Effect of Group Dynamics–Based Exercise Versus Personal Training in Breast Cancer Survivors

Heather J. Leach, PhD, Kelley R. Covington, MS, Corrine Voss, MS, Kelli A. LeBreton, MS, Samantha M. Harden, PhD, and Steven R. Schuster, MD

OBJECTIVES: To determine the feasibility and preliminary effectiveness of a group dynamics–based exercise intervention versus a personal training intervention for increasing physical activity (PA), physical fitness, and quality of life (QOL) in post-treatment breast cancer survivors.

SAMPLE & SETTING: 26 women with stage I or II breast cancer who attended intervention activities at a local academic institution.

METHODS & VARIABLES: Participants were randomly assigned to receive an eight-week intervention in either a group dynamics–based exercise or a personal training setting. Both intervention arms received supervised exercise twice per week, as well as PA education and discussion sessions.

RESULTS: Significant increases were noted in both intervention arms for vigorous PA, chest press, and leg press. Increases in overall QOL and total PA were significant only in the group dynamics–based exercise intervention arm.

IMPLICATIONS FOR NURSING: The group dynamics–based exercise intervention produced similar improvements in PA and physical fitness compared to the personal training intervention, and it may have facilitated greater improvements in overall QOL.

KEYWORDS group dynamics; physical activity; fitness; quality of life; breast cancer; personal training

***ONF, 46*(2), 185–197.**

DOI 10.1188/19.ONF.185-197

Physical activity (PA) can mitigate the negative effects of breast cancer treatment on fatigue (Brown et al., 2011; Meneses-Echávez, González-Jiménez, & Ramírez-Vélez, 2015), physical function (Fong et al., 2012; McNeely et al., 2006), and quality of life (QOL) (Ferrer, Huedo-Medina, Johnson, Ryan, & Pescatello, 2011; Mishra, Scherer, Snyder, Geigle, & Gotay, 2014), as well as reduce risk for cardiovascular disease, cancer recurrence, and mortality (Ammitzbøll et al., 2016; Ibrahim & Al-Homaidh, 2011). Despite these known benefits, breast cancer survivors' PA levels tend to decline and remain low following treatment (Smith & Chagpar, 2010). This may be attributable to cancer-specific barriers to engaging in PA, such as fatigue, pain, lymphedema, neuropathy, feelings of fear or uncertainty, lack of motivation, and lack of knowledge regarding appropriate exercise regimens (Blaney et al., 2010; Rogers, Courneya, Shah, Dunnington, & Hopkins-Price, 2007). Interventions that are structured and supervised and that include exercise types and intensities tailored to breast cancer survivors' needs can help patients overcome these barriers and may be most effective for increasing PA (Bluethmann, Basen-Engquist, et al., 2015) and improving physical function and QOL (Sweegers et al., 2018). However, to make these supervised, structured opportunities widely accessible to breast cancer survivors, it is important to explore exercise intervention delivery modalities that are effective, practical, and resource-conscientious.

Based on an instructor-to-participant ratio, group-based exercise may be less expensive than individually supervised exercise, illustrating the potential of group-based exercise to be implementable and sustainable in real-world settings. However, it has been argued that not all group-based exercise interventions are created equal. Previous studies have found that those that

implement group dynamics strategies to target the group's environment, structure, and processes (Carron & Spink, 1993) can enhance cohesion and may be superior to individually supervised exercise for increasing PA (Burke, Carron, Eys, Ntoumanis, & Estabrooks, 2006). Group dynamics is a field of study that examines the positive and negative forces that reside within groups. The theoretical basis of group dynamics is attributed to Kurt Lewin (1939) and proposes that by joining a group, one's interactions with fellow members change the individual and the other group members; in addition, a highly attractive group can exert influence on its members, whereas a weak group does not have the same ability. Cohesion, defined as "a dynamic property reflecting [group] members' perceptions of the unity and personal attractions to task and social objectives of the group" (Eys & Kim, 2017, para. 1), has been suggested as the central characteristic underlying group dynamics. Cohesion of the group can provide the distinction between interventions that include strategies based on group dynamics versus those that are delivered to an aggregate of people. The former (interventions that use group dynamics principles to increase cohesiveness) are effective for increasing PA (Estabrooks, Harden, & Burke, 2012) across a variety of settings and populations (Harden, McEwan, et al., 2015). However, to the current authors' knowledge, no previous studies have systematically implemented and tested the effects of a group dynamics–based exercise intervention for increasing PA or QOL among breast cancer survivors.

An exercise intervention that includes strategies based on group dynamics may be particularly effective for increasing PA and improving QOL in breast cancer survivors. Previous qualitative studies have reported that for breast cancer survivors, gaining social support, networking, and being around peers or others similar to them are primary motives for initial and continued participation in PA interventions and programs (Emslie et al., 2007; Wurz, St-Aubin, & Brunet, 2015). However, findings from quantitative studies are inconsistent with this proposition. A meta-analysis by Floyd and Moyer (2009) found that group-based exercise interventions demonstrated no advantage over individual exercise interventions for improving QOL, and a study by Naumann et al. (2012) that compared nine weeks of individual- versus group-based exercise and counseling found that QOL increased to a greater extent among participants in the individual-based exercise intervention group compared to participants in the control group.

