Physical activity and psychosocial benefits among breast cancer patients

Bernardine M. Pinto1,2*, Shira Dunsiger1,2 and Marissa Waldemore1

1The Miriam Hospital, Providence, RI, USA
2W. Alpert Medical School of Brown University, Providence, RI, USA

Abstract

Objective: Physical activity (PA) has been shown to provide health benefits for breast cancer patients. The effects of augmenting oncology healthcare provider (HCP) advice for PA with 3 months of telephone counseling versus contact control were evaluated in a randomized trial. Our goal in this secondary analysis was to examine the amount of PA (min/week) needed for psychosocial benefits among both groups.

Methods: After receiving brief HCP advice to become physically active, 192 women (age in years: mean = 60.6, SD = 9.9) who had completed treatment for Stage 0–IV breast cancer were randomized to telephone counseling to support PA (n = 106) or contact control (n = 86). Their PA, fatigue, physical functioning, and quality of life were assessed at baseline (before receiving HCP advice), 3, 6, and 12 months. A non-randomized design was used to examine the dose–response relationship between PA and psychosocial outcomes.

Results: Exercising for at least 150 min/week at moderate intensity was associated with improved physical functioning (b = 5.9, SE = 2.9, p = 0.04) and quality of life (b = 3.6, SE = 1.9, p = 0.05) at 3 months. These relationships were not found at 6 and 12 months (p’s > 0.05). However, women who reported at least 150 min/week of PA at both 3 and 6 months had significantly reduced fatigue (b = 1.3, SE = 0.7, p = 0.05) and improved physical functioning (b = 3.1, SE = 1.3, p = 0.02) and quality of life (b = 2.0, SE = 0.9, p = 0.02) compared with women who did not meet this criterion.

Conclusion: Women who exercised at recommended levels (at least 150 min/week) and sustained this level of activity for at least 6 months accrued psychosocial benefits.

Copyright © 2013 John Wiley & Sons, Ltd.

Introduction

Cancer survival rates are improving, and 89% of women diagnosed with breast cancer (BC) survive 5 years after diagnosis [1]. Because cancer treatment can often lead to psychological distress, rising survival rates highlight a growing necessity to address quality of life (QOL) and psychosocial functioning in cancer survivors after treatment [2]. Behavioral intervention research has provided evidence of benefits of physical activity (PA) on psychosocial functioning in cancer survivors [3,4].

Recent meta-analyses have further examined the effects of PA interventions on psychosocial functioning of cancer survivors and have also identified the amount of PA necessary to see the greatest benefits. For example, a meta-analysis noted the impact of PA on QOL: survivors in longer PA interventions (i.e., 26 weeks) and those exercising at greater intensities (e.g., five metabolic equivalents or higher) reported greater improvements in QOL [5]. These results highlight a dose–response relationship between PA and QOL, with cancer survivors participating in more intense activities sustained for a longer period experiencing the greatest improvements [5]. Cancer survivors who increased duration and intensity of strength training exercise reported reductions in cancer-related fatigue in a dose–response fashion, whereas aerobic exercise did not exhibit the same relationship [6]. In another meta-analysis, BC survivors who participated in supervised aerobic exercise reported significant reductions in cancer-related fatigue, but duration and intensity of exercise were not examined as moderators [7]. The results of these meta-analyses on PA and cancer-related fatigue are somewhat mixed. Further investigation regarding this relationship in intervention trials is needed. Finally, increasing weekly minutes of aerobic PA led to greater reductions in depressive symptoms [8,9], signifying a similar dose–response relationship. The strongest effects were found when survivors exercised for at least 180 min/week and when the trials were of a higher quality [9].

Results of these analyses lend support to the American College of Sports Medicine’s (ACSM) guidelines for cancer survivors, that is, the recommendation of participating in at least 150 min/week of moderate-intensity PA or 75 min of vigorous-intensity PA or an equivalent combination [10]. These recommendations are similar to the US Department of Health and Human Services PA guidelines [11].

