predictors of cancer symptoms (Global Distress Index)

Two variables were found to be significant predictors of global distress regarding cancer symptoms as measured by the Global Distress Index on the MSAS \((\chi^2 = 56.04, p \leq 0.0001)\). Higher levels of affective social support predicted lower global distress \((\beta = -0.06, z = -3.65, p = 0.0001, 95\% \text{ C.I.}, -0.09, -0.03)\), as did longer time since diagnosis \((\beta = -0.001, z = -2.25, 95\% \text{ C.I.} -0.002, -0.0001)\). Exercise was not found to be predictive of global distress.

Predictors of quality of life (Physical Functioning, Physical Role Functioning, Pain, and Vitality)

Four variables were significant predictors of Physical Functioning \((\chi^2 = 163.62, p \leq 0.0001)\): exercising below recommended levels \((\beta = 35.13, z = 1.32, p = 0.19, 95\% \text{ C.I.}, 0.42, 0.73)\), exercising at recommended levels for moderate-intensity exercise \((\beta = 111.07, z = 2.86, p = 0.004, 95\% \text{ C.I.}, 34.82, 187.32)\), exercising at recommended levels for vigorous-intensity exercise \((\beta = 130.49, z = 3.72, p = 0.0001, 95\% \text{ C.I.}, 61.69, 199.29)\) were positive predictors, whereas older age was a negative predictor of Physical Functioning \((\beta = -5.34, z = -3.04, p = 0.002, 95\% \text{ C.I.}, -8.79, -1.89)\).

Affective social support positively predicted Physical Role Functioning \((\beta = 0.16, z = 2.56, p = 0.01, 95\% \text{ C.I.}, +0.04, +0.29)\), while older age \((\beta = -0.04, z = -2.66, p = 0.008, 95\% \text{ C.I.} -0.06, -0.09)\) and higher BMI \((\beta = -0.05, z = -0.21, p = 0.038, 95\% \text{ C.I.}, -0.09, -0.003)\) were negative predictors of Physical Role Functioning \((\chi^2 = 19.42, p \leq 0.0006)\).

Higher level of confidant social support \((\beta = 0.75, z = 2.42, p = 0.02, 95\% \text{ C.I.}, +0.14, +1.36)\) and lower BMI \((\beta = -0.67, z = -2.65, p = 0.008, 95\% \text{ C.I.}, -1.16, -0.17)\) predicted greater freedom from pain (higher Pain scores), \(\chi^2 = 61.72, p \leq 0.0001\).

Three variables predicted higher scores on the Vitality subscale \((\chi^2 = 82.51, p \leq 0.0001)\): higher affective social support \((\beta = 1.17, z = 2.48, p = 0.01, 95\% \text{ C.I.}, +0.24, +2.09)\), lower BMI \((\beta = -0.60, z = -2.77, p = 0.006, 95\% \text{ C.I.}, -1.02, -0.17)\), and longer time since diagnosis \((\beta = 0.03, z = 2.08, p = 0.04, 95\% \text{ C.I.}, +0.01, +0.06)\). Predictor variables for Total Mood Disturbance, POMS Vigor, GDI, and quality of life outcomes are summarized in Table 3.

DISCUSSION

A primary purpose of this paper was to examine the natural course of exercise participation among women diagnosed and treated for early-stage breast cancer. We found, contrary to our
hypothesis, that women did not significantly increase exercise participation over time. Only one participant met guidelines for moderate- or vigorous-intensity exercise across the five assessments. More disturbing was the observation that 35% of the sample did not meet guidelines at any assessment. Overall mean minutes of exercise participation (moderate- and vigorous-intensity) were below recommended levels (approximately 150 min/week of moderate-intensity exercise or 120 min/week of vigorous-intensity exercise).

These data, together with the findings on intended change in exercise participation, showed that although a majority of the sample were not exercising at levels that can yield health benefits, they expressed the intention to increase activity levels. This suggests that early-stage cancer patients may respond positively to recommendations by health care professionals to become physically active as they recover from cancer treatments. However, one cannot overlook the observation that a large subgroup (35–52%) was not interested in changing exercise participation. The reasons for the lack of interest are unclear. Perhaps women who have breast cancer are unaware of the potential benefits that exercise may offer towards improving cardiovascular health, reducing weight gain, and improving mood.

When examining the baseline predictors of exercise participation, we found that being younger, having greater confidant social support, living with a partner or spouse, and increased time since diagnosis were positively associated with vigorous-intensity exercise. Younger age and social support have been positively associated with exercise among women in the general population (Sallis et al., 1992, 1989). Surprisingly, higher baseline levels of depression also predicted greater participation in vigorous exercise. Studies have shown that exercise helps to improve depressed mood (e.g., Doyne et al., 1987; King et al., 1991; Ossip-Klein et al., 1989), and it is possible that potential mental health benefits may have prompted participation in vigorous exercise. These data are somewhat consistent with the findings of higher depression among newly diagnosed early-stage breast cancer patients who used alternative medicine three months following surgery (Burstein et al., 1999). Our findings suggest that breast cancer survivors who are younger, more depressed, and have social support may be receptive to exercise recommendations with increased time since diagnosis.