Floyd and Moyer (2009) surmised that despite the findings of their review, group-based exercise interventions may still have the potential to be superior to individual-based exercise interventions. One limitation was that the studies reviewed did not involve sufficient social interaction to elicit improvement over and above that of individual programs (Floyd & Moyer, 2009). In addition, the studies reviewed by Floyd and Moyer (2009) did not include sufficient detail regarding exercise dose or measures of PA or physical fitness (e.g., muscle strength, aerobic capacity), which may be problematic because increases in PA and physical fitness may mediate improvements in QOL (Buffart et al., 2014; De Backer et al., 2007).

The current authors believe that an essential next step is testing whether a group-based exercise program that intentionally fosters a shared and cohesive experience by systematically implementing group dynamics–based strategies while matching the exercise dose of an individually supervised exercise intervention is effective for increasing PA and QOL in breast cancer survivors.

The aims of this study were to determine the feasibility and preliminary effectiveness of a group dynamics–based exercise intervention for increasing PA, physical fitness, and QOL in a sample of post-treatment breast cancer survivors. The authors hypothesized that an exercise intervention that includes strategies based on group dynamics would result in similar increases in physical fitness and greater increases in PA and QOL compared to individually supervised exercise.

Methods

This study was a pilot two-arm randomized controlled trial comparing group dynamics–based exercise to individually supervised exercise (i.e., personal training). Participants completed baseline assessments to gather demographic and health history information, as well as various other measures; they were then randomized to an eight-week personal training or group dynamics–based exercise intervention arm. Assessments were repeated within one week of the last exercise session and conducted by health and exercise science graduate research assistants (Master of Science or doctoral students) who were trained on the study protocol. Randomization was computer-generated and kept in sequentially numbered opaque sealed envelopes to prevent bias in intervention arm allocation. All participants received supervised exercise sessions twice per week for eight weeks, along with social cognitive theory–based

education and discussion sessions targeting PA behavior change and maintenance (Bandura, 1986).

Sample and Setting

Breast cancer survivors diagnosed with stage I–III breast cancer who had completed chemotherapy and/or radiation therapy less than one year prior were eligible to participate in this study. Recruitment took place from September 2016 to March 2017. Participants were primarily recruited by clinical research nurses at UCHealth Cancer Center–Harmony Campus in Fort Collins, Colorado, or could self-refer via flyers sent to local breast cancer support groups.

The study coordinator screened potential participants via telephone for additional eligibility criteria, which were as follows:

- Aged 18–70 years
- Eight weeks or greater postsurgery
- No surgery scheduled for six months
- Willing to travel to the study site two days per week
- Not currently meeting American College of Sports Medicine guidelines for PA (150 minutes or greater of moderate PA or 75 minutes or greater of vigorous PA per week)
- Able to pass the Physical Activity Readiness Questionnaire (PAR-Q) or obtain written physician clearance to confirm safety for participation in exercise (Bredin, Gledhill, Jamnik, & Warburton, 2013)

All procedures performed in this study were in accordance with the ethical standards of Colorado State University's institutional review board for the protection of human participants. Informed consent was obtained from all participants in this study.

Intervention

Supervised exercise sessions lasted about one hour and consisted of the following elements:

- A five-minute warm-up
- 20–30 minutes of aerobic exercise at 55%–75% of heart rate reserve (HRR) (rating of perceived exertion [RPE] of 4–7 on a scale ranging from 1 [nothing at all] to 10 [very, very heavy])
- 20–25 minutes of muscle strengthening, with a goal of two to three sets of 8–12 repetitions (RPE of 4–7)
- A five-minute cooldown and light stretching

In general, class format consisted of aerobic exercise first, followed by resistance training. Some of the group-based exercise classes conducted resistance training in a circuit to foster interaction among participants.

Aerobic exercise duration and intensity was progressed every two weeks. Duration was progressed by two to three minutes every two weeks, and intensity was progressed if participants' HR failed to reach 55% of HRR for a given workload. Compliance to aerobic exercise intensity was monitored by a Polar A300 activity tracker and HR monitor and recorded by the research assistant delivering the exercise session.

Aerobic exercise modalities included treadmill, elliptical, stationary bike, and outdoor walking. Every exercise session for both intervention arms included chest and leg press exercises using a plate-loaded machine; these were prescribed at 55%–75% of baseline 1-repetition maximum (1-RM). Resistance exercise intensity started at 55% 1-RM and was progressed by the smallest increment possible once participants were able to complete 3 sets of 12 or more repetitions for a given load for two consecutive sessions. In addition to chest and leg press exercises, an additional four to six resistance exercises targeting major muscle groups were included, with the same goal of three sets of 8–12 repetitions. Strength training modalities included machines, dumbbells, body weight, and resistance bands. To increase group cohesion during exercise sessions in the group dynamics–based intervention arm, several strategies that target group structure, processes, and environment were used (Estabrooks, 2007) (see Figure 1).

To help facilitate independent PA and work toward achieving PA guidelines (Rock et al., 2012; Schmitz, Courneya, et al., 2010), participants in both intervention arms were encouraged to complete at least one aerobic exercise session of 20–60 minutes and performed at the same intensity (55%–75% of HRR) per week outside of the supervised sessions. Participants were given an HR monitor and a physical activity logbook to track any PA completed outside of the supervised sessions.

