Physical activity (PA) has been recommended to improve cancer patients' recovery and functioning (Rock et al., 2012; Schmitz et al., 2010). The recommendations are based on several trials that tested the effects of PA adoption among patients treated for various cancers, with the majority of these efficacy studies conducted among middle-aged patients with early-stage breast cancer (Brown et al., 2011; Duijts, Faber, Oldenburg, van Beurden, & Aaronson, 2011; Ferrer, Huedo-Medina, Johnson, Ryan, & Pescatello, 2011; Schmitz et al., 2010; Speck, Courneya, Masse, Duval, & Schmitz, 2010). With the growing evidence of the role that PA can play in cancer recovery, it is timely to extend the reach of PA interventions into the "real world." One approach to scaling up an intervention is the training of peer/community volunteers to encourage survivors to become physically active.

There are quasi-experimental studies that support the use of trained peer volunteers providing PA advice by telephone to middle-aged and older adults (Hooker et al., 2005; Wilcox et al., 2006). More recently, in a 12-month randomized controlled trial (RCT) of 12 volunteer peer mentors and 181 initially inactive adults aged 50 years and older, researchers compared telephone-
based advice delivered by professional staff with telephone-based advice delivered by trained volunteers and with an attention control arm of telephone advice for nutrition (Castro, Pruitt, Buman, & King, 2011). Both activity arms significantly increased their PA participation relative to the control group at 12 months, but the peer volunteers showed superior quality in intervention content compared with the professional staff. In another RCT, 81 sedentary adults received peer-delivered, theory-based support for exercise in a 16-week group-based program versus a community-based exercise intervention with health education (Buman et al., 2011). At 16 weeks, both groups showed similar significant improvements in moderate-to-vigorous exercise but at 18 months, the group that received peer support reported significantly greater exercise participation. To our knowledge, a peer mentoring approach has not been used to promote exercise among cancer survivors.

We conducted a successful pilot study in collaboration with the American Cancer Society’s (ACS) Reach to Recovery (RTR) program in which RTR volunteers offered an evidence-based PA intervention to breast cancer patients (Pinto, Rubin, Abelow, & Papandonatos, 2008). The PA intervention had previously been tested in an RCT: the Moving Forward study (Pinto, Frierson, Trunzo, & Marcus, 2005). The intervention was grounded in the transtheoretical model (TTM) (DiClemente et al., 1991; Prochaska & DiClemente, 1983) and social cognitive theory (Bandura, 1986). The TTM is based on the stages of adopting a new health behavior, and it has been adapted to PA (Marcus & Simkin, 1993). RTR volunteers (who are breast cancer survivors themselves) receive intensive training from ACS and provide emotional and information support (e.g., empathy for anxiety/ear, making patients aware of community resources) to patients and survivors. These services are offered during an in-person meeting and subsequently in one to two follow-up calls. We used this “natural fit” in a single group longitudinal pilot study and found that it was feasible to train these volunteers (n = 7) to coach sedentary breast cancer survivors (n = 25) over 12 weeks to become more physically active. We also obtained promising results on survivors’ self-reported PA and psychological outcomes at 12 and 24 weeks (Pinto et al., 2008).

In the current study, we extended our pilot work by conducting an RCT and increased the reach of the intervention to RTR programs in six New England (NE) states. Our goal was to compare the PA counseling provided by the RTR volunteers (coaches) with a contact control condition also provided by the volunteers. The primary aim was to examine the effects of the intervention versus contact control on participants’ self-reported (and, hence, similar to the pilot study and to other trials of peer mentoring for PA; Castro et al., 2011; Buman et al., 2011) activity of moderate-to-vigorous intensity PA (MVPA) at 12 and 24 weeks. Secondary outcomes included effects on objective activity monitoring using an accelerometer, the proportion of participants who met or exceeded American College of Sports Medicine (ACSM) exercise guidelines for cancer survivors (i.e., 150 min/week; Schmitz et al., 2010) and the proportion of participants who showed progression in motivational readiness for exercise. Our hypotheses were that the intervention group (PA plus RTR) would report greater MVPA and improved secondary outcomes than the control group (RTR control) at 12 and 24 weeks. An exploratory goal was to examine potential moderators of intervention effects on MVPA such as age, body mass index, seasonal effects, NE state of residence, and coach.