Surveys have shown that reaching these recommendations leads to significant psychosocial benefits among cancer survivors including better physical functioning [12–15] and higher QOL, whereas lower doses of PA did not have the same effects [16–21]. Less is known about the dose–response relationship between PA and psychosocial outcomes in intervention studies, apart from conclusions drawn from meta-analyses. Given the challenges of changing behavior, it is important to determine the amount of PA necessary for the greatest improvements in psychosocial outcomes. By examining whether reaching these recommendations are associated with improved psychosocial outcomes,
we can create and implement interventions for BC survivors to reach and sustain the necessary amount of PA.

In this paper, we examined the dose–response relationship between PA and psychosocial outcomes in a randomized controlled trial for BC survivors [22]. All BC survivors received recommendations from their oncology healthcare providers (HCPs) to be physically active, and they were given a brief explanation of the benefits of PA for cancer survivors. The BC survivors were then randomly assigned to either the contact control group or a 12-week program of telephone-based PA counseling. The primary analyses indicated that at 3 and 6 months, those in the Counseling group reported significantly greater exercise participation and were more likely to meet ACSM guidelines than those who only received HCP advice, but these differences were not maintained at 12 months [22].

Using a secondary analysis of the RCT data, we examined the effects of meeting PA recommendations (at least 150 min/week) on psychosocial outcomes at each time point, hypothesizing that BC survivors who participated in at least 150 min/week of PA at each follow-up would report greater psychosocial improvements, including reductions in fatigue and improvements in QOL and self-reported physical functioning, than participants who did not. We also examined the effects of attaining and sustaining the ACSM recommendations of at least 150 min/week of PA on psychosocial outcomes. We expected that survivors who achieved and maintained at least 150 min/week of PA at all time points would report the greatest improvements in psychosocial outcomes, because they not only met criteria but also sustained this amount of activity. By examining this cohort of BC survivors and controlling for group assignment, we examined if exercise at or above ACSM guidelines was associated with psychosocial benefits and whether sustaining this activity over time improves psychosocial outcomes.

Methods

Design

The data were obtained from a randomized trial in which all study participants received HCP advice for PA and then compared (a) 12 weeks of additional telephone counseling and (b) contact control. Assessments were conducted at baseline, 3 (post-treatment), 6, and 12 months. Institutional Review Boards at the Miriam Hospital and Women and Infants Hospital approved the study. The study was conducted in accordance with the Helsinki Declaration from 2004 to 2009, and data for this paper were analyzed in January 2012–August 2012.

Recruitment

Participants were recruited by informational letters sent by oncologists and surgeons to their patients and by in-person recruitment at a hospital-based oncology clinic. HCPs were asked to review their non-urgent follow-up care schedules and identify women who had completed BC treatment, had no current evidence of disease, and were expected to live ≥12 months. Letters were mailed to these patients approximately 3 months before their next visit. If patients were interested in the study, they were asked to contact the study staff who conducted an eligibility screen by telephone. Women aged ≥18 years were eligible if they (1) had completed primary and adjuvant treatment for BC (patients on hormone treatment such as Tamoxifen were eligible), (2) were ≤5 years since treatment completion, (3) were able to read and speak English, (4) provided consent for medical chart review, (5) were able to walk unassisted, (6) were relatively inactive (<30 min/week of vigorous-intensity PA or <90 min/week of moderate-intensity PA), and (7) had access to a telephone. Participants were excluded if they had a prior history of cancer or if they had a medical or current psychiatric illness that could hinder compliance with the study procedures.

We completed 351 initial telephone screens to determine study eligibility [22]. Of those screened, 192 (71% of eligible respondents) were eligible, interested, and eventually randomized. The study was designed to have 80% power to detect a between-group difference in change scores in PA (minutes of moderate-to-vigorous PA) of 0.35 SD units at the 5% level of significance, based on cross-sectional comparisons at 3 months.