PA education and discussion sessions were used to facilitate independent PA. Sessions operationalized social cognitive theory constructs by discussing the following topics:

- PA guidelines and benefits for breast cancer survivors (behavioral capability, expectations and expectancies, observational learning)
- Goal setting and self-monitoring (self-efficacy, reinforcement, self-control)
- Identification of PA barriers and facilitators and problem solving to overcome PA barriers (environment, reinforcement)

These sessions lasted about 30 minutes to one hour and were held following exercise sessions in weeks two, five, and seven. Both intervention arms

FIGURE 1. Group Structure, Processes, and Environment Principles Used to Increase Cohesion

Group Structure

- Establish group norms for appropriate exercise (e.g., sets, repetitions, heart rate zone).
- Assign role for each exercise session (e.g., determine motivational word of the day, lead warm-up).

Group Processes

- Personal introductions and name tags
- Share motivation or reason for joining the intervention.
- Partner exercises, and partner records heart rate, sets, repetitions, and load.
- Friendly competition to achieve goals
- Facilitated opportunities for social interaction during exercise sessions (e.g., water breaks, partner exercises)
- Collaboratively develop a group physical activity goal.
- Group problem solving for overcoming physical activity barriers

Group Enviroment

- Group size of 3–10 to allow for interaction
- Group T-shirt design
- Some classes included circuit-based resistance exercises to encourage interaction among participants.

Note. Based on information from Estabrooks, 2007.

received the same information. The personal training intervention arm discussion sessions were delivered one-on-one with the trainer and the participant, whereas the sessions for the group dynamics–based exercise intervention arm were delivered in the group setting. The sessions for the latter arm also included additional strategies targeting processes to increase group cohesion (Estabrooks, 2007). All exercise and education and discussion sessions were delivered by health and exercise science undergraduate and graduate research assistants trained on the study protocol.

Assessment of Outcomes

Feasibility: Feasibility of the group dynamics–based exercise intervention was assessed by recruitment rate, adherence to exercise sessions, and attrition barriers to participation (i.e., reasons for refusal and withdrawal). Compliance with exercise prescription ensured that participants in both intervention arms received the same amount of exercise. Compliance was calculated for each exercise session and separately for aerobic exercise, upper body resistance exercise (chest press), and lower body resistance exercise (leg press). A participant was considered adherent to the aerobic exercise prescription if he or she completed a minimum of 20 minutes and his or her average HR for the given exercise session was within 50%–80% of HRR. A participant was considered adherent to the upper body and lower body resistance exercise prescription if he or she completed at least two sets of eight repetitions within 50%–80% of 1-RM. Compliance with each component at each session (yes = 1, no = 0) was summed and divided by the number of sessions attended to get a percent compliance for aerobic exercise, upper body resistance exercise, and lower body resistance exercise.

Group cohesion: Group cohesion was measured at week 1 and postintervention (week 8) in the group dynamics–based exercise intervention arm using the Physical Activity Group Environment Questionnaire (PAGE-Q) (Estabrooks & Carron, 2000). The PAGE-Q is comprised of four subscales, which are as follows:

- Attraction to the group–social (ATG-S) (e.g., "If this program were to end, I would miss my contact with other participants")
- Attraction to the group–task (ATG-T) (e.g., "I like the program of physical activities done in this group")
- Group integration–task (GI-T) (e.g., "We encourage each other in order to get the most out of the program")
- Group integration–social (GI-S) (e.g., "Members of our group sometimes socialize together outside of activity time")

Items are summed and averaged for each subscale, with a higher score indicating a greater perception of cohesion. The PAGE-Q was developed specifically for the assessment of cohesion in exercise classes. It has been tested for content, predictive, and concurrent validity in samples of older adult exercisers and has demonstrated high reliability (Estabrooks & Carron, 2000). Reliability of the PAGE-Q for the current study, evaluated with the Cronbach alpha, was 0.855 for ATG-S, 0.902 for ATG-T, 0.513 for GI-T, and 0.533 for GI-S (Leach, Covington, Voss, Schuster, & Harden, 2018).

Physical activity: PA was assessed at baseline and postintervention using a wrist-worn pedometer and the International Physical Activity Questionnaire–Short Form (IPAQ-Short) (https://sites.google.com/site/theipaq). Immediately following the baseline and postintervention assessments, participants

wore the pedometer for seven consecutive days during waking hours and were blinded to the step count. At the end of a monitoring period, devices were synced online, with log-in information unique to each participant. Days with at least 10 hours of wear were considered valid, and participants had to have a minimum of four valid days (including one weekend day) for data to be included. Daily steps were summed and averaged for the number of valid days for each participant. The IPAQ-Short provides self-reported PA data regarding the frequency and duration of walking and moderate, vigorous, and total PA in the previous seven days. The IPAQ-Short has been tested for reliability and validity in several different populations with acceptable measurement properties that are comparable to other established self-reports (Craig et al., 2003).

Physical fitness: All physical fitness assessments followed procedures outlined in the American College of Sports Medicine's (2013) guidelines for exercise testing and prescription. Muscular strength was assessed by performing 1-RM plate-loaded seated chest press and leg press exercises quantified by the maximum absolute load (kg) lifted (Logan, Fornasiero, Abernathy, & Lynch, 2000). Aerobic fitness was assessed with a submaximal graded exercise