**Method**

**Design**

This RCT compared the effects of a theoretically based 12-week PA program (PA plus RTR) versus contact control (RTR control) offered by RTR volunteers to breast cancer survivors (participants). Participants’ MVPA and related outcomes were assessed at baseline, 12 weeks, and 24 weeks. The study received approval from the institutional review boards at The Miriam Hospital (Rhode Island) and Women & Infants Hospital (Rhode Island).

**Recruitment of ACS RTR Volunteers**

ACS offices in six NE states (Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont) were contacted to assess their interest in partnering with the researchers in this study (there were seven regional offices across the six states that participated in this trial). Of the six states, it was not feasible to recruit volunteers to serve as coaches in two for reasons such as lack of sufficient volunteer pool, difficulty traveling to the ACS offices for training, and lack of Internet facilities for training. Eligibility to serve as coaches for the study included: having completed RTR training and having been an RTR volunteer for at least a year as well as willingness: (a) to participate in group training, (b) to provide coaching to four to five participants, (c) to be supervised by telephone, and (d) to audiorecord telephone contacts with study participants. Volunteer coaches completed informed consent procedures and were asked to complete brief questionnaires at the start of the study, at the end of training, and at the end of study participation.

ACS staff in the four states approached 335 Reach volunteers about study participation through email, informational mailings, and personal contact. Thirty-one volunteers expressed interest in the study; 28 were screened for eligibility (two were lost to follow-up prior to telephone screen, one was not available for training sessions during the day). Of the 28, 18 volunteers (hereafter referred to as coaches) completed training (64%; M_\text{age} = 54.89 years, SD = 7.76; M_\text{time postdiagnosis} = 7.00 years; M_\text{time volunteering with RTR} = 4.47 years). The reasons for dropping out prior to training completion were: too busy caring for family members (n = 3), time constraints (n = 2), not interested (n = 2), did not like the questionnaires (n = 1), lost to follow-up (n = 1), and not available for training (n = 1).

**Training of Coaches**

Coaches were trained in small groups; the training was offered either in person or using video conferencing. The four session training program (approximately 2 hr per session) consisted of didactics on the research program, intervention theory, intervention program, and issues relevant to human subjects certification and HIPAA requirements. Coaches were provided with a training manual and copies of the print materials that participants received.

The coaches received training in delivering the RTR control condition, but the majority of the training time was focused on PA...
counseling. Three sessions focused on role-plays to train skills in PA counseling techniques (e.g., empathy, reflective listening). To ensure safety of participants, coaches were trained to ask about physical symptoms that may be indicative of a serious medical issue (e.g., chest pain): in these instances, they were instructed to advise participants to seek medical consultation and to contact the research team. Coaches were also trained to review pulse rate and rates of perceived exertion, as reported by participants during home exercise, to ensure that participants exercised at least at moderate-intensity levels and did not overexert. If participants became distressed, coaches were trained to notify research staff so that appropriate referrals could be made. Training was terminated after coaches completed a successful mock intervention call (PA plus RTR) and an RTR control call.

Participants

Women aged 21 years and older with Stage 0–3 breast cancer (diagnosed in the past 5 years) were eligible if they (a) had completed surgery (patients receiving ongoing chemotherapy, radiation, or hormone treatment were eligible); (b) were able to read and speak English; (c) were ambulatory and able to walk a half mile without stopping; (d) were sedentary (i.e., less than 30 min/week of vigorous exercise for the past 6 months or less than 90 min/week of moderate-intensity exercise for the past 6 months); and (e) had access to a telephone and were willing to receive telephone calls. Women with medical or psychiatric problems (e.g., myocardial infarction, stroke, transient ischemic attacks, substance abuse, orthopedic problems) that might interfere with protocol adherence were excluded. Our goal was to recruit 108 participants.

