



Published in final edited form as:

Health Psychol Rev. 2009 May 1; 4(1): 22–41. doi:10.1080/17437190903384291.

Group vs. individual exercise interventions for women with breast cancer: a meta-analysis

Anna Floyd, PhD and

Stony Brook University, Psychology, Stony Brook, 11794-2500 United States

Anne Moyer

Stony Brook University, Psychology, Stony Brook, 11794-2500 United States

Anna Floyd: afloyd@kleinbuendel.com

Abstract

Background—Both during and after treatment, cancer survivors experience declines in physical and psychosocial quality of life (QoL). Prior research indicates that exercise interventions alleviate problems in physical functioning and some aspects of psychological functioning. For survivors seeking social support, exercise programs that are conducted in group settings may foster optimal QoL improvement (by addressing additional issues related to isolation, social support) over individually-based exercise programs.

Methods—We reviewed literature on group cohesion in exercise studies, and conducted a meta-analysis to test the hypothesis that group as compared to individual exercise interventions for breast cancer survivors would show greater improvement in QoL.

Results—As currently implemented, group exercise interventions showed no advantage. However, they typically did not provide any evidence that they capitalized upon potentially beneficial group processes.

Conclusions—Future exercise intervention studies could investigate the effect on QoL of deliberately using group dynamics processes, such as team building experiences and group goal setting to foster group cohesion.

Keywords

cancer; oncology; exercise; group dynamics; quality of life; meta-analysis

“We laugh the most when we push ourselves the hardest, because then it doesn’t hurt so much. It is a little hard to laugh alone... The group definitely matters.”

- group exercise participant (Midtgaard, Rorth, Stelter, & Adamsen, 2006)

Improved survival rates for cancer patients have encouraged researchers and practitioners to address the challenges that cancer presents for quality of life (Holland, 1998). Multiple quality of life (QoL) dimensions encompassing physical (e.g., functional status), psychological (e.g., emotional well-being), and social domains (e.g., family well being, social functioning) are all considered important (Cella, Baum, & Andersen, 2001). Thus, interventions that address multiple aspects of quality of life may be optimal. Here we examine whether exercise interventions designed to improve physical functioning, when

delivered in a group format, might foster improved QoL as compared to those delivered in an individual format because of the access to social interaction provided by the group itself.

Meta-analytic reviews support the effectiveness of exercise interventions, which have included aerobic exercise, such as biking (e.g., Courneya et al., 2003; Pinto, Clark, Maruyama, & Feder, 2003), running (e.g., Schulz et al., 1998), dance (e.g., Campbell, Mutrie, White, McGuire, & Kearney, 2005; Kolden et al., 2002; Sandel et al., 2005), Tai Chi (e.g., Adamsen, Rasmussen, & Pedersen, 2001; Mustian, 2003), and resistance training (Galvão & Newton, 2005; McNeely et al., 2006), in improving physical functioning (Courneya & Friedenreich, 2007; Galvão & Newton, 2005; McNeely et al., 2006) reducing fatigue (McNeely et al., 2006), improving physical and psychological coping (Courneya & Friedenreich, 2007), and improving some psychological outcomes such as reducing distress and improving emotional well-being (Knobf, Musanti, & Dorward, 2007).

It may be possible that exercise interventions delivered in a *group* format might represent an optimal intervention to improve QoL for people with cancer, because the group format provides access to other survivors and thus could address psychosocial needs related to survivors' increased dependence on others (Harrison, Maguire, & Pitceathly, 1995), strained social relationships (Wortman & Dunkel-Schetter, 1979), stigma (Hebl, Tickle, & Heatherton, 2000), and isolation (Rosenbaum, Rosenbaum, Kneier, & Spiegel, 2005).

Theoretically, social support has a positive influence on well-being both directly by providing an individual with a large community network (Cohen & Wills, 1985), and indirectly, through the perceived availability of support which protects individuals from the harm of stressful events (the stress-buffering hypothesis, Cohen & Wills, 1985). Social support is theorized to contribute to how ones appraises events (Dunkel-Schetter, Folkman, & Lazarus, 1987), and to enable individuals to cope by modeling coping behavior and providing incentives for engagement in positive coping methods, enhancing self-efficacy (Benight & Bandura, 2004).

Studies have shown that cancer patients seek group interventions, specifically social support group interventions, for a number of reasons: they desire to dissipate their fear and reduce depression (Cella & Yellen, 1993); they want to learn how to cope from other patients (Cella & Yellen, 1993); they feel stigmatized by their cancer, and seek refuge from the resulting social isolation (Vugia, 1991) and self-rejection (Cella & Yellen, 1993). Cancer support groups give patients emotional support and promote social interaction (Bloom, 1982). The mere presence of others sharing the same physical and psychosocial challenges can be quite profound. The group setting provides a normalization of the cancer experience (Wortman & Dunkel-Schetter, 1979) and can reduce feelings (i.e., anxiety, depression) associated with the stigma of having cancer that cancer patients often feel when surrounded by persons without cancer (Blascovich, Mendes, Hunter, & Lickel, 2000).

Reviews of group psychosocial interventions have shown that these group interventions have positive effects for many participants, improving almost every aspect of QoL for participants outside of longevity itself (Gottlieb & Wachala, 2007). Perhaps improvements that are attributable to group processes (as opposed to the unique effects from the therapeutic process itself) could also be seen in group exercise interventions. Processes highly valued by members of cancer support groups include most notably group cohesion, which is ranked by participants to be the most valuable group aspect (Magen & Glajchen, 1999). In the context of social support groups, cohesion is the emotional connection that facilitates self-disclosure. Other valued aspects include the providing of hope and universality, or being in the same situation as other members (Magen & Glajchen, 1999). In addition, group processes in the context of support groups indicate how important having

face-to-face interaction within the context of a supportive and non-judgmental group is for ease in sharing feelings (Paulus, Baum, & Andersen, 2001).

If facilitated in a group exercise intervention, improvement in QoL obtainable through group processes could occur alongside benefits seen by the exercise component of the intervention. These may include improved cardiovascular fitness (MacVicar, Winningham, & Nickel, 1989), muscle mass (Courneya & Friedenreich, 1999), and body image (Pinto et al., 2003), which may decrease survivors' need to depend on others. In addition, the exercise may decrease fatigue (Schwartz, 1999), depression (Segar et al., 1998), and anxiety (Mock et al., 1997; Segar et al., 1998).