Procedure

After providing informed consent and obtaining medical clearance from their oncologist, study participants received PA advice from an oncologist/surgeon during a clinic visit (n = 100) or advice documented in a letter (n = 92) after they were referred for study participation during a clinic visit. After receiving HCP advice, they were randomly assigned to the two study groups after stratification for prior chemotherapy status (yes/no) and PA level (participants classified as active versus not based on a PA threshold of 30 min/week). HCPs and staff conducting the assessments were blinded to participants’ group assignments. Participants and interventionists were not blinded to group assignments.

Healthcare provider advice

Fourteen oncologists and surgeons (29% women, mean years in practice = 15.6, SD = 8.9, mean age = 50.8, SD = 9.6) at three local hospitals and two private practices received training (15–30 min) in providing brief PA advice (<5 min). Their role was to provide patients a brief message about PA benefits for cancer survivors, recommend at least 30 min/day of moderate intensity on most days of the week per available public health recommendations [23] and arrange for follow-up with study staff.

Participants who were recruited via informational letters received HCP advice at the next regularly scheduled clinic visit. At this visit, providers were cued by prompts placed on patients’ chart to deliver PA advice. After completing the clinic visit, each participant was met by research staff, the chart prompt was collected, and her randomization status was determined. For participants recruited on-site (n = 92), HCPs recommended the study to their patients. If interested, eligible, and enrolled in the study, the participant was given a letter from her HCP documenting ‘brief advice’ elements. Advice documented in a letter was used to reduce delays in study enrollment because the next clinic visit may have been more than 3 months later.
Healthcare provider advice plus telephone counseling

As described previously [22], these participants received in-person counseling to promote moderate-intensity aerobic PA (e.g., brisk walking, biking, or swimming) at 55–65% maximum heart rate. The intervention was individualized to the participant’s baseline PA (and motivational readiness) such that inactive participants were encouraged to be physically active for at least 10 min on at least 2 days/week (these goals were higher for those who were physically active at baseline), and the goals were gradually increased over the 12 weeks to 30 min/day on at least 5 days/week [23].

Each participant received eight telephone calls over 12 weeks (weekly for 4 weeks, bi-weekly for 8 weeks) from interventionists to support PA adoption. Counseling was based on the Transtheoretical Model and Social Cognitive Theory [24,25] and was tailored to each participant’s motivational readiness [26]. After the 3-month assessments were completed, monthly phone calls over the next 3 months were provided to reinforce regular PA and prevent lapses.

Healthcare provider advice plus contact control group

These participants received eight calls over 12 weeks (weekly for 4 weeks, bi-weekly for 8 weeks) during which the Symptom Questionnaire [27] was administered to monitor problems such as headaches. Participants did not receive any additional advice about PA. After the 3-month assessment, they received monthly phone calls for 3 months, during which the Symptom Questionnaire was administered.

Measures

Disease and treatment variables (from medical records) and demographic information were obtained at baseline. At baseline and subsequent assessments, body weight and height were measured. Participants received small incentives (e.g., $10 gift cards) for completing the assessments that included the following:

1. Seven Day Physical Activity Recall (7 Day PAR) [28]. This interviewer-administered measure [29,30] assesses hours spent in sleep as well as moderate, hard, and very hard activity (leisure and occupational) over the past week. We were interested in the weekly minutes of PA (of at least moderate intensity). These data were used to determine whether participants met recommendations [11] of at least 150 min/week of PA.

2. Functional Assessment of Cancer Therapy Scale—Fatigue (FACT-F). This 13-item scale is a brief, reliable, and valid measure of the physical and functional effects of fatigue. It has strong internal consistency and shows a significant positive relationship with other measures of fatigue [31]. Scores range from 6 (high fatigue) to 52 (low fatigue).