We were unable to identify variables associated with moderate-intensity exercise over the 12 months. The inability to do so may be related to

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**Table 3. Predictors of mood, cancer symptoms and quality of life over 12 months**

<table>
<thead>
<tr>
<th>Variables</th>
<th>POMS Total Mood Disturbance</th>
<th>POMS Vigor</th>
<th>MSAS Global Distress Index</th>
<th>SF-36 Physical Functioning</th>
<th>SF-36 Physical Role Functioning</th>
<th>SF-36 Pain</th>
<th>SF-36 Vitality</th>
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<td>Chemotherapy</td>
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<td>Exercise participation</td>
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</table>

![](https://doi.org/10.1002/psy2002.11.389) = p ≤ 0.05/0.1.
difficulties in recall of moderate-intensity activity: participants may have found it easier to recall a discrete event such as running (a vigorous-intensity exercise) vs brisk walking (moderate-intensity exercise).

We also examined the contributions of exercise to mood (POMS Total Mood Disturbance and Vigor), cancer symptoms (Global Distress Index), and quality of life (four subscales of the SF-36). We found that exercising at or below recommended levels for moderate-intensity or vigorous-intensity was associated with higher levels of Physical Functioning (SF-36) vs no exercise. This is consistent with previous findings (see Courneya and Friedenrich [1999] for review). Exercise participation was not associated with Total Mood Disturbance (POMS) nor with the Global Distress Index. It is unclear why exercise was not associated with overall mood in our sample. Meta-analytic reviews have concluded that both acute and chronic exercises are related to a significant reduction in depression (e.g. Calfas and Taylor, 1994; North et al., 1990) and that there is a small-to-moderate relationship in the effects of both acute and chronic exercise in reducing anxiety e.g. Calfas and Taylor, 1994; Landers and Petruzzello, 1994). However, the mean Total Mood Disturbance scores for our sample were fairly low (range 10.01–12.32 across the five assessments, S.D. =19.2 and 21.53, respectively), suggesting that our volunteer sample was relatively free from distress. The literature suggests that the benefits of exercise towards reducing distress are stronger among individuals reporting higher levels of mood disturbance (Landers, 1997; North et al., 1990).

We speculate that the absence of effects of exercise participation on cancer symptoms can be explained partially because the Global Distress Index includes psychological symptoms similar to those that contribute to the POMS Total Mood Disturbance and physical symptoms such as dry mouth, constipation, and lack of appetite. There are no data to suggest that these physical symptoms are likely to be affected by exercise participation among non-cancer populations. Older age predicted lower Physical Functioning and lower Physical Role Functioning, which is to be expected given the changes in physical abilities with aging (e.g. Epping-Jordan et al., 1999; Mor et al., 1994; Vinokur et al., 1990). Findings concerning the other variables showed some trends with higher affective social support being predictive of lower Total Mood Disturbance, higher Vigor, lower Global Distress Index, higher Physical Role Functioning, and higher Vitality. Higher confidant social support predicted greater freedom from pain. These results are consistent with the literature supporting the positive effects of social support on adjustment (see review by Helgeson and Cohen, 1996). Out review of the literature indicates that no studies have prospectively investigated the role of social support and exercise in this population. Studies have demonstrated the positive relationship of social support and physical activity, but this research was conducted with non-cancer populations (Kelsey et al., 2000; Leslie et al., 1999; Sallis et al., 1999).

When Reardon and Aydin (1993) explored the relationship between social support and exercise in cancer patients, they found attitudes towards responsibility for recovery, not social support, was most predictive of exercise behavior. The fact that social support was such a consistent predictor across the variables which we investigated suggests that it should be included as a covariate when investigating the contributions of exercise to quality of life and distress in early-stage breast cancer patients.

Karnofsky scores, which represent performance status, did not significantly predict any of the outcome variables except POMS Vigor. These results are inconsistent with previous studies of the relationship between Karnofsky scores, quality of life and cancer symptoms (e.g. Ganz et al., 1990; Portenoy et al., 1994a). The women in this study were functioning well, with a mean Karnofsky rating of 85.7 (S.D. =8.5). This restricted range of scores may have had a ceiling effect on these results, accounting for the inconsistency with previous research.

The strengths of this study lie in its longitudinal assessment of exercise behavior in a sample of breast cancer survivors. Additionally, overestimating exercise behavior may have been minimized, since the purpose of the study and the majority of questionnaires focused on mood, adjustment, and coping. While this was not an intervention trial, thus limiting our ability to make statements of causality regarding the effects of exercise on the variables studied, our use of the previous time point’s exercise as the predictor variable allows us to suggest that this predictor, when significant, is likely causal.

Finally, our data were limited to self-reports of exercise participation from a volunteer sample,
and we were unable to use longer, interviewer-administered measures of exercise such as the 7-Day Physical Activity Recall (Sallis et al., 1985) or objective activity monitoring. Generality of our results are limited to self-reports of mood and quality of life from a Caucasian sample and cannot be extended to all women with early-stage breast cancer.

In summary, it appears that a majority of breast cancer survivors in this volunteer sample were either not exercising at all or exercising below recommended levels, increasing their risk for cardiovascular disease, obesity, and the like. Participating in exercise, particularly at recommended levels, predicted higher levels of physical functioning. As cancer survivors seek ways of improving their health and well-being, promoting exercise may be a viable option to consider. However, our longitudinal data do not suggest that women spontaneously become more active after their diagnosis and treatment. Many of them expressed an intention to become more physically active. Hence, they may benefit from education and various cognitive-behavioral strategies that have been found to be effective for exercise adoption among the general population. Finally, women who have social support, who are younger, and report more distress may be more receptive to recommendations to increase exercise participation.

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REFERENCES


EXERCISE PARTICIPATION AFTER BREAST CANCER