Interviews with members of group exercise programs for cancer survivors indicate that participants appreciate these programs for several reasons. Participants report forming a collective identity with group members (Midtgaard et al., 2006; Parry, 2007; Unruh & Elvin, 2004), improvement in their self-image by re-conceptualizing themselves from patients to athletes (Midtgaard et al., 2006; Parry, 2007), that the group has motivational factors (Midtgaard et al., 2006), that they enjoy being with other cancer survivors while exercising (Adamsen et al., 2001), and that they prefer action-oriented groups as opposed to talking support groups (Emslie et al., 2007; Midtgaard et al., 2006; Parry, 2007). Many qualitative studies indicate how much participants value exercising with others "in the same boat" or "in the same situation" (Adamsen et al., 2001; Emslie et al., 2007; Midtgaard et al., 2006; Parry, 2007), which is similar to the aspect of universality valued by members of cancer support groups (Magen & Glajchen, 1999).

Group Cohesion in the Exercise Environment

To understand how QoL could be improved with group exercise interventions, we can borrow insights from the group cohesion literature. Group cohesion is "a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron, Brawley, & Widmeyer, 1998, p. 213). This "sticking together" and related feelings of closeness could be a powerful experience for people, like cancer survivors, experiencing stigma and isolation. Estabrooks and Carron studied the effects of group cohesion on exercise class attendance in several studies of non-cancer patient populations. They found that group cohesion predicted attendance, and that using cohesion-building activities resulted in an improved return rate after a 10-week class hiatus as compared to control and placebo groups (Estabrooks & Carron, 1999). Also in support of the findings that cohesion-building benefits exercise programs, a meta-analytic review by Burke and colleagues (2006) found that group exercise programs that incorporated team-building activities were superior to three other exercise program styles: classes of people exercising with a leader but not interacting (standard aerobics class), home-based exercise with telephone contact, and home-based exercise without contact (Burke et al., 2006).

Participants' Perspectives on Group Programs

Some studies of group exercise and cancer survivors have looked qualitatively at general aspects of group dynamics. These studies provide preliminary evidence that cohesion building enhances exercise programs for cancer survivors. For example, participants in two group exercise studies (Adamsen et al., 2001; Midtgaard et al., 2006) voiced ideas that implied that cohesion was an important factor in their exercise group experiences. Adamsen and colleagues (2001) reported results from a physical activity program for men with various types of cancer. They report that "[participants'] comradeship was made even more meaningful by the 'break' it created from the illness, notwithstanding that it actually was the illness that bonded the men" (Adamsen et al., 2001, p. 532).

Both Adamsen et al. (2001), and Midtgaard et al. (2006) report rich qualitative information in the comments of the participants themselves as they describe their experiences in the groups. In both studies, participants reported *that they felt they were all 'in the same boat'*: "we have all been united by something concrete" (Midtgaard et al., 2006, p. 30); *that they liked convening as a group, without talking about cancer*: "I wouldn't like to meet with other people just because they have cancer. I try to avoid those types of support groups... if you only meet because of the disease it becomes overwhelming... it becomes a lot of 'poor us'" (Midtgaard et al., 2006, p. 30); *the benefits of exercising as a group*: "there is always someone from the group who comes up and asks: 'How are things going with you?' ...and offers encouragement." (Midtgaard et al., 2006, p. 29).

Participants often state that they appreciate being able to unite as a group without talking about cancer (Unruh & Elvin, 2004, pp. 141-142); "The one thing we all have in common is breast cancer, but that's not our focus. I didn't join the team to talk about breast cancer." (Parry, 2007, p. 63). This idea was so central to a study by Emslie et al. (2007) that it appeared in their study's title: 'I wouldn't have been interested in just sitting round a table talking about cancer'; exploring the experiences of women with breast cancer in a group exercise trial. The process of convening with cancer survivors and *not* discussing cancer is one characteristic that distinguishes these group exercise interventions from typical group psychosocial interventions: in group psychosocial intervention, members *talk about* the cancer experience. Most venues that exist for cancer survivors to convene as a group focus on processing the cancer experience by talking about it (e.g., support groups, psychotherapy). Sharing the cancer experience verbally with others is undeniably important for QoL, as we see from positive outcomes of group therapies (e.g., Fawzy et al., 1990; Gottlieb & Wachala, 2007; Kissane DW, 2003; Spiegel et al., 1999), but the fact that cancer survivors express appreciation of being able to convene and *not* talk about the experience indicates a potential void in our support system. Group exercise interventions could fill this void.

Group Exercise, QoL, and Chronic Illness

Although to our knowledge, no meta-analyses have been conducted directly comparing group and individual exercise, group exercise has been reported to be beneficial among other patients populations including hemiplegic patients (Taskinen, 1999), for whom the group was reported to be motivating and rewarding, patients with chronic muscular pain (Steihaug, Ahlsen, & Malterud, 2001), for whom the group was reported to provide a sense of security and feeling of belonging, and psychotherapy patients with mood and personality disorders (O'Kelly, Piper, Kerber, & Fowler, 1998).

Because QoL is comprised of both physical *and* psychosocial domains, it seems reasonable that group exercise interventions, by addressing both, might be more effective in improving QoL for cancer survivors than individually-based programs. It is likely, and thus important to note here, that individual differences affect the type of social support preferred by survivors. Although research has shown that some survivors prefer an activity-oriented group over a talking support group (e.g., Emslie et al., 2007), the social support obtained from support groups differs from that obtained from exercise groups. For participants who need a type of social support distinct from that offered by psychosocial group therapy programs, group exercise programs may be ideal.

Prior reviews of exercise interventions for cancer survivors have not investigated whether individual versus group exercise programs have different quality of life outcomes. Thus, we employed meta-analytic techniques to investigate the hypothesis that group exercise interventions would show greater improvement in QoL over individual exercise programs.

To reduce variability, because the research has been predominantly conducted with women with breast cancer, we included only studies of breast cancer survivors.

Methods

Literature Search and Eligibility Criteria

Studies were eligible if they: reported the effects of individual or group aerobic and/or resistance exercise on breast cancer survivors' QoL; used a randomized or a pre-post design; were published between January 1980 and June 2009; were peer-reviewed articles; and were written in English or German. Studies were not eligible if they: included fewer than six subjects per condition; had no intervention component; included several types of interventions (e.g., an exercise program with group counseling); or assessed QoL only with respect to fatigue, without other psychosocial outcomes.

Electronic databases were searched (PsycINFO, CINAHL Plus, MEDLINE, Cochrane Central Register of Controlled Trials) using key words related to breast cancer: *breast, cancer, neoplasms, mastectomy*; to exercise: *exercise, physical activity, sport, physiotherapy*; and the phrase *quality of life*. *The Journal of Clinical Oncology, Medicine & Science in Sports & Exercise*, and *Psycho-Oncology* were hand-searched and reference sections of eligible articles were reviewed.