3. MOS 36-Item Short Form Health Survey (SF-36) [32,33] assesses eight health concepts (e.g., physical functioning and bodily pain) to evaluate health-related QOL. We used the Physical Functioning subscale as cancer survivors who adopted PA have shown improvements on this subscale [34]. This subscale has been used as a dimension of health-related QOL [35,36]. This measure yields a continuous variable that ranges from a low score of 0 (limitations in physical activities) to a high score of 100 (no limitations).

4. Functional Assessment of Cancer Therapy Scale for Breast Cancer (FACT-B) is a 55-item scale that assesses QOL with subscales for physical, functional, social and emotional well-being, satisfaction with the treatment relationship, and concerns specific to BC. The scale has been used in oncology clinical trials and is reliable and valid [37]. The range of scores is 0 to 144, with higher scores indicating a better QOL.

Analysis

Descriptive statistics were summarized for the aggregate sample of participants (means and standard deviations for continuous variables and percentages and n’s for categorical variables), including demographic variables, baseline PA (7 Day PAR), fatigue (FACT-F), physical functioning (SF-36), and QOL (FACT-B). Between-group differences in these variables have been tested elsewhere [22]. In addition, normality of continuous variables was assessed using graphical methods.

To assess the effect of meeting ACSM guidelines on psychosocial outcomes, we used a series of generalized linear models, controlling for age, BMI, chemotherapy use, and baseline value of the outcome. Specifically, we regressed psychosocial outcome (fatigue, physical functioning, and QOL) at follow-up (3, 6, and 12 months, respectively) on an indicator of whether participants reported at least 150 min/week of PA by the given follow-up (3, 6, and 12 months, respectively), controlling for potential confounders of the dose effect. Residual diagnostics were used to assess model fit as well as potential outliers. In addition, linearity was examined using a non-parametric method for estimating local regression surfaces (proc loess in SAS 9.3) (SAS Institute Inc. 2011. SAS/STAT® 9.3 User’s Guide, Cary, NC: SAS Institute Inc. Copyright ©2011. SAS Institute Inc., Cary, NC, USA).

Finally, we further subdivided the sample into categories of PA behavior. Categories were chosen apriori to represent mutually exclusive types of PA. Participants were classified as ‘Never Achievers’ if they never reported meeting ACSM guidelines (at least 150 min/week of at least moderate intensity PA) at 3 and 6 months follow-up. They were considered ‘Early Achievers’ if they met criteria at 3 months but not at 6 months. ‘Late Achievers’ were defined as those participants who did not meet criteria at 3 months but did at 6 months. Finally, ‘PA Adopters’ were defined as participants who met criteria at both 3 and 6 months. The frequency of such categories was described using percentages and n sizes. Because of the limits of our sample size, we could not include 12-month outcomes as part of these categorizations as this would lead to eight potential groups (2³ combinations of binary variables), many of which had very small cell sizes. However, we did explore the additional categorization of ‘Early PA Adopters’ (met guidelines at 3 and 6 months but not 12 months) and ‘PA Maintainers’ (met guidelines at 3, 6, and 12 months).

Using a series of longitudinal regression models implemented with generalized estimating equations with robust standard errors, we assessed whether there were differences in mean psychosocial outcomes (fatigue, physical
functioning, and QOL) between categories of PA at 3, 6, and 12 months. Models adjusted the standard errors for repeated outcomes collected over time. Models adjusted for baseline values of the outcome, as well as potential confounders (age, BMI, and chemotherapy use). It should be noted that we tested whether the addition of treatment condition (Counseling versus Contact Control) as a covariate changed the effect estimates (and model fit), as well as whether the effect of PA category on outcomes changed over time (using interaction terms between category and follow-up time). All analyses were conducted on the intent-to-treat sample and thus included all participants randomized at baseline \(n = 192\).

All analyses were conducted in SAS 9.3.

### Results

On average, participants were 55.9 years of age (SD = 9.8), an average of 2.9 years since diagnosis (SD = 2.2), predominately employed (66%), and self-identified as White (96%). A complete description of the sample is included in Table 1.