TABLE 1. Baseline Participant Characteristics

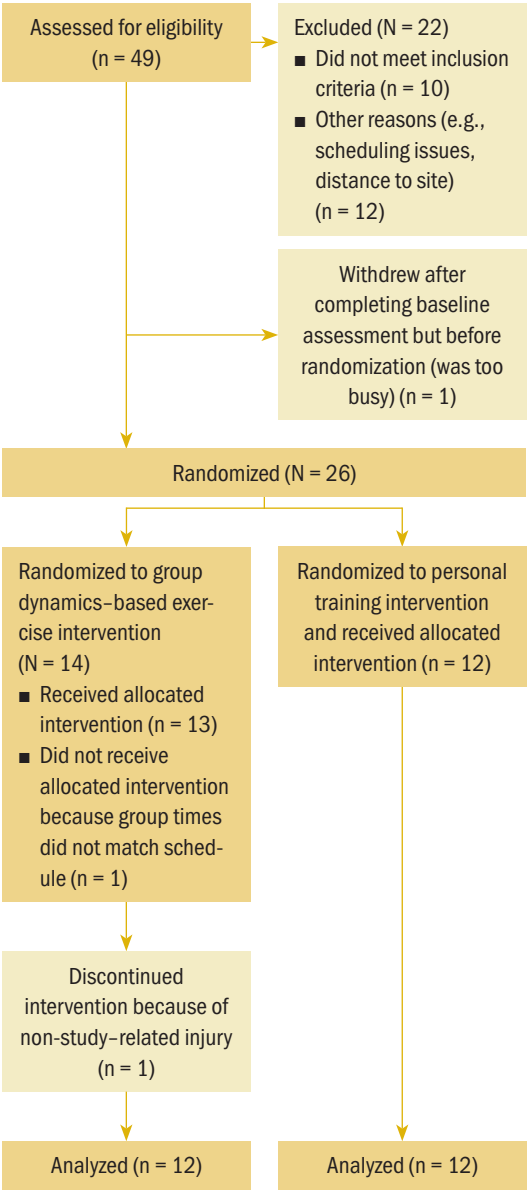
	Enrolled (N = 27)			Personal Training (N = 12)		Group Dynamics–Based Exercise (N = 14)[a]		
Characteristic	**$\bar{X}$**	**SD**	**Range**	**$\bar{X}$**	**SD**	**$\bar{X}$**	**SD**	**p**
Age (years)	52	8.5	29–69	51.9	8.3	51.8	9.2	0.97
Body mass index (kg/m^2)	29.3	7.3	19.3–44.5	29.6	8.1	29	7	0.833
Months postchemotherapy[b]	10.1	5.3	1.3–17.5	10.7	4.6	9.5	6.1	0.682
Months postdiagnosis	13.4	5.1	3.8–23.8	14.4	4.5	13.3	5.2	0.566
Months post–radiation therapy[c]	6.7	4.5	0.25–15.3	6.5	4.2	6.4	4.7	0.951
Months postsurgery	10.9	4.7	2.8–20.5	10.2	3.8	12	5.1	0.322
Characteristic			**n**		**n**		**n**	**p**
Cancer stage								
I			10		4		6	–
II			16		7		8	–
Missing or no response			1		1		–	–
Education								0.859
Post–high school			24		10		13	–
High school diploma or less			2		1		1	
Missing or no response			1		1		–	
Employment								0.249
Part- or full-time			15		5		9	–
Not working			12		7		5	
Hormone therapy								0.307
Yes			25		12		12	–
No			2		–		2	
Race								0.636
Caucasian			24		11		12	–
Other			3		1		2	

[a] 2 participants did not complete the intervention and were not included in subsequent analyses.
[b] N = 18
[c] N = 26
Note. Participants in the enrolled category (N = 27) completed the baseline assessment, and 26 were randomized.

test on a motorized, calibrated treadmill. Participants began walking at 2.5 miles per hour (mph) at a 0% grade; after three minutes, the speed increased to 3 mph. Every three minutes thereafter, the grade increased by 2.5%. The test was terminated when participants reached 85% of HRR or symptom limitation (e.g., dyspnea, fatigue). Aerobic fitness was quantified by test duration (i.e., time to reach 85% of age-predicted maximal HR) and by the estimated volume of oxygen consumption (VO_2) achieved at the final stage of the test, which is calculated using the following equation: 85% VO_2 = 1.38 × time + 5.22 (Pollock et al., 1982).

Quality of life: QOL was measured using the Functional Assessment of Cancer Therapy–Breast (FACT-B) questionnaire (Webster, Cella, & Yost, 2003). The FACT-B, version 4.0, is a 37-item self-report measure yielding a total score of 0–148, with higher scores indicating better QOL. The questionnaire consists of emotional, social, physical, functional, and breast cancer–specific concerns subscales. The FACT-B has been tested previously for reliability and validity (Brady et al., 1997).

FIGURE 2. Participant Flow Diagram



Statistical Analyses

Baseline comparisons between the group dynamics–based exercise and personal training intervention arms were performed using independent samples t tests or chi-square analyses. Postintervention levels of group cohesion in the group dynamics–based exercise intervention arm were compared between waves using analysis of variance (ANOVA) with Bonferroni correction for multiple comparisons. Repeated measures t tests examined within-group changes in PA, physical fitness, and QOL from pre- to postintervention. Analysis of covariance (ANCOVA) was conducted to compare changes in PA, physical fitness, and QOL between group dynamics–based exercise and personal training at postintervention, controlling for the baseline value of the specific outcome. Within-group effect sizes represented as Cohen's d were calculated using G*Power, version 3.1, for differences between two dependent means for main study outcomes (total PA, muscle strength, aerobic fitness, overall QOL), regardless of within-group statistical significance, owing to the pilot nature of the study. All other analyses were completed using IBM SPSS Statistics, version 24.0, and statistical significance was set at $p < 0.05$.