Studies used variety of self-report measures to assess QoL, often employing more than one. Because improvements may be domain-specific, the variability among QoL measures, with some assessing overall QoL, and some assessing domain-specific QoL, can be problematic to meta-analytic interpretation. Previously conducted meta-analyses investigating the effects of exercise on QoL have coded data from various measures, using the QoL measures as a moderator variable when possible (e.g., Gillison, Skevington, Sato, Standage, & Evangelidou, 2009; McNeely et al., 2006; Rehse & Pukrop, 2003). Gillison et al. (2009) recommend maintaining data when possible for overall QoL, which can maintain a multi-dimensional perspective on QoL. Using overall QoL to calculate effect size may also allow for further investigation into domain-specific QoL, when reported by authors. In keeping with the effort to code for overall QoL when possible, and making an effort to keep QoL measures as consistent as possible across studies, measures were prioritized for coding. The most commonly used measure was the Functional Assessment of Cancer Therapy (FACT - G), so we prioritized using data from this measure when it was available (5 out of 18 studies). The second most commonly available measure to obtain our data was from the FACT-B (4 studies). The third was from the QoL Index for Patients with Cancer (2 studies). The fourth was either the SF-36 Mental Health Domain or Mental Health subscale, or the POMS total mood disturbance (2 studies each). If a study did not include any of the previously listed measures, the measure included the analysis was randomly selected from those available. Therefore, our meta-analysis also included QoL data from the EORTIC QLQ-C30 (1 study), and the CARES-SF (1 study).

One study (Segal et al., 2001) contained three groups; usual care, self-directed exercise, and supervised exercise. The usual care and supervised exercise groups were selected for comparison because this combination most closely matched the interventions of the other studies in the analyses.

Six studies included data from only a single intervention group, with no control group. To incorporate the information from these studies, we conducted two types of analyses: comparisons of treatment and control groups post intervention (*treatment-control*) and comparisons of intervention group pre- and post-intervention (*pre-post*). Both of these types of analyses are standard practice for meta-analyses (Lipsey & Wilson, 2001), though

because of the difference in whether or not the analyses includes a control group, these two analyses are kept distinct from one another. Some studies reported data that could be used for both analyses. The test-retest reliability of the outcome measures was necessary to calculate effect sizes for the pre-post analysis. In cases where this information was not reported for the sample examined, the typical test-retest reliability of the instrument was determined from other literature.

Literature Retrieval and Coding

The search initially identified 645 studies. Exclusion criteria were applied to abstracts and in some cases full texts. This left a final sample of 17 articles, reporting on 18 studies (one article reported on 2 distinct samples; Table 1).

Coding was conducted by two raters, who were guided by specific coding instructions. Coders rated their studies independently and met after coding was completed to resolve discrepancies. The average two-way mixed effect intraclass correlation (Shrout & Fleiss, 1979) assessing rating agreement for both coders was .99, for the 5 continuous variables (exercise duration, intervention length, exercise frequency, participant age, and time since diagnosis). The average generalized kappa (Siegel & Castellan, 1988) assessing the rating agreement of both coders was .98 for the 13 categorical variables (exercise intensity, cancer stage, whether the intervention occurred during or after treatment, whether exercise was supervised, and the PEDro scale items).

The moderating variable of interest for this meta-analysis was the format in which the exercise intervention was implemented (group vs. individual). Because any interaction with other study participants is conceptually distinct from having absolutely no interaction with other study participants, studies were considered to have “group” format if participants had any access to other study participants during the exercise intervention. This included studies where participants exercised with others during some sessions, and individually during some sessions. Studies were only considered to have individual format if participants always exercised alone.

Studies were coded with respect to 10 methodological and descriptive variables: exercise duration, exercise intensity, length of intervention, exercise frequency, participant age, time since diagnosis, cancer stage, whether the intervention took place during or after treatment, whether the participants were supervised in their exercise (regardless of group format), and coded for quality based on the PEDro scale (Maher, Sherrington, Herbert, Moseley, & Elkins, 2003). For studies indicating a range of exercise duration, an average was calculated and reported for coding. Exercise intensity was coded for the aerobic portion of the interventions based on the American College of Sports Medicine guidelines: with less than 54% of maximum heart rate being low, 55-69% being moderate, and 70-89% being hard intensity (Pollock et al., 1998). Studies reporting an intensity range including more than one level of intensity (e.g., 50-65%) were coded to express that range (e.g., low-moderate). Some studies that recruited participants during treatment reported nonspecific information for time since diagnosis, instead indicating that participants were “newly” or “recently” diagnosed. These studies were coded as participants being “1” month since diagnosis. Studies were considered supervised if some but not all of the exercise sessions were supervised, because any access to a supervisor was considered very distinct from no access to a supervisor.

Studies that were coded as having a group exercise format were further inspected (by A.F.) regarding how social interaction during the exercise intervention was described by the research team. Some authors mentioned that they considered social interaction to be an important component of the program (e.g., social interaction was explicitly addressed in the

Introduction or Methods section of the article); some studies considered possible effects of social interaction on QoL post-hoc (e.g., social interaction was mentioned only in the Discussion section of the article); and some studies did not mention social interaction at all. In addition, studies were examined for whether they reported the unique contribution of Social Functioning QoL (see Table 1).

Participants were, on average, 52.8 years of age, and had been diagnosed with cancer 17.0 months prior to enrollment in the study. The majority of studies contained participants with primarily stage I and/or stage II cancer (Table 1). Interventions were, on average, 45.5 minutes in duration, 14.1 weeks in length, and had participants exercise an average of 3.24 times per week. Exercise intensity was low-moderate for 11.1% of studies, moderate for 11.1% of studies, moderate-hard for 27.8% of studies and hard for 22.2% of studies. Studies covered a range of exercise types, including dance, biking, resistance training, arm ergometers, and swimming. Most studies were walking-based or included walking (Table 1). The average quality score for the studies, based on the PEDro quality rating scale (Maher et al., 2003) was fairly good, 5.6 out of 8.¹

Data Analysis

Individual effect sizes (d), corrected for small sample bias (Hedges, 1981) were calculated for QoL. These were then aggregated using inverse-variance weighting, and the moderating effects of group format was examined with macros for SPSS 11.0 software (Lipsey & Wilson, 2001). To determine the extent to which group versus individual exercise interventions were comparable on other indices, we used t-tests and chi-square tests to examine differences in the participant (e.g., mean time since diagnosis, age of participants) and study characteristics (e.g., length of intervention, exercise intensity).

Results

There were no significant differences between studies conducted in group format compared to individual format regarding exercise frequency, duration, intensity, intervention length, and participant age or time since diagnosis.