Our primary analysis was to compare RTR control and PA plus RTR groups on the change from baseline to 12 and 24 weeks on MVPA. Sample size (N = 108 before attrition) was projected from an anticipated large effect (δ = 0.97) at 12 weeks and a moderate effect (δ = 0.60) at 24 weeks. The estimates were obtained from the effect sizes in the pilot study (Pinto et al., 2008) and a prior RCT (Pinto et al., 2005). We anticipated a 99% power to detect differential change on MVPA at 12 weeks and an 80% power at 24 weeks at a multiplicity-adjusted significance level of alpha equal to .025. The power estimates were based on the assumption that participant outcomes were independent within each ACS office.

Participant Recruitment

The original recruitment plan was to solicit participants from those who contacted the ACS in NE for RTR services. We found that, after 3 months of recruitment in RI, the request for RTR services was very low and we enrolled one participant into the trial. We then used alternative methods of recruitment. Our primary recruitment source was a mailing from the Senior Operations Vice President for Health Initiatives at ACS to breast cancer constituents on mailing lists maintained by ACS in six states (N = 8,111), electronic newsletters sent by ACS to their constituents in NE, recruitment at ACS sponsored events in Rhode Island, and referrals from RTR coordinators (n = 26). In addition, we used non-ACS sources of recruitment. These included informational mailings by three hospitals in three states (Rhode Island, Massachusetts, and Connecticut; mailing size = 2,425) and three private practices to breast cancer patients in two states (Rhode Island and Connecticut) (mailing size = 321), and in-person recruitment at one hospital in Rhode Island, health fairs, and other events in Rhode Island. Recruitment was conducted from January 2010 to April 2012.

Interested participants were asked to contact the study staff to determine eligibility using a toll-free number. Research staff called those patients who provided contact information at the community events. After completing a telephone screen for eligibility, obtaining informed consent from participants, and physician consent for study participation, research staff conducted baseline assessments. In total, 595 potential participants were contacted, 304 were ineligible at initial contact or telephone screen (51.1%), 123 were not interested (20.7%), and 168 were eligible at telephone screen (28.2%). Reasons for ineligibility are shown in Figure 1. Of the 168 potential participants, 31 were no longer interested, 61 became ineligible, and the remaining 76 were eligible and randomized (76/168 = 45.2%).

Intervention Delivery

After patients completed baseline assessments, the intervention coordinator opened the sealed envelope that contained the randomization status (the sample was stratified by age and whether they had received chemotherapy) and notified the participant by telephone. Group assignments were generated at an offsite location and placed in sequentially numbered and sealed opaque envelopes. The intervention coordinator assigned participants to coaches based on scheduling availability and similarity of cancer treatment(s). Each coach was asked to contact her participant in PA plus RTR or RTR control once a week over 12 weeks and audiorecord the calls.

PA Plus RTR Group

Participants randomized to this group received telephone-based PA counseling, a pedometer (Digi-Walker) and a heart rate monitor. The PA intervention was modeled on the “Moving Forward” trial and consisted of PA counseling matched to participants’ motivational readiness plus PA tipsheets (Pinto et al., 2005). Counseling focused on building a supportive relationship with participants, assessing motivational readiness, monitoring PA, identifying health concerns, and identifying and problem-solving barriers to PA. The goal was to encourage participants to gradually increase the amount of aerobic PA (e.g., brisk walking) over 12 weeks to recommendations of 30 min of more of moderate-intensity PA on most days of the week (Schmitz et al., 2010; U.S. Department of Health and Human Services, 1996). All participants received instructions and were given logs to monitor PA: participants recorded the duration of their exercise, type of exercise, heart rate, rate of perceived exertion, and pedometer steps. Coaches reviewed the logs during the telephone calls; the logs were then sent to the research staff for data entry.