Results

Baseline demographic and medical characteristics of all 27 participants who enrolled in the study and those randomized to each intervention arm (N = 26, with 12 in the personal training intervention arm and 14 in the group dynamics–based exercise intervention arm) are displayed in Table 1. All participants had completed active treatment (surgery, radiation therapy, chemotherapy), but the majority (n = 25) were on endocrine manipulation therapy during the intervention. Only one participant reported being on trastuzumab during the intervention. One

TABLE 2. Physical Activity, Physical Fitness, and Quality-of-Life Changes After an Eight-Week Personal Training Intervention (N = 12)

	Baseline		Postintervention		
Variable	**$\bar{X}$**	**SD**	**$\bar{X}$**	**SD**	**CS**
Physical activity					
Walking (MET-hours per week)	18	25.7	26.4	25	8.4
Moderate (MET-hours per week)	5.6	7.4	6.7	4.6	1.1
Vigorous (MET-hours per week)	3.9	5.2	15.7	9.5**	11.8
Total (MET-hours per week)	27.6	27.7	48.9	28.5	21.3
Pedometer (steps per day)	7,451.9	4,011.5	8,754	4,067.1	1,302.1
Physical fitness					
Chest press 1-RM (kg)[a]	35.2	6.5	40.5	7*	5.3
Leg press 1-RM (kg)	83.6	17.3	106	22.1**	22.4
Arm curl (repetitions in 30 seconds)	16.5	1.9	20.5	2.8**	4
Sit-to-stand (repetitions in 30 seconds)	13	2.9	16.5	2.9**	3.5
Treadmill (minutes)	15.6	1.6	16.3	1.7	0.74
85% predicted VO_2max (ml/kg/minutes)	26.8	7.8	27.8	8	1
Quality of life					
FACT-B physical	20.7	4.9	23.6	3.8*	2.9
FACT-B social	22.3	5.2	20.1	9.3	–2.3
FACT-B emotional	16.3	4.9	18	3.7*	1.8
FACT-B functional	20.6	4.5	21.3	7.8	0.65
FACT-B breast cancer–specific concerns	24.8	7.3	25.3	7.1	0.5
FACT-B total	104.7	20.3	108.2	20	3.5

* $p < 0.05$; ** $p < 0.01$
[a] N = 10
CS—change score; FACT-B—Functional Assessment of Cancer Therapy–Breast; MET—metabolic equivalent of task; 1-RM—1-repetition maximum; VO_2max—maximal volume of oxygen consumption
Note. FACT-B total scores range from 0 to 148, with higher scores indicating better quality of life. For subscales, the higher the score, the better the quality of life. Physical, social, and functional subscale scores each range from 0 to 28, emotional subscale scores range from 0 to 24, and breast cancer–specific concerns subscale scores range from 0 to 40.

participant withdrew prior to randomization, and two withdrew after randomization for a completion rate of 92% (see Figure 2).

Feasibility

There was a 55% recruitment rate. Most participants (n = 25) were referred from a healthcare provider at the local cancer center, one was referred through a local cancer support group, and one participant did not respond. The group dynamics–based exercise intervention arm consisted of three waves, or cohorts (n = 5 in wave 1, n = 4 in wave 2, n = 3 in wave 3). Participants in the personal training intervention arm attended an average of 15.8 of 16 sessions (SD = 0.5), whereas those in the group dynamics–based exercise intervention arm attended an average of 13.4 sessions (SD = 1) (p = 0.000). Physical assessments were feasible, with only two participants unable to complete the 1-RM chest press exercise because they were advised by their doctor not to lift more than 13.6 kg (30 lbs). For these two participants, resistance training load was set at 55%–75% of the upper limit they were allowed to lift (i.e., if physician clearance was a maximum of 11.3 kg [25 lbs], resistance load was set at 6.2–8.5 kg [13.75–18.75 lbs] for 8–12 repetitions and progressed as tolerated to the maximum of 11.3 kg). Regarding safety, two participants in the group dynamics–based exercise intervention arm experienced affected limb swelling related to lymphedema. These participants self-referred to their lymphedema therapist for treatment and were advised by the therapist to continue the intervention. Other nonserious events unrelated to the intervention (e.g., unspecified knee pain, unspecified shoulder pain, cold, flu) were

TABLE 3. Physical Activity, Physical Fitness, and Quality-of-Life Changes After an Eight-Week Group Dynamics–Based Exercise Intervention (N = 12)

	Baseline		Postintervention		
Variable	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**CS**
Physical activity					
Walking (MET-hours per week)	20.6	22.2	18.8	24	–1.7
Moderate (MET-hours per week)	3.2	5.3	10.9	10.2	7.8
Vigorous (MET-hours per week)	6.6	14.7	22.3	18.3**	15.7
Total (MET-hours per week)	30.4	31.1	52.1	43.4*	21.7
Pedometer (steps per day)	7,980.5	3,626.1	7,581.2	3,200.6	–399.2
Physical fitness					
Chest press 1-RM (kg)	35.1	6.9	40	7.9*	4.9
Leg press 1-RM (kg)	86.6	17.2	111.6	24.4**	25
Arm curl (repetitions in 30 seconds)	16.8	1.2	21.8	3.6**	4.9
Sit-to-stand (repetitions in 30 seconds)	14.3	3.7	16.3	3.4**	2
Treadmill (minutes)	15.1	5.9	17.4	3.4	2.2
85% predicted VO_2max (ml/kg/minutes)	26.1	8.1	29.2	4.7	3.1
Quality of life					
FACT-B physical	21.9	4.6	23.3	5.1	1.3
FACT-B social	22	4.4	24.1	3	2.1
FACT-B emotional	18.9	3.6	19.6	3.1	0.72
FACT-B functional	22.7	3	23.8	3	1.1
FACT-B breast cancer–specific concerns	26.3	5.7	29.2	5.2*	2.9
FACT-B total	111.7	15.9	119.8	13.7*	8.1