Effect sizes for the 12 studies with treatment-control comparisons had a significant aggregate random-effects effect size of .56 ($p < .001$; range 0 to 2.37), with significant heterogeneity ($Q = 37.24$, $p < .001$; Table 2). Effect sizes for the 16 studies with pre-post comparisons had a significant aggregate random-effects effect size of .31 ($p < .001$; range -.43 to 1.02), with significant heterogeneity ($Q = 70.21$, $p < .001$). Analogue to ANOVA mixed-effects moderator analyses indicated no significant effect of exercising in groups versus individually for either the treatment-control analysis, $Q(1, 10) = .00$, $p = .95$ (mean aggregate effect size .58 for group-based studies, .56 for individual studies), or for the pre-post analysis, $Q(1, 15) = 1.26$, $p = .26$ (mean aggregate effect size .36 for group-based studies, .22 for individual studies). The mean aggregate effect size was in the expected direction, with effect size being larger in group-based studies as compared to individual-based.

¹The Total PEDro score as used here is 8, not 10 as the scale is usually used; two of the items were not applicable to behavioral interventions such as physical activity interventions (these were the items assessing the blinding of participants and the blinding of therapists conducting the interventions). Previous meta-analyses have used a score of 6 out of 10 to distinguish lower quality from higher quality studies (e.g., Orr, Raymond, & Singh, 2008).

Discussion

We examined 18 studies of group- and individually-delivered exercise interventions for breast cancer survivors. The aggregate effect sizes were medium-to-large, .56 (treatment-control), and small-to-medium, .31 (pre-post) (Cohen, 1988), in accord with prior findings that exercise interventions are generally an effective means of improving QoL for cancer patients (Galvão & Newton, 2005; McNeely et al., 2006; Oldervoll, Kaasa, Hjerstad, Lund, & Loge, 2004). Our prediction that group exercise programs would show greater QoL outcomes in comparison to individual exercise programs was not supported; heterogeneity among the studies was not accounted for by whether exercise interventions were delivered in a group format. Thus, in this sample of studies of breast cancer survivors, group exercise interventions did not affect overall QoL outcomes differently than individual interventions.

However, group exercise interventions may still have potential to be superior to individual exercise interventions. It may be that *the designs of current group exercise programs may not involve sufficient social interaction to create psychosocial improvements over and above those of individual programs*. None of the study reports of the eleven interventions we coded as having group format explicitly stated that capitalizing on group processes was a goal (see Table 1). However, three of the eleven group exercise studies described their intervention in a manner that *indicated* that social interaction was a consideration in their design, even though they did not provide great detail about how the social interaction was fostered (Ohira, Schmitz, Ahmed, & Yee, 2006; Sandel et al., 2005; Schulz et al., 1998). For example, Ohira et al. (2006, p. 2077) indicated, “Participants were encouraged to train with other survivors to foster friendships.” Sandel et al. (2005, p. 303) noted, “Every session began with breathing and stretching... This was usually done sitting in a circle...”; “During the breaks, there was unstructured conversation about a variety of topics ranging from breast cancer treatment to family and social activities” (p. 304); and “It is likely that the group process of women who had a shared experience (breast cancer survivors) participating in a well-designed program had a more powerful effect [on QoL] than the leadership style of the instructor” (p. 308). Schulz and colleagues (Schulz et al., 1998) stated “Die Spiele waren so konzipiert, daß sie Kontakt und Kommunikation der Teilnehmerinnen förderten... [The activities were designed to encourage contact between the participants...]” (pp. 401-402). One study (Mutrie et al., 2007) noted that the, “group itself was an important aspect... exercise in standard settings did not provide the same benefits” (Mutrie et al., 2007, p. 520).

It would have been informative to test whether the programs that appeared to make use of group dynamics differed from those that did not in terms of social functioning QoL (SF QoL), since SF QoL is the QoL dimension most probably influenced by group processes. However, few (five) studies reported the unique contribution of SF QoL (Kolden et al., 2002; Mutrie et al., 2007; Ohira et al., 2006; Schulz et al., 1998; Segal et al., 2001), making quantitative comparison unadvisable. Of these five studies, the two that did not find improvement (Kolden et al., 2002; Segal et al., 2001)² also did not report interest in the potentially available resource of group dynamics in their programs. Three of the studies that *did* report and find improvement in SF QoL (Mutrie et al., 2007; Ohira et al., 2006; Schulz et al., 1998) were among the six group exercise studies that implied making use of social interaction in their groups (Table 1).³

²Kolden et al. (2002) reported three different outcomes related to SF QoL. Two of these showed no significant change over the course of the intervention (LFS: Social functioning, FACT: Social Well-Being); one showed significant improvement (CARES: Psychosocial, at $p < .05$). Because of the number of analyses they ran (presenting an increased possibility of a Type I error) and because two of the SF subscale outcomes were not significant, we chose to categorize this study as a study that reported SF QoL, but did not report an improvement.

³The other three studies that implied interest in social interaction did not report SF QoL outcomes separately.

Thus, there is some indication that the studies that incorporated social interaction as a component of the intervention design or mentioned the importance of the group aspects in the Discussion section of their reports found improved SF QoL. That these studies did not find improved overall QoL could mean that they lacked sufficient emphasis on other intervention components (such as exercise intensity) that might influence dimensions of QoL outside of social functioning (Table 1). In fact, the three studies (Ohira et al., 2006; Sandel et al., 2005; Schulz et al., 1998) that indicated some focus on social interaction in their Introduction or Methods sections were three of the four studies that did not report exercise intensity and/or exercise duration, and were the three studies with the lowest exercise frequency (Table 1).

Research on exercise interventions for cancer survivors appears divided into two approaches: an emphasis predominantly on psychosocial outcomes versus an emphasis predominantly on physical outcomes. Emphasizing one factor over others may not maximize participants' overall QoL. This may explain why the meta-analysis showed no superior benefit for group exercise interventions.

This meta-analysis was limited in that only overall QoL effect sizes were computable for most studies. Specific dimensions (e.g., social functioning) were reported inconsistently across studies, making aggregation across them impossible, and the interpretation that studies branch into an emphasis on either psychological or psychosocial components tentative.

An additional potential limitation involves our inclusion of pre-post contrasts (data for the intervention group only, comparing pre-intervention to post-intervention scores). Although the pre-post analysis used data from the intervention group only, which does not incorporate comparison with a control group, we were careful to keep this analysis distinct from our analysis involving treatment-control group comparisons, which did involve intervention and control group comparisons. The decision to include both a pre-post analysis in addition to a treatment-control analysis was based on our fairly small sample size. Six of our studies did not use a control group, and eliminating these from analysis would have resulted in a sample size of only 12 studies. In addition, use of pre-post comparisons is an acceptable practice for meta-analysis (Lipsey & Wilson, 2001), when care is given to consider the lack of a control group in interpreting results.

The results did not indicate that group exercise is more beneficial than individual exercise in improving QoL. However, there was suggestive evidence that the studies examined generally did not specifically focus on fostering group cohesion in their group participants, and, furthermore, that even some fostering of social interaction improved SF QoL. These results imply that group exercise programs could potentially maximize psychosocial improvements by encouraging social interaction. The results also suggest the need for group programs to continue to emphasize the physical components of their exercise design. A focus on group processes might improve SF QoL, but if this comes at the cost of proper exercise intensity or duration, functional QoL could suffer and improvements in overall QoL may be compromised.