During the weekly calls, if participants reported symptoms such as chest pain, they were referred to their physicians. There were instances of participants reporting chest pain and shortness of breath during exercise (n = 6), vertigo (n = 1), and ankle injury (n = 4) that required we temporarily suspend their study participation until a physician evaluation and consent were obtained.
Figure 1. Flow diagram showing participant recruitment and retention. PA = physical activity; RTR = Reach to Recovery.
Participants were also given RTR informational booklets (available from ACS) and 12 exercise tipsheets that focused on PA topics (e.g., exercising safely, staying motivated). Coaches also responded to questions that participants asked about breast cancer and its treatment (similar to the type of information and support provided in the RTR program). Quality control procedures are described in the online supplemental materials. Finally, feedback reports that showed participants’ PA and summarized their barriers to PA and ways to overcome these barriers (as discussed during the calls) were sent to participants at Weeks 2, 4, 8, and 12.

RTR Control Group

Our aim was to assess the effects of a structured peer mentoring program on MVPA. Hence, participants assigned to the control group were asked not to join a structured PA program during the 12-week intervention phase. Although the RTR program generally consists of one to three contacts with patients who request services, for the purpose of this study, we extended the contact to 12 calls to control for frequency of contact between the two study groups. During each weekly call, the coach administered the Weekly Symptom Questionnaire (Winningham, 1993), which assesses problems such as headaches people may experience that can affect normal activity of daily life. Participants were also given RTR informational booklets. Coaches responded to participants’ questions about breast cancer and its treatment, and provided support, as is typical of the RTR program. The PA tipsheets (identical to those sent to the PA plus RTR group) were given to these participants at 24 weeks.

Measures

Coaches. Prior to training, coaches completed a brief demographic form. We recorded the number and duration of calls (from the audiotapes) delivered to each participant.

Participants. At baseline, participants were asked to provide demographic information (e.g., age, education, height, weight). Information on cancer diagnosis and treatment was obtained by a form sent to participants’ physicians’ offices. Participants were given accelerometers (ActiGraph) with instructions to wear the unit for 7 days and a packet of questionnaires assessing stage of motivational readiness and psychosocial variables. Participants were asked to mail back the ActiGraph and the completed questionnaires. A research assistant (blind to participants’ group assignments) conducted a PA interview (described in Seven-Day Physical Activity Recall) by telephone and was responsible for collecting all data. The same procedure was repeated to collect data at 12 and 24 weeks.

Seven-Day Physical Activity Recall. Seven-Day Physical Activity Recall (7-Day PAR; Blair et al., 1985), a widely used, validated measure of PA, was administered by telephone at baseline and at 12 and 24 weeks. It assesses hours spent in sleep, moderate activity, as well as hard and very hard activity. Total minutes of MVPA was our key outcome measure. These data were also used to determine the proportion of participants who reported exercising at the nationally recommended level of 150 min/week (U.S. Department of Health and Human Services, 2008).

Accelerometer. Participants were asked to wear a tri-axis accelerometer (ActiGraph GT3X) for 7 days at each assessment point. The ActiGraph monitors activity counts, energy expenditure, and steps taken. Software is available to categorize the counts into light, moderate, hard, or very hard categories. Intensity categories based on monitor data have been developed in a calibration study (Freedson, Melanson, & Sirard, 1998). For analyses, only activity of at least moderate intensity was considered.

Stage of readiness for PA. Stage of readiness for PA was measured using a 5-item instrument (Marcus, Rossi, Selby, Niaura, & Abrams, 1992) that was mailed to participants for completion. It is reliable (κ = .78; Marcus et al., 1992), has concurrent validity with the 7-Day PAR, and stage progression is significantly associated with fitness improvements (Marcus & Simkin, 1993).

Statistical Analysis

As a preliminary step, between-group differences in baseline demographics, medical history, and MVPA were tested using t tests for continuous variables and chi-square tests for categorical variables. In addition, descriptive statistics were calculated for coach data, including both baseline demographics and medical history variables.