* $p < 0.05$; ** $p < 0.01$
CS—change score; FACT-B—Functional Assessment of Cancer Therapy–Breast; MET—metabolic equivalent of task; 1-RM—1-repetition maximum; VO_2max—maximal volume of oxygen consumption
Note. FACT-B total scores range from 0 to 148, with higher scores indicating better quality of life. For subscales, the higher the score, the better the quality of life. Physical, social, and functional subscale scores each range from 0 to 28, emotional subscale scores range from 0 to 24, and breast cancer–specific concerns subscale scores range from 0 to 40.

recorded and evenly distributed between intervention arms. These events resulted in minor exercise session modification (e.g., wall ball squats instead of lunges, squats instead of leg press, front raise instead of shoulder press, additional stretching time).

There was no significant difference in compliance to exercise prescription between intervention arms. Average compliance for aerobic exercise was 77.2% (SD = 0.17) for the personal training intervention arm, compared to 70.1% (SD = 0.17) for the group dynamics–based intervention arm ($t[22] = 0.842$, $p = 0.409$). Average compliance for upper body resistance exercise was 76% (SD = 0.37) for the personal training intervention arm and 82.4% (SD = 0.2) for the group dynamics–based exercise intervention arm ($t[22] = -0.537$, $p = 0.597$). Average compliance for lower body resistance exercise was 80.2% (SD = 0.23) for the personal training intervention arm and 87.9% (SD = 0.21) for the group dynamics–based exercise intervention arm ($t[22] = -0.856$, $p = 0.401$).

Average group cohesion subscales scores at week 8 were as follows: 7.3 (SD = 1.1) for the ATG-S, 8.3 (SD = 0.71) for the ATG-T, 8 for the GI-T (SD = 0.89), and 6.4 (SD = 1.4) for the GI-S. GI-S was significantly different between waves, or cohorts, within the group dynamics–based exercise intervention arm ($F[2, 11] = 7.7$, $p = 0.011$), with lower scores in wave 3 ($\bar{X} = 4.5$, SD = 0.9) compared to wave 1 ($\bar{X} = 7.1$, SD = 0.91, $p = 0.017$) and wave 2 ($\bar{X} = 7$, SD = 1.1, $p = 0.024$).

Physical Activity

Tables 2 and 3 display changes in PA from baseline to postintervention. Vigorous PA increased significantly in the personal training ($t[11] = -3.9$, $p = 0.002$) and group dynamics–based exercise intervention arms ($t[11] = -5.2$, $p = 0.000$). There was no significant change

in walking or moderate PA in either intervention arm. Total PA increased significantly in the group dynamics–based exercise intervention arm ($t[11] = -2.4$, $p = 0.034$, $d = 0.6$) and to a similar extent in the personal training intervention arm, but this was not statistically significant ($t[11] = -2$, $p = 0.071$, $d = 0.8$). There was no change in average steps per day from baseline to postintervention in either arm. Between-groups analyses (see Table 4) showed no difference in pre- to postintervention changes for any measure of PA.

Physical Fitness

Chest press increased (increase in the amount of weight lifted) in the personal training ($t[9] = -7.2$, $p = 0.000$, $d = 0.87$) and group dynamics–based exercise intervention arms ($t[11] = -2.7$, $p = 0.02$, $d = 0.7$). Leg press increased in the personal training ($t[11] = -5.2$, $p = 0.000$, $d = 1.4$) and group dynamics–based exercise intervention arms ($t[11] = -4.61$, $p = 0.001$, $d = 1.4$). There was no change in aerobic fitness as measured by treadmill test duration and predicted VO_2 at 85% of HRR. Between-groups analyses controlling for the baseline value of each outcome showed no difference in pre- to postintervention changes for any measure of physical fitness.

Quality of Life

Physical well-being subscale scores ($t[11] = -2.6$, $p = 0.025$) and emotional well-being subscale scores ($t[11] = -2.6$, $p = 0.023$) improved significantly in the personal training intervention arm but not in the group dynamics–based exercise intervention arm. There were no statistically significant changes in social and functional well-being in either intervention arm. Subscale scores related to breast cancer–specific concerns improved significantly in the group dynamics–based exercise intervention arm ($t[11] = -2.2$, $p = 0.046$) but not in the personal training intervention arm. Overall, QOL scores showed significant improvements in the group dynamics–based exercise intervention arm ($t[11] = -2.3$, $p = 0.041$, $d = 0.56$) but not in the personal training intervention arm ($t[11] = -0.55$, $p = 0.591$, $d = 0.17$). Between-groups analyses controlling for the baseline value of each outcome showed no difference in pre- to postintervention changes for any measure of QOL.

Discussion

This study was unique in its use of group dynamics–based strategies in breast cancer survivors and rigorous control of supervised exercise dose (e.g., frequency, intensity, time, type) between intervention arms. Both intervention arms demonstrated similar improvements to vigorous and total PA, muscle strength, and aerobic fitness. Breast cancer–specific concerns and overall QOL improved in the group dynamics–based intervention arm, whereas physical and emotional subscales of QOL improved in the personal training intervention arm.