Recommendations for Future Study

Successfully implementing an exercise program that considers physical and psychosocial factors presents a unique opportunity for collaboration among social and health psychologists, exercise physiologists, kinesiologists, physical therapists, group dynamics experts. Future intervention studies could borrow from what we know from other literatures, including group cohesion studies, to explore how QoL outcomes are affected by deliberately capitalizing on group dynamics.

Exercise intervention studies conducted in other types of samples have examined several mechanisms for promoting group cohesion, such as team-building exercises (Estabrooks & Carron, 1999). Setting group goals has also been effective in establishing cohesion. For example, Estabrooks and Carron (1999) outline one task cohesion-building activity, in which participants “travel” a targeted distance by equating 10 minutes of exercise class participation to 1 kilometer of walking; each person’s individual contribution helps the class reach their goal. Similarly, Estabrooks (2007) outlines concrete examples of methods used to promote cohesion. Some specific examples include incorporating partner interaction activities like partnered stretching exercises, using activities that require participants to be physically close, having participants work toward a common goal, and taking group photographs. It may also be useful to consider insights from literature on close relationships. For example, novel activities have been used to increase relationship satisfaction among romantic partners (Reissman, Aron, & Bergen, 1993). Future studies could apply this to the group exercise context to determine if this could be used to enhance feelings of closeness among participants, as well as provide novel and thus interesting exercise options.

The 13 most often cited barriers to exercise among cancer patients include: exercise not being a priority, lack of self-discipline, procrastination, fatigue, lack of interest, lack of time, inconvenient exercise schedule, lack of enjoyment, discouragement, family responsibilities, exercise being boring, exercise costing too much, and lack of equipment (Rogers, Courneya, Shah, Dunnington, & Hopkins-Price, 2007). Interestingly, some of these barriers could be directly addressed with a group exercise format (lack of self-discipline, procrastination), though some may be exacerbated by the group format (inconvenient schedule). It may be the case that, if group programs intentionally make use of the group processes at their fingertips, exercise could become more fun (exercise is no longer boring), cohesion among members might make them more dedicated to the group (exercise becomes a priority through the group, becomes interesting, becomes enjoyable), and the social support of the group may address discouragement by enabling self-efficacy (Benight & Bandura, 2004). In addition, having an exercise program that is enjoyable may distract from any self-consciousness about performance. For example, team sports in which individual performance is not as important as working together as a team, such as in rowing, may help distract individuals from being self-conscious about their performance. Finally, exercise programs for survivors may find it beneficial to make the exercise groups as homogeneous as possible. People report more interest in exercising with others who are similar to themselves in ways such as age (Beauchamp, Carron, McCutcheon, & Harper, 2007).

Conclusions

Although the background information regarding exercise and group psychosocial interventions indicates that exercising in a group could provide a much-needed combination of physical and psychosocial benefits for cancer survivors, the present study did not find that group exercise interventions improved QoL over that of individual exercise interventions. Still, qualitative data from group exercise participants indicated that the group exercise format is a much appreciated intervention. An essential next step is testing QoL outcomes in group exercise programs that intentionally foster a shared and cohesive experience for their participants – an experience in which they are “all in the same boat.” Future multidisciplinary studies can build from research in other areas, such as on group cohesion, to determine the effects of social and task-cohesion building activities and incorporating novel activities into intervention design. Group exercise interventions may address some of the often cited barriers to exercise for cancer patients (e.g., lack of self-discipline, procrastination, exercise being boring). A deliberate effort to incorporate group processes in group exercise interventions, while still keeping rigorous standards for physical components may provide the most benefit possible to cancer survivors regarding overall QoL.

Acknowledgments

The authors would like to extend their sincere thanks to the authors of the studies included in the meta-analysis who provided data upon request (Dr. Kerry Courneya, Dr. Melinda Irwin, Dr. Alejandro Lucia, Dr. Don McKenzie, and Dr. Bernadine Pinto), to Dr. Barbara Resnick and Dr. Paul Estabrooks for information and suggestions, to Dr. Hans-Joachim Huff and Anna Kuhlen for assistance coding studies written in German, and to the members of the Vermont Dragonheart Dragonboat team for inspiring this project. This project was partially supported by a grant from the National Cancer Institute (R01 CA100810) to Anne Moyer.

References

*References indicated with an asterisk are included in the meta-analysis

- Adamsen L, Rasmussen JM, Pedersen LS. 'Brothers in arms': How men with cancer experience a sense of comradeship through group intervention which combines physical activity with information relay. *Journal of Clinical Nursing* 2001;10:528–537. [PubMed: 11822501]
- Beauchamp MR, Carron AV, McCutcheon S, Harper O. Older adults' preferences for exercising alone versus in groups: Considering contextual congruence. *Annals of Behavioral Medicine* 2007;33:200–206. [PubMed: 17447872]
- Benight CC, Bandura A. Social cognitive theory of posttraumatic recovery: the role of perceived self-efficacy. *Behaviour Research and Therapy* 2004;42:1129–1148. [PubMed: 15350854]
- Blascovich, J.; Mendes, WB.; Hunter, SB.; Lickel, B. Stigma, threat, and social interactions. In: Heatherton, TF.; Kleck, RE.; Hebl, MR.; Hull, JG., editors. *Social psychology of stigma*. New York: The Guilford Press; 2000. p. 307-333.
- Bloom, JR. Social support systems and cancer: A conceptual view. In: Cohen, J.; Cullen, JW.; Martin, RL., editors. *Psychosocial Aspects in Cancer*. New York, NY: Raven Press; 1982. p. 129-149.
- Burke SM, Carron AV, Eys MA, Ntoumanis N, Estabrooks PA. Group versus individual approach? A meta-analysis of the effectiveness of interventions to promote physical activity. *Sport & Exercise Psychology Review* 2006;2:19–35.
- *. Cadmus LA, Salovey P, Yu H, Chung G, Kasl S, Irwin ML. Exercise and quality of life during and after treatment for breast cancer: Results of two randomized controlled trials. *Psycho-Oncology* 2009;18:343–352. [PubMed: 19242918]
- *. Campbell A, Mutrie N, White F, McGuire F, Kearney N. A pilot study of a supervised group exercise programme as a rehabilitation treatment for women with breast cancer receiving adjuvant treatment. *European Journal of Oncology Nursing* 2005;9:56–63. [PubMed: 15774341]
- Carron, AV.; Brawley, LR.; Widmeyer, WN. The measurement of cohesiveness in sport groups. In: Duda, JL., editor. *Advances in Sport and Exercise Psychology Measurement*. Morgantown, WV: Fitness Information Technology; 1998. p. 213-226.
- Cella, D.; Baum, A.; Andersen, BL. Quality-of-life measurement in oncology. In: Baum, A.; Andersen, BL., editors. *Psychosocial interventions for cancer*. Washington DC: American Psychological Association; 2001. p. 57-76.
- Cella DF, Yellen SB. Cancer support groups: the state of the art. *Cancer Practice* 1993;1:56–61. [PubMed: 8324531]
- Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*. 2. Hillsdale, NJ: Erlbaum; 1988.
- Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychological Bulletin* 1985;98:310–357. [PubMed: 3901065]
- Courneya KS, Friedenreich CM. Physical exercise and quality of life following cancer diagnosis: a literature review. *Annals of Behavioral Medicine* 1999;21:171–179. [PubMed: 10499138]
- Courneya KS, Friedenreich CM. Physical Activity and Cancer Control. *Seminars in Oncology Nursing* 2007;23:242–252. [PubMed: 18022052]
- *. Courneya KS, Mackey JR, Bell GJ, Jones LW, Field CJ, Fairey AS. Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. *Journal of Clinical Oncology* 2003;21:1660–1668. [PubMed: 12721239]
- Dunkel-Schetter C, Folkman S, Lazarus RS. Correlates of social support receipt. *Journal of Personality and Social Psychology* 1987;53:71–80. [PubMed: 3612494]