Using a mixed-effect longitudinal regression model, the effects of group assignment (PA plus RTR vs. RTR control) on minutes per week of MVPA at 12 and 24 weeks were simultaneously assessed, while controlling for baseline values of the outcome, as well as age and chemotherapy use. Although there were no between-groups differences in mean age or chemotherapy use, these covariates were included in the model (and chosen a priori), because they are known to be associated with MVPA adoption among this population. Models included random intercepts to account for within-subject correlation of repeated measurements over time. In a subsequent step, we assessed whether clustering by coach significantly impacted model estimates. Models were run for each of the MVPA outcomes (subjectively collected and objectively measured PA), and results are presented separately for each. In addition, the correlation between MVPA, as measured by the 7-Day PAR and collected by accelerometer, was estimated using Spearman rank order correlations (at each time point). Finally, a series of models to assess moderation were run (which included main effects of the intervention, the potential moderator, and the interaction between the two). Modifiers included age, body mass index, seasonal effects, NE state of residence, and chemotherapy use.

Unadjusted proportion of participants meeting ACSM guidelines (defined as reporting at least 150 min/week of at least moderate-intensity PA; Schmizt et al., 2010) were summarized for both groups at each follow-up (12 and 24 weeks). Using a longitudinal regression model implemented with generalized estimating equations (GEEs) with robust standard errors, we estimated the effect of the intervention on the probability of meeting guidelines at each follow-up, adjusting for age and chemotherapy use. Models included both main effects of time and intervention group, as well as the interaction between them, thus assuming that the slope of the effect changes over time. Models assumed an unstructured working correlation matrix.

In addition, we assessed whether there were between-group differences in the probability of increasing stage of motivational readiness from baseline to 12 and 24 weeks, respectively. Outcomes were binary (1 = increased stage from last follow-up, 0 =
stayed the same/regressed), and unadjusted proportions were summarized by intervention group. Using a longitudinal regression model implemented with GEEs with robust standard errors, we examined whether the odds of increasing stage of motivational readiness differed over time and by intervention group, after adjusting for age and chemotherapy use. Models assumed an unstructured working correlation matrix.

Finally, using t tests, we assessed whether there were between-group differences in number of calls and length of calls during the intervention period. In addition, using models similar to those described for the main outcome (minutes per week of MVPA from the 7-Day PAR), we assessed whether there was a dose effect on MVPA outcomes. Models included a main effect of dose (number of calls and length of calls in two separate models, respectively), adjusted for age and chemotherapy use.

All analyses were carried out using SAS, Version 10.0, and significance level was set a priori at an alpha of .05.

**Results**

On average, participants were 55.6 years of age (SD = 9.6), and the majority were married/living with partner (82.9%). The sample identified themselves as predominantly White (98.7%), with 6.6% identifying themselves as Hispanic/Latino. Overall, participants reported 24.6 min/week of MVPA at baseline (SD = 30.0) (see Table 1). There were no between-group differences in baseline characteristics (ps > .05) or in baseline psychosocial constructs (data not shown). The mean age of the coaches was 54.9 years, with an average of 7.0 years since diagnosis. The complete description of the coaches is presented in online supplemental Table 468 PINTO, STEIN, AND DUNSIGER

### Self-Reported MVPA

Participants randomized to PA plus RTR increased their self-reported minutes per week of MVPA from 31.8 min/week at baseline (SD = 33.9) to 129.5 min/week at 12 weeks (SD = 73.4) and 98.4 min/week at 24 weeks (SD = 83.2), whereas RTR control participants increased from 17.1 min/week at baseline (SD = 23.4) to 25.0 min/week at 12 weeks (SD = 67.4) and 63.9 min/week at 24 weeks (SD = 82.9). Adjusted model results (from the mixed-effects models described previously) suggest significant between-group differences at both 12 and 24 weeks such that the mean difference in minutes per week of MVPA between those randomized to PA plus RTR and RTR control was 103.0 min/week (SD = 15.4, p < .001) at 12 weeks and 34.7 min/week (SD = 15.5, p = .03) at 24 weeks (see Table 2). Main effects of the intervention from the mixed-effects model was 12.60 (SE = 14.72), and interactions between intervention and follow-up time represents change in slope at follow-up for those randomized to PA plus RTR. Further clustering on coach did not significantly impact the results (see Fig. 2) and, thus, are not included here. In addition, there were no significant moderators of the intervention effects (ps > .05, for interaction terms).