At 3 months, 29% of the women reported at least 150 min/week of PA. This proportion dropped to 22% at 6 months and 20% at 12 months. Women who reported at least 150 min/week of PA at 3 months reported significantly higher QOL \((b = 3.6, SE = 1.9, p = 0.05)\) and physical functioning \((b = 5.9, SE = 2.9, p = 0.04)\) compared with those who did not meet PA guidelines. However, no such associations were shown at 6 or 12 months. There were no significant associations between meeting PA guidelines and changes in fatigue at follow-up (3, 6, or 12 months).

Amongst the aggregated sample of participants, 64.1% were classified as Never Achievers (60.4% Counseling vs. 68.6% Control, \(p > 0.05\)), 13.5% as Early Achievers (14.2% Counseling vs. 12.8% Control, \(p > 0.05\)), 6.8% Late Achievers (6.6% Counseling vs. 7.0% Control, \(p > 0.05\)), and 15.6% as PA Adopters (18.9% Counseling vs. 11.6% Control, \(p > 0.05\)). Figures 1–3 show the unadjusted mean changes in psychosocial outcomes (fatigue, physical functioning, and QOL) over time by PA category. Unadjusted mean values of the psychosocial outcomes over time by PA category are reported in Table 2.

Longitudinal regression models suggest a significant difference in mean fatigue over time amongst PA Adopters versus Never Achievers \((b = 1.3, SE = 0.7, p = 0.05)\), such that those adopting PA reported less fatigue (higher fatigue score) at any given time compared with those who never achieved guidelines. There were no significant interactions between PA category and follow-up time.

In addition, results indicate a significant difference in mean physical functioning over time amongst Late Achievers versus Never Achievers \((b = 4.5, SE = 1.5, p = 0.05)\).

### Table 1. Descriptives of the study sample \((N = 192)\)

<table>
<thead>
<tr>
<th>Aggregate sample of participants ((N = 192))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
</tr>
<tr>
<td>Race/ethnicity (% White)</td>
</tr>
<tr>
<td>Education (% college educated)</td>
</tr>
<tr>
<td>Employment (% full time)</td>
</tr>
<tr>
<td>Income (% &lt;$50k)</td>
</tr>
<tr>
<td>Marital status (% married/partnered)</td>
</tr>
<tr>
<td>Time since diagnosis, years</td>
</tr>
<tr>
<td>Disease stage, %</td>
</tr>
<tr>
<td>Stage 0</td>
</tr>
<tr>
<td>Stage 1</td>
</tr>
<tr>
<td>Stage 2</td>
</tr>
<tr>
<td>Stage 3 and 4</td>
</tr>
<tr>
<td>Treatment (% chemotherapy)</td>
</tr>
<tr>
<td>BMI</td>
</tr>
<tr>
<td>Fatigue (FACT-F)</td>
</tr>
<tr>
<td>Physical functioning (SF-36)</td>
</tr>
<tr>
<td>Quality of life (FACT-B)</td>
</tr>
<tr>
<td>Baseline physical activity (min/week)</td>
</tr>
</tbody>
</table>

FACT-F, Functional Assessment of Cancer Therapy Scale—Fatigue; SF-36, MOS 36-Item Short Form Health Survey; FACT-B, Functional Assessment of Cancer Therapy Scale for Breast Cancer.
p = 0.002), as well as PA Adopters versus Never Achievers (b = 3.1, SE = 1.3, p = 0.02). Specifically, mean physical functioning scores were higher (corresponding to better physical functioning) at any given follow-up time amongst those making a late attempt or adopting PA (compared with those who never achieved guidelines). There were no significant interactions between PA category and follow-up time.

Finally, results indicate a significant difference in mean QOL over time amongst PA Adopters versus Never Achievers (b = 2.0, SE = 0.9, p = 0.02), such that those adopting PA reported better QOL (higher score) at any given time compared with those who never achieved guidelines. There were no significant interactions between PA category and follow-up time. The full series of regression results are presented in Table 3.