- Emslie C, Whyte F, Campbell A, Mutrie N, Lee L, Ritchie D, et al. 'I wouldn't have been interested in just sitting round a table talking about cancer'; Exploring the experiences of women with breast cancer in a group exercise trial. *Health Education Research* 2007;22:827–838. [PubMed: 17272293]
- Estabrooks, PA. Group Integration Interventions in Exercise: Theory, Intervention, & Future Directions. In: Beauchamp, MR.; Eys, MA., editors. *Group Dynamics Advances in Sport and Exercise Psychology: Contemporary Themes*. London UK: Routledge; 2007.
- Estabrooks PA, Carron AV. Group cohesion in older adult exercisers: Prediction and intervention effects. *Journal of Behavioral Medicine* 1999;22:575–588. [PubMed: 10650537]
- Fawzy FI, Cousins N, Fawzy NW, Kemeny ME, Elashoff R, Morton D. A structured psychiatric intervention for cancer patients. I. Changes over time in methods of coping and affective disturbance. *Archives of General Psychiatry* 1990;47:720–725. [PubMed: 2378543]
- Galvão DA, Newton RU. Review of exercise intervention studies in cancer patients. *Journal of Clinical Oncology* 2005;23:899–909. [PubMed: 15681536]
- Gillison FB, Skevington SM, Sato A, Standage M, Evangelidou S. The effects of exercise interventions on quality of life in clinical and healthy populations; a meta-analysis. *Social Science & Medicine* 2009;68:1700–1710. [PubMed: 19297065]
- Gottlieb BH, Wachala ED. Cancer support groups: A critical review of empirical studies. *Psychooncology* 2007;16:379–400. [PubMed: 16986205]
- Harrison J, Maguire P, Pitceathly C. Confiding in crisis: Gender differences in pattern of confiding among cancer patients. *Social Science & Medicine* 1995;41:1255–1260. [PubMed: 8545678]
- Hebl, MR.; Tickle, J.; Heatherton, TF. Awkward moments in interactions between nonstigmatized and stigmatized individuals. In: Heatherton, TF.; Kleck, RE.; Hebl, MR.; Hull, JG., editors. *Social psychology of stigma*. New York: The Guilford Press; 2000. p. 275–306.
- Hedges LV. Distribution theory for Glass's estimator of effect size and related estimators. *Journal of Educational Statistics* 1981;6:107–128.
- *. Herrero F, San Juan AF, Fleck SJ, Balmer J, Pérez M, Cañete S, et al. Combined aerobic and resistance training in breast cancer survivors: A randomized, controlled pilot trial. *International Journal of Sports Medicine* 2006;27:573–580. [PubMed: 16802254]
- Holland, JC. Societal views of cancer and the emergence of psycho-oncology. In: Holland, JC., editor. *Psycho-oncology*. New York: Oxford University Press; 1998. p. 3–15.
- *. Hughes DC, Leung P, Naus MJ. Using single-system analyses to assess the effectiveness of an exercise intervention on quality of life for Hispanic breast cancer survivors: a pilot study. *Social Work in Health Care* 2008;47:73–91. [PubMed: 18956514]
- Kissane DW, Smith GC, Miach P, Clarke DM, Ikin J, Love A, Ranieri N, McKenzie D. Cognitive-existential group psychotherapy for women with primary breast cancer: a randomised controlled trial. *Psycho-oncology* 2003;12:532–546. [PubMed: 12923794]
- Knobf MT, Musanti R, Dorward J. Exercise and quality of life outcomes in patients with cancer. *Seminars in Oncology Nursing* 2007;23:285–296. [PubMed: 18022056]
- *. Kolden GG, Strauman TJ, Ward A, Kuta J, Woods TE, Schneider KL, et al. A pilot study of group exercise training (GET) for women with primary breast cancer: Feasibility and health benefits. *Psycho-Oncology* 2002;11:447–456. [PubMed: 12228878]
- *. Kramer, MM. Unpublished doctoral dissertation, Arizona State University. 1996. The effects of exercise on psychological well-being in women recovering from breast cancer.
- Lipsey, MW.; Wilson, DB. *Practical Meta-Analysis*. Thousand Oaks, CA: Sage Publications; 2001.
- MacVicar MG, Winningham ML, Nickel JL. Effects of aerobic interval training on cancer patients' functional capacity. *Nursing Research* 1989;38:348–351. [PubMed: 2587289]
- Magen RH, Glajchen M. Cancer support groups: Client outcome and the context of group process. *Research on Social Work Practice* 1999;9:541–554.
- Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy* 2003;83:713–721. [PubMed: 12882612]