### Accelerometer Data

Results suggested a significant correlation between self-reported and objectively measured PA at 12 (p = 0.59, p < .01) and 24 weeks (p = 0.43, p < .01). PA plus RTR participants increased their minutes per week of MVPA from 13.4 (SD = 25.0) at

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**Table 1**

*Baseline Demographic and Medical History Variables for Participants*

<table>
<thead>
<tr>
<th>Variable</th>
<th>PA plus RTR (n = 39)</th>
<th>RTR control (n = 37)</th>
<th>All (N = 76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yearsa</td>
<td>55.64 (8.59)</td>
<td>55.59 (10.59)</td>
<td>55.62 (9.55)</td>
</tr>
<tr>
<td>Marital status, married/living with partnerb</td>
<td>79.49 (31)</td>
<td>86.49 (32)</td>
<td>82.89 (36)</td>
</tr>
<tr>
<td>Race, Whiteb</td>
<td>97.44 (38)</td>
<td>100 (37)</td>
<td>98.68 (75)</td>
</tr>
<tr>
<td>Ethnicity, Hispanic/Latinob</td>
<td>10.26 (4)</td>
<td>2.70 (1)</td>
<td>6.58 (5)</td>
</tr>
<tr>
<td>Education, at least some collegeb</td>
<td>94.87 (37)</td>
<td>83.78 (31)</td>
<td>89.47 (68)</td>
</tr>
<tr>
<td>Employment, full-timeb</td>
<td>30.77 (12)</td>
<td>48.65 (18)</td>
<td>39.47 (30)</td>
</tr>
<tr>
<td>Income, ≥$40,000b</td>
<td>76.92 (30)</td>
<td>62.16 (23)</td>
<td>69.74 (53)</td>
</tr>
<tr>
<td>Stageb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>7.69 (3)</td>
<td>5.41 (2)</td>
<td>6.58 (5)</td>
</tr>
<tr>
<td>1</td>
<td>41.03 (16)</td>
<td>35.14 (13)</td>
<td>38.16 (29)</td>
</tr>
<tr>
<td>2</td>
<td>41.03 (16)</td>
<td>48.65 (18)</td>
<td>44.74 (34)</td>
</tr>
<tr>
<td>3</td>
<td>10.26 (4)</td>
<td>10.81 (4)</td>
<td>10.53 (8)</td>
</tr>
<tr>
<td>Years since diagnosisa</td>
<td>1.05 (0.98)</td>
<td>1.16 (1.14)</td>
<td>1.11 (1.05)</td>
</tr>
<tr>
<td>Treatmentb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumpectomy</td>
<td>58.97 (23)</td>
<td>48.65 (18)</td>
<td>53.95 (41)</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>35.90 (14)</td>
<td>37.84 (14)</td>
<td>36.84 (28)</td>
</tr>
<tr>
<td>Radiation</td>
<td>83.78 (31)</td>
<td>72.97 (27)</td>
<td>78.38 (58)</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>78.38 (29)</td>
<td>64.86 (24)</td>
<td>71.62 (53)</td>
</tr>
<tr>
<td>Hormone treatment</td>
<td>57.89 (22)</td>
<td>54.05 (20)</td>
<td>56.00 (42)</td>
</tr>
<tr>
<td>Baseline min/week of MVPAa</td>
<td>31.77 (33.87)</td>
<td>23.42 (29.98)</td>
<td>24.64 (29.98)</td>
</tr>
</tbody>
</table>

Note. MVPA = moderate-to-vigorous intensity PA; PA = physical activity; RTR = Reach to Recovery.