In the group dynamics–based exercise intervention arm, there were two withdrawals and lower exercise session adherence (84% versus 93% in the personal training intervention arm). Only one of the withdrawals was related to the group dynamics–based exercise delivery modality; this participant was unable to match her schedule to the group exercise session times. Despite the lower exercise session attendance, the group dynamics–based exercise intervention arm had similar effects on PA, physical fitness, and QOL. From a system-level perspective, a group dynamics–based exercise intervention or program has the potential to be delivered at one-fifth of the cost of a personal training intervention or program (assuming there are five participants per group). In addition, potentially less contact time is needed to elicit similar effects. Two participants in the group dynamics–based exercise intervention arm experienced limb swelling from breast cancer–related lymphedema (BCRL), which is a finding similar to previous randomized controlled trials in which intervention participants experienced BCRL onset (e.g., 11% in Schmitz, Ahmed, et al. [2010]) (Cavanaugh, 2011; Schmitz, Ahmed, et al., 2010) or exacerbation of swelling and symptoms (Cormie et al., 2013) at a rate no greater than the control group (e.g., 17% experienced BCRL onset in the control group in Schmitz, Ahmed, et al. [2010]). The group dynamics–based exercise intervention arm in the current study increased group cohesion in breast cancer survivors, which is comparable to original testing of the PAGE-Q in older adults (Estabrooks & Carron, 2000).

This study found significant improvements in both intervention arms for vigorous PA. Significant changes in total PA were observed only in the group dynamics–based exercise intervention arm, but the increase of total PA in both intervention arms was of a similar magnitude. Daily step count measured by the pedometer did not show significant increases in either intervention arm, and steps decreased by an average of 399.2 in the group dynamics–based exercise intervention arm. A review of PA interventions to improve walking in breast cancer survivors found that daily steps increased by an average of 526; however, results varied dramatically

TABLE 4. Between-Group Analysis of Changes in Physical Activity, Physical Fitness, and Quality of Life

Variable	Between-Group Difference	F	p
Physical activity			
Walking (MET-hours per week)	10.1	0.698	0.413
Moderate (MET-hours per week)	6.7	1.24	0.277
Vigorous (MET-hours per week)	3.9	0.896	0.355
Total (MET-hours per week)	0.4	0.013	0.91
Pedometer (steps per day)	1,701.3	2.73	0.113
Physical fitness			
Chest press 1-RM (kg)[a]	0.8	0.03	0.863
Leg press 1-RM (kg)	5.7	0.158	0.695
Arm curl (repetitions in 30 seconds)	0.9	0.954	0.34
Sit-to-stand (repetitions in 30 seconds)	1.5	2.13	0.159
Treadmill (minutes)	1.46	1.4	0.251
85% predicted VO_2max (ml/kg/minutes)	2.1	1.4	0.251
Quality of life			
FACT-B physical	1.6	0.621	0.439
FACT-B social	4.4	0.125	0.109
FACT-B emotional	1.1	0.01	0.922
FACT-B functional	0.5	0.811	0.378
FACT-B breast cancer–specific concerns	2.4	2.2	0.153
FACT-B total	4.6	1.73	0.203

[a] N = 10 for personal training intervention
FACT-B—Functional Assessment of Cancer Therapy–Breast; MET—metabolic equivalent of task; 1-RM—1-repetition maximum; VO_2max—maximal volume of oxygen consumption
Note. FACT-B total scores range from 0 to 148, with higher scores indicating better quality of life. For subscales, the higher the score, the better the quality of life. Physical, social, and functional subscale scores each range from 0 to 28, emotional subscale scores range from 0 to 24, and breast cancer–specific concerns subscale scores range from 0 to 40.

among studies (range = –92–1,299 steps) (Knols, de Bruin, Shirato, Uebelhart, & Aaronson, 2010). Because steps do not account for increases in PA intensity, participants may have experienced a shift toward more vigorous activity without a comparable increase in steps, or the increases in vigorous activity may have been counteracted with compensatory sedentary behavior, resulting in no increase in overall step count.

Muscle strength improved in both intervention arms, and increases were comparable to previous strength training interventions in breast cancer survivors (Cormie et al., 2013; Schmitz, Ahmed, et al., 2010). Few other PA behavior change studies in breast cancer survivors have quantified intervention effects on muscle strength (Bluethmann, Vernon, Gabriel, Murphy, & Bartholomew, 2015). Although aerobic fitness did not show statistically significant increases in either intervention arm, the magnitude of change was greater in the group dynamics–based exercise intervention arm, with estimated VO_2 at 85% of maximal HR increasing by 3.1 ml/kg/minute, which nearly reached the clinically meaningful change of 3.5 ml/kg/minute (Kodama et al., 2009).

Overall QOL increased significantly in the group dynamics–based exercise intervention arm and reached the meaningful clinically important difference of seven to eight points (Yost & Eton, 2005). The greater increase in overall QOL seen in the group dynamics–based exercise intervention arm versus the personal training intervention arm is contrary to the only previous study that directly compared individually supervised and group-based exercise in breast cancer survivors (Naumann et al., 2012). This finding may be explained by the statistically and clinically significant score increase in the breast cancer–specific concerns subscale in the group dynamics–based exercise intervention arm. This increase may

reflect the benefits of empathy and of discussions about the commonality of these concerns (e.g., "I am bothered by hair loss," "I am bothered by a change in weight") that came from being in the group.