- * McKenzie DC, Kalda AL. Effect of upper extremity exercise on secondary lymphedema in breast cancer patients: A pilot study. *Journal of Clinical Oncology* 2003;21:463–466. [PubMed: 12560436]
- McNeely ML, Campbell KL, Rowe BH, Klassen TP, Mackey JR, Courneya KS. Effects of exercise on breast cancer patients and survivors: A systematic review and meta-analysis. *Canadian Medical Association Journal* 2006;175:34–41. [PubMed: 16818906]
- Midtgaard J, Rorth M, Stelter R, Adamsen L. The group matters: An explorative study of group cohesion and quality of life in cancer patients participating in physical exercise intervention during treatment. *European Journal of Cancer Care* 2006;15:25–33. [PubMed: 16441674]
- Mock V, Dow KH, Meares CJ, Grimm PM, Dienemann JA, Haisfield-Wolfe ME, et al. Effects of exercise on fatigue, physical functioning, and emotional distress during radiation therapy for breast cancer. *Oncology Nursing Forum* 1997;24:991–1000. [PubMed: 9243585]
- Mustian, KM. Unpublished doctoral dissertation, University of North Carolina at Greensboro. Greensboro, NC: 2003. Breast cancer, tai chi chuan, and self-esteem: A randomized trial.
- * Mutrie N, Campbell AM, Whyte F, McConnachie A, Emslie C, Lee L, et al. Benefits of supervised group exercise programme for women being treated for early stage breast cancer: pragmatic randomised controlled trial. *BMJ (Clinical Research Ed.)* BMJ 16 February 2007 2007;334:517–520. abridged text, in print: *BMJ* 2007;334:517–20. 10.1136/bmj.39094.648553.AE
- O’Kelly JG, Piper WE, Kerber R, Fowler J. Exercise groups in an insight-oriented, evening treatment program. *International Journal of Group Psychotherapy* 1998;48:85–98. [PubMed: 9509771]
- * Ohira T, Schmitz KH, Ahmed RL, Yee D. Effects of weight training on quality of life in recent breast cancer survivors: the Weight Training for Breast Cancer Survivors (WTBS) study. *Cancer* 2006;106:2076–2083. [PubMed: 16568409]
- Oldervoll LM, Kaasa S, Hjermstad MJ, Lund JÅ, Loge JH. Physical exercise results in the improved subjective well-being of a few or is effective rehabilitation for all cancer patients? *European Journal of Cancer* 2004;40:951–962. [PubMed: 15093569]
- Orr R, Raymond A, Singh MF. Efficacy of Progressive Resistance Training on Balance Performance in Older Adults. *Sports Medicine* 2008;38:317–343. [PubMed: 18348591]
- Parry DC. ‘There is life after breast cancer’: Nine vignettes exploring dragon boat racing for breast cancer survivors. *Leisure Sciences* 2007;29:53–69.
- Paulus, PB.; Baum, A.; Andersen, BL. Psychosocial interventions for cancer. Washington, DC: American Psychological Association; 2001. Group processes in therapeutic support groups; p. 131–141.
- * Pinto BM, Clark MM, Maruyama NC, Feder SI. Psychological and fitness changes associated with exercise participation among women with breast cancer. *Psycho-Oncology* 2003;12:464–467.
- * Pinto BM, Frierson GM, Rabin C, Trunzo JJ, Marcus BH. Home-based physical activity intervention for breast cancer patients. *Journal of Clinical Oncology* 2005;23:3577–3587. [PubMed: 15908668]
- Pollock ML, Gaesser GA, Butcher JD, Despres J-P, Dishman RK, Franklin BA, et al. ACSM position stand: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Medicine & Science in Sports & Exercise* 1998;30:975–991. [PubMed: 9624661]
- Rehse B, Pukrop R. Effects of psychosocial interventions on quality of life in adult cancer patients: Meta-analysis of 37 published controlled outcome studies. *Patient Education and Counseling* 2003;50:179–186. [PubMed: 12781933]
- Reissman C, Aron A, Bergen MR. Shared activities and marital satisfaction: Causal direction and self-expansion versus boredom. *Journal of Social and Personal Relationships* 1993;10:243–254.
- Rogers LQ, Courneya KS, Shah P, Dunnington G, Hopkins-Price P. Exercise stage of change, barriers, expectations, values and preferences among breast cancer patients during treatment: A pilot study. *European Journal of Cancer Care* 2007;16:55–66. [PubMed: 17227354]
- Rosenbaum, EH.; Rosenbaum, IR.; Kneier, AW.; Spiegel, D. The will to live. In: Rosenbaum, EH.; Rosenbaum, IR., editors. *Everyone’s Guide to Cancer Supportive Care*. Kansas City, MO: Andrews McMeel; 2005. p. 136–148.

- *. Sandel SL, Judge JO, Landry N, Faria L, Ouellette R, Majczak M. Dance and movement program improves quality-of-life measures in breast cancer survivors. *Cancer Nursing* 2005;28:301–309. [PubMed: 16046894]
- *. Schulz K-H, Szlovák C, Schulz H, Gold S, Brechtel L, Braumann M, et al. Implementierung und Evaluation eines ambulanten bewegungstherapeutischen Rehabilitationsangebotes für Brustkrebspatienten. [Implementation and evaluation of an exercise rehabilitation training for breast cancer patients]. *Psychotherapie Psychosomatik Medizinische Psychologie* 1998;48:398–407.
- *. Schwartz AL. Fatigue mediates the effects of exercise on quality of life. *Quality of Life Research* 1999;8:529–538. [PubMed: 10548868]
- *. Segal R, Evans W, Johnson D, Smith J, Colletta S, Gayton J, et al. Structured exercise improves physical functioning in women with stages I and II breast cancer: Results of a randomized controlled trial. *Journal of Clinical Oncology* 2001;19:657–665. [PubMed: 11157015]
- Segar ML, Katch VL, Roth RS, Garcia AW, Portner TI, Glickman SG, et al. The effect of aerobic exercise on self-esteem and depressive and anxiety symptoms among breast cancer survivors. *Oncology Nursing Forum* 1998;25:107–113. [PubMed: 9460778]
- Shrout PE, Fleiss JL. Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin* 1979;86:420–428. [PubMed: 18839484]
- Siegel, S.; Castellan, NJ, Jr. *Nonparametric statistics for the behavioral sciences*. 2. New York, NY: McGraw-Hill Book Company; 1988.
- Spiegel D, Morrow GR, Classen C, Raubertas R, Stott PB, Mudaliar N, et al. Group psychotherapy for recently diagnosed breast cancer patients: A multicenter feasibility study. *Psycho-Oncology* 1999;8:482–493. [PubMed: 10607981]
- Steihaug S, Ahlsen B, Malterud K. From exercise and education to movement and interaction: Treatment groups in primary care for women with chronic muscular pain. *Scandinavian Journal of Primary Health Care* 2001;19:249–254. [PubMed: 11822650]
- Taskinen P. The development of health enhancing exercise groups adapted for hemiplegic patients: A pilot study. *NeuroRehabilitation* 1999;13:35–43.
- *. Turner J, Hayes S, Reul-Hirche H. Improving the physical status and quality of life of women treated for breast cancer: A pilot study of a structured exercise intervention. *Journal of Surgical Oncology* 2004;86:141–146. [PubMed: 15170652]
- Unruh AM, Elvin N. In the eye of the dragon: Women's experience of breast cancer and the occupation of dragon boat racing. *Canadian Journal of Occupational Therapy* 2004;71:138–149.
- Vugia HD. Support groups in oncology: Building hope through the human bond. *Journal of Psychosocial Oncology* 1991;9:89–107.
- Wortman CB, Dunkel-Schetter C. Interpersonal relationships and cancer: A theoretical analysis. *Journal of Social Issues* 1979;35:120–155.