In the sample of PA Adopters (n = 30), more than half (n = 17) were considered Early PA Adopters (met guidelines at 3 and 6 months but not at 12 months), and the remaining 13 were classified as PA Maintainers (met guidelines at 3, 6, and 12 months). Further exploration suggests that the differential effects of PA category (PA Adopters versus Never Achievers) on outcomes (fatigue, physical functioning, and QOL) were stronger among PA Maintainers versus Early PA Adopters (relative to Never Achievers). That is, those who met guidelines at 3, 6, and 12 months reported less fatigue (b = 1.7, SE = 0.5, p < 0.01), better physical functioning (b = 5.3, SE = 1.4, p < 0.01), and better QOL (b = 4.2, SE = 0.9, p < 0.01) at any given time compared with those who never achieved guidelines. There were no significant differences between Early PA Adopters and Never Achievers with respect to these outcomes (p’s > 0.05).

### Discussion

The goals of this paper were to determine if meeting ACSM guidelines for PA and reaching the guidelines and sustaining this level of PA were associated with psychosocial outcomes (fatigue, self-reporting physical functioning, and QOL) among BC survivors. Improvements in physical functioning and QOL were found among women who met (or exceeded) ACSM guidelines at 3 months compared with those who did not achieve 150 min/week. These effects were not found at 6 or 12 months. There were no improvements in fatigue among those achieving ACSM guidelines at any time point. Finally, women who met guidelines at 3 months and sustained this level of PA over 6 months did report reduced fatigue, improved physical functioning, and QOL compared with women who did not achieve and sustain PA at guidelines at these follow-ups.

Women achieving ACSM guidelines at 3 months reported improved physical functioning and QOL, lending support to the importance of exercising at recommended levels. However, these relationships were not found among women who met guidelines at 6 or 12 months and were not found for fatigue at any time point. It is not clear why women who reported exercising per recommendations did not report improved psychosocial outcomes at these later time points.

Although dose–response relationships between PA and psychosocial outcomes in intervention trials among cancer survivors have not been examined, these data are available from non-cancer populations: for example, improvements on the SF-36 were associated with 150 min to 225 min/week of moderate-to-vigorous intensity aerobic exercise in a 1-year long exercise program among 320 post-menopausal sedentary women [36]. These analyses (non-randomized

### Table 3. Longitudinal regression models of physical activity (PA) category on outcomes (N = 192)

<table>
<thead>
<tr>
<th>Category</th>
<th>N = 192</th>
<th>Mean (SD)</th>
<th>b</th>
<th>Standard error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue (FACT-F)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Achiever versus Never Achiever</td>
<td>4.44</td>
<td>0.87</td>
<td>0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Achiever versus Never Achiever</td>
<td>0.60</td>
<td>0.58</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Adopter versus Never Achiever</td>
<td>1.30</td>
<td>0.66</td>
<td>0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical functioning (SF-36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Achiever versus Never Achiever</td>
<td>1.97</td>
<td>1.45</td>
<td>0.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Achiever versus Never Achiever</td>
<td>4.47</td>
<td>1.46</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Adopter versus Never Achiever</td>
<td>3.10</td>
<td>1.29</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of life (FACT-B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Achiever versus Never Achiever</td>
<td>0.12</td>
<td>0.99</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Achiever versus Never Achiever</td>
<td>0.51</td>
<td>1.36</td>
<td>0.70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Adopter versus Never Achiever</td>
<td>1.99</td>
<td>0.88</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Models adjusted for baseline value of the outcome, age, BMI, and chemotherapy use. There was no change in effect when controlling for employment, and thus, it was not included in the final model.