Strengths and Limitations

Strengths were the use of group dynamics principles, detailed reporting of exercise prescription to ensure similarity of dose between intervention arms, and the measurement of group cohesion in a sample of breast cancer survivors. In the group dynamics–based exercise intervention arm, group dynamics strategies were woven throughout the exercise and education and discussion sessions. However, to the current authors' knowledge, there is no consensus on the correct number of group dynamics strategies that should be implemented to see improvement in PA or QOL. In reviews of group dynamics–based PA interventions, it was reported that strategies and doses remain understudied (Estabrooks et al., 2012; Harden, Burke, Haile, & Estabrooks, 2015; Harden, McEwan, et al., 2015). Often, the group dynamics–based portions of such interventions are based on best available data from the specific target audience or developed through formative work with potential participants.

This study was not without limitations. Although participants were given logs to track exercise done outside of the supervised sessions, compliance for completing these logs was poor; therefore, these data could not be included in the calculation of overall PA. Although participants were encouraged to complete these logs and many anecdotally reported that they did engage in PA outside of the supervised sessions, they often forgot to enter it in the logs. Future studies will include stricter control of independent exercise by requiring logs to be turned into study staff each week or by using smartphone or application-based PA tracking to enhance compliance. Because of staffing availability and financial constraints, exercise specialists performing the physical fitness assessments were not blinded to participant intervention arm allocation. The device used to measure steps had not yet been tested for reliability and validity. Future studies should incorporate validated, objective measures of PA (e.g., accelerometer).

Implications for Nursing

Overall, findings from this study will increase nurses' knowledge about physical and psychosocial improvements that may result from breast cancer survivors' participation in a group dynamics–based PA intervention. When encouraging PA or referring individuals with breast cancer to exercise programs, nurses may consider seeking out group-based programs, particularly those that intentionally foster group cohesion and social support. Programs that facilitate group cohesion and/or provide peer support as part of the exercise sessions may increase QOL to a greater extent and offer similar benefits in terms of improving PA and physical fitness while providing a potentially less expensive option than individually supervised exercise programs. In addition, for those delivering group-based exercise programs for breast cancer survivors, this study suggests that it may be beneficial to incorporate strategies drawn from the group dynamics literature to enhance cohesion (Estabrooks et al., 2012).

KNOWLEDGE TRANSLATION

- Comparing exercise intervention delivery modalities is important for recommending the most optimal programs for improving physical activity and quality of life in breast cancer survivors.
- When controlling for exercise dose (e.g., frequency, intensity, time, type), group-based exercise interventions can result in similar improvements in breast cancer survivors' physical fitness compared to individually supervised training.
- Among breast cancer survivors, an exercise intervention or program that includes group dynamics strategies to enhance group cohesion during exercise sessions may facilitate greater improvements in quality of life than individually supervised training.

Conclusion

Findings from this study provide preliminary data and add to the findings from other team-based approaches that support the use of group dynamics strategies as an effective modality to increase cohesion (Carter et al., 2012) and QOL (Culos-Reed, Shields, & Brawley, 2005) in breast cancer survivors. A fully powered comparative effectiveness trial is needed to conclusively determine whether a group dynamics–based approach is superior to an individually supervised intervention and/or an intervention delivered to an aggregate of individuals (i.e., a traditional group-based exercise class) to increase PA or QOL in breast cancer survivors, as well as to conduct a formal cost-analysis to establish metrics for implementation.

Future studies should examine which elements of a group dynamics intervention are integral for enhancing dimensions of cohesion in breast cancer survivors and which of these dimensions are most important for mediating increases in PA and QOL. Future studies should also test strategies to increase

the reach of group dynamics–based exercise programs for breast cancer survivors (e.g., web-based or virtual programs) to include members of underrepresented breast cancer survivor populations (e.g., low-income, rural, ethnic minorities).

Heather J. Leach, PhD, is an assistant professor in the Department of Health and Exercise Science, and **Kelley R. Covington, MS,** is a research assistant and PhD student in the Department of Occupational Therapy, both at Colorado State University in Fort Collins; **Corrine Voss, MS,** is an adjunct instructor in the Department of Kinesiology at Taylor University in Upland, IN; **Kelli A. LeBreton, MS,** is a fitness specialist at UCHealth Medical Fitness in Windsor, CO; **Samantha M. Harden, PhD,** is an assistant professor in the Department of Human Nutrition, Foods, and Exercise at Virginia Tech in Blacksburg; and **Steven R. Schuster, MD,** is a physician and the medical director of oncology clinical research at the UCHealth Cancer Care and Hematology Clinic–Harmony Campus in Fort Collins. Leach can be reached at heather.leach@colostate.edu, with copy to ONFEditor@ons.org. (Submitted June 2018. Accepted September 21, 2018.)

The authors gratefully acknowledge Joy Chilson-Foy, RN, BSN, OCN®, CCRP, and Sarah Tarver, BSN, RN, CCRP, from the UCHealth Cancer Center–Harmony Campus for their assistance in recruiting participants for this study.

Schuster has previously served on speakers bureaus for Celgene Corporation and Pharmacyclics.

Leach and Schuster contributed to the conceptualization and design. Leach, Covington, Voss, and LeBreton completed the data collection. Leach and Harden provided statistical support. Leach, Covington, and Harden provided the analysis. Leach, Covington, Voss, LeBreton, Harden, and Schuster contributed to the manuscript preparation.

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