Table 1

Characteristics of Studies Included in the Meta-Analysis.

Study	QoL Measure ^d	Exercise Duration (Minutes)	Exercise Intensity ^b	Length of Intervention	Frequency (Times/Week)	Exercise Type	Participant Age	Time Since Diagnosis (Months)	Cancer Stage(s)	Exercise During or Post Cancer Treatment	Supervised Exercise?	Total PEDro Quality Score ^c	Social Interaction Mentioned as Intentional Component of Intervention?	Unique Contribution of Social Functioning QoL
Group Format Interventions														
Cadmus et al., 2009 YES Study	QoL; FACT B	30	m-h	24	5	participant can choose activity, most choose walking	55.8	45	0-IIIa	post	yes	7	no	not reported
Campbell et al., 2005	QoL; FACT G	15	m-h	12	2	biking; circuits; dance/aerobics; resistance training; walking	47.5	1	?	during	yes	3	mentioned post hoc	not reported
Herrero et al., 2006	QoL; EORTC	90	h	8	3	cycle ergometer; resistance	50.5	?	I - II	post	yes	5	no	not reported
Kolden et al., 2002	QoL; FACT G	60	h	16	3	biking; dance; step and other aerobics; walking	55.3	-	I, II, III	most during	yes	n/a	no	some improvement; some no change
Mutrie et al., 2007	QoL; FACT G	45	m-h	12	3	aerobics; circuits; cycling; resistance training; walking	51.6	5.4	0, I, II, III	during	yes	7	mentioned post hoc	improvement
Ohira et al., 2006	CARES-SF	?	?	24	2	resistance training	53.1	22.5	DCIS, I, II, III	post	yes	7	yes	improvement
Pinto et al., 2003	POMS total mood disturbance	50	m	12	3	arm/leg ergometers; arm cycling; rowing; stationary biking; walking	52.5	15.1	0, I, II	post	yes	4	no	not reported
Sandel et al., 2005	QoL; FACT B	56	?	12	1.5	dance/aerobics	59.6	?	?	both	yes	6	yes	not reported
Schulz et al., 1998	SF-36 Mental Health subscale of Mental Health domain	90	?	10	2	gymnastics and games; running	53.9	?	?	?	?	n/a	yes	improvement
Segal et al., 2001	QoL; FACT G	?	l-m	26	5	walking	50.9	1	I, II	during	yes	4	no	no change
Turner et al., 2004	QoL; FACT B	50	h	8	3	aerobics; ergometers; water exercise	47	17	?	post	yes	n/a	mentioned post hoc	not reported
Individual Format Interventions														
Cadmus et al., 2009 IMPACT Study	QoL; FACT B	30	m-h	24	5	participant can choose activity, most choose walking	54.3	1.2	0-IIIa	during	no	7	-	-
Courneya et al., 2003	QoL; FACT G	35	h	15	3	biking	59	?	I, IIa, IIb, IIIa	post	yes	8	-	-
Hughes et al., 2008	SF-36 Mental Health domain	60	?	10	?	stationary bike; walking; exercise tailored to each participant	50	61.3	I, II, III, IV, some participants did not know	post	no	n/a	-	-
Kramer, 1996	Quality of life index for patients with cancer	45	m-h	12	3	walking	?	?	I, II	both	no	n/a	-	-

Study	QoL Measure ^a	Exercise Duration (Minutes)	Exercise Intensity ^b	Length of Intervention	Frequency (Times/Week)	Exercise Type	Participant Age	Time Since Diagnosis (Months)	Cancer Stage(s)	Exercise During or Post Cancer Treatment	Supervised Exercise?	Total PEDro Quality Score ^c	Social Interaction Mentioned as Intentional Component of Intervention?	Unique Contribution of Social Functioning QoL
McKenzie & Kalda, 2003	SF-36 Mental Health domain	20	?	8	3	arm cycle ergometers; resistance training	56.6	?	I, II	post	yes	4	-	-
Pinto et al., 2005	POMS total mood disturbance	30	m	12	5	participants choose activity (e.g., biking; swimming; walking)	53.1	22	0, I, II	post	no	5	-	-
Schwartz, 1999	Quality of Life Index for patients with Cancer	22.5	l-m	8	3.5	?	47	1	I, II, III, IV	during	no	n/a	-	-

Notes:

^aFACT-G = Functional Assessment of Cancer Therapy – General; FACT-B = Functional Assessment of Cancer Therapy for patients with Breast cancer (includes FACT-G in all studies included in this meta-analysis); WHOQOL-BREF = World Health Organization Quality of Life instrument, short form; EORTC QLQ-C30 = The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire; SF-36 = The Short Form (36) Health Survey; CARES-SF = The Cancer Rehabilitation Evaluation System – Short Form; POMS = Profile of Mood States.

^bExercise intensity abbreviations as follows: “l” = low; “m” = moderate; “h” = hard.

^cTotal PEDro Score is out of 8; two of the usually included items were not applicable to behavioral interventions such as physical activity interventions (these were the items assessing the blinding of participants and the blinding of therapists conducting the interventions).

“?” indicates that the data were not reported by study authors.

“-” indicates that the data was not appropriate for coding for the meta-analysis

Table 2

Quality of Life Effect Size.

Study	N Intervention Group	N Control Group	N Total	Effect Sizes	
				Treatment - Control Analysis ^a	Pre-Post Analysis ^a
Group-format Interventions					
Cadmus, 2009 (YES)	37	37	74	0.39	0.07
Campbell et al., 2005	10	9	19	2.37	0.74
Herrero et al., 2006	8	8	16	1.71	–
Kolden et al., 2002	40	n/a	40	–	0.36
Mutrie et al., 2007	82	92	174	0.24	0.27
Ohira et al., 2006	39	40	79	0.35	0.26
Pinto et al., 2003	12	6	18	0.6	0.36
Sandel et al., 2005	19	16	35	0.53	0.9
Schulz et al., 1998	28	n/a	28	–	0.61
Segal, et al., 2001	32	34	66	0	0
Tumer et al., 2004	10	n/a	10	–	0.51
Individual-format Interventions					
Cadmus, 2009 (IMPACT)	25	25	50	0.09	0.23
Coumeya et al., 2003	24	26	52	1.7	0.49
Hughes et al., 2008	25	n/a	25	–	0.32
Kramer, 1996	13	n/a	13	–	1.02
McKenzie & Kalda, 2003	7	7	14	0	–
Pinto et al., 2005	39	43	82	0.33	0.15
Schwartz, 1999	27	n/a	27	–	-0.43
Total/Mean	477	343	822	0.56 95% CI (.25, .87)	0.31 95% CI (.19, .43)

^a adjusted for small sample bias.