FACT-F, Functional Assessment of Cancer Therapy Scale—Fatigue; SF-36, MOS 36-Item Short Form Health Survey; FACT-B, Functional Assessment of Cancer Therapy Scale for Breast Cancer.
comparisons) found that participants falling short of the 150 min/week reported worse SF-36 scores than the control group who were asked not to change their level of exercise. Another study using a randomized comparison, among 430 post-menopausal women exercising at three different levels (75, 150, and 225 min of moderate-intensity PA/week) also found a dose–response effect on QOL using the SF-36 [38]. Finally, among adults diagnosed with mild to moderate depressive disorder, a dose–response relationship was found with reduced depression among patients who exercised at ACSM guidelines versus those who exercised at a lower level [39]. These training programs were generally conducted with on-site supervision. Our study participants were not diagnosed with major depression, and it is possible that they over-estimated the intensity and other parameters of their PA performed in their home environments, thus accounting for lack of significant findings on the relationship of PA and QOL at 6 and 12 months.

Although there is some evidence for the benefits of aerobic PA to reduce cancer-related fatigue, a recent meta-analysis showed that resistance exercise intensity was related to reductions in fatigue [6]. Our study participants were advised to participate in aerobic PA. Although no significant effects on fatigue were found among those who met or exceeded guidelines at 3, 6, or 12 months, PA Adopters reported significantly lower fatigue (than Never Achievers) at 3 and 6 months, suggesting that sustaining PA may be associated with reduced fatigue.

The longitudinal group analyses revealed that achieving at least 150 min/week and sustaining PA at the recommended levels until 6 months (PA Adopters) were significantly associated with reduced fatigue, improved physical functioning, and QOL compared with participants who did not exercise at this level at 3 and 6 months (Never Achievers). Self-reported physical functioning was significantly higher among Late Achievers than those who did not meet PA recommendations at 3 or 6 months. These results offer support for PA at recommended levels (or above) and the relevance of short-term maintenance to accrue psychosocial benefits. Our exploration of the effects of maintaining PA at 3, 6, and 12 months lends further support for the importance of long-term PA maintenance.

The clinical implications for BC survivors are that if patients are to continue to accrue benefits, it is important for them to sustain activity at or above recommended levels; otherwise, the benefits are not maintained.

The strengths of our study include a large sample size of women within 5 years of a BC diagnosis, use of standardized measures of PA, fatigue, physical functioning, and QOL, and follow-up assessments at three time points. Weaknesses include the inability to analyze data using all eight possible categorizations of PA behavior across the 12-month study because of sample size limitations. We used a non-randomized comparison for these secondary analyses, so it is possible that participants who achieved ACSM guidelines were different from those who did not achieve guidelines. The lack of objective corroboration for self-reported PA is an additional study drawback. Lastly, the sample was heterogeneous in that 8% of the participants had Stage 3 or 4 BC and their experiences may vary from women with early stage BC.

In sum, these data suggest that achieving 150 min/week of at least moderate-intensity PA at 3 months was associated with specific psychosocial benefits (improved physical functioning and QOL) among BC survivors. Additionally, sustaining activity at or above this level for 6 months was associated with reduced fatigue and improved physical functioning and QOL. Emphasis on these psychosocial benefits can be used in efforts to promote PA among BC survivors to help with their recovery. Results also suggest the importance of conducting dose–response analyses of PA and related psychosocial outcomes in intervention studies.

Acknowledgements

We gratefully acknowledge the contributions of the research staff (Susan Abdow, M.Ed., Stephanie Berube, B.A., Christopher Breault, B.S., Jennifer Correia, B.S., Kelly Greenwood, B.S., and Joyce Lee, B.A.) and Drs. Goldstein and Papandonatos for help with study implementation. We thank the physicians who participated in the study and assisted with patient recruitment. The trial is registered in the Clinical Trials Registry (NCT 002 30711). This research was funded by a grant from the American Cancer Society (RSGPB-03-243-01-PBP) and the Rays of Hope.

References


22. Pinto BM, Papadonatou GD, Goldstein MG. A randomized trial to promote physical activity among breast cancer patients. *Health Psychol* in press.


Copyright of Psycho-Oncology is the property of John Wiley & Sons, Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.