* Values are mean (standard deviation).  † Values are n (%).
baseline to 70.3 (SD = 65.9) at 12 weeks and 54.6 (SD = 81.6) at 24 weeks. In contrast, RTR control participants changed from 14.3 min/week (SD = 23.6) at baseline to 16.5 min/week (SD = 31.9) at 12 weeks and 13.4 min/week (SD = 35.2) at 24 weeks. Regression models suggested a significant difference in minutes per week of MVPA as measured by accelerometer at 12 and 24 weeks (p < .01) such that the mean difference in MVPA between PA plus RTR and RTR control was 48.5 min/week at 12 weeks (SE = 11.9) and 38.7 min/week (SE = 12.0) at 24 weeks, after adjusting for age and chemotherapy use (see Table 3). Main effects of intervention from the mixed-effects model was -3.52 (SE = 11.16, p = .75), and interactions between intervention and follow-up time were 52.05 (SE = 13.75 p < .01) at 12 weeks and 42.23 (SE = 13.89, p < .01) at 24 weeks. Note that the interaction between intervention and follow-up time represents change in slope at follow-up for those randomized to PA plus RTR (see Figure 3).

### Meeting PA Guidelines

Among those randomized to PA plus RTR, 41.0% met PA guidelines (Schmitz et al., 2010; U.S. Department of Health and Human Services, 2008) at 12 weeks and 25.6% met guidelines at 24 weeks. Among those in RTR control, these proportions were 5.4% and 16.2%, respectively. Regression models suggested a significant intervention effect such that the odds of meeting guidelines was significantly higher among PA plus RTR participants than RTR control participants (odds ratio [OR] = 13.1, SE = 10.5) at 12-week follow-up. Regression parameters are presented in online supplemental Table 2.

### Motivational Readiness

Unadjusted proportions of participants increasing their stage of motivational readiness are presented in Table 4 for both groups at both follow-up times. Models suggested a significant intervention effect such that the odds of increasing stage of change was greater among PA plus RTR participants than RTR controls at 12 weeks (B = 2.76, SE = 0.62; OR = 15.84, p < .01) but not at 24 weeks (p > .05).

### Intervention Delivery

Finally, RTR coaches were able to deliver 92.24% of expected calls; the mean number of calls across participants was 11.07 (SD = 2.24). There were nonsignificant group differences in the mean number of calls delivered (PA plus RTR: \( M = 11.16, SD = 2.24 \); RTR control: \( M = 10.97, SD = 2.27; p > .05 \)). As expected, there was a significant difference in mean duration of calls, with PA plus RTR call length (\( M = 18.46 \text{ min}, SD = 7.36 \)) exceeding that of RTR control (\( M = 12.67 \text{ min}, SD = 4.04; p < .05 \)). There was no association between number of calls or length of calls and PA outcomes (minutes per week of MVPA as measured by the 7-Day PAR).

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**Table 2**

<table>
<thead>
<tr>
<th>Time</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 12</td>
<td>103.0</td>
<td>15.4</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Week 24</td>
<td>34.7</td>
<td>15.5</td>
<td>.03</td>
</tr>
</tbody>
</table>

**Table 3**

<table>
<thead>
<tr>
<th>Time</th>
<th>Estimate</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 12</td>
<td>48.5</td>
<td>11.9</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Week 24</td>
<td>38.7</td>
<td>12.0</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

**Note.** Estimates are adjusted mean difference between treatment conditions at each follow-up. MVPA = moderate-to-vigorous intensity PA; PA = physical activity; RTR = Reach to Recovery.

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**Figure 2.** Mean minutes of self-reported MVPA. MVPA = moderate-to-vigorous intensity PA; PA = physical activity; RTR = Reach to Recovery.

**Figure 3.** Mean minutes of MVPA (accelerometer data). MVPA = moderate-to-vigorous intensity PA; PA = physical activity; RTR = Reach to Recovery.
The main finding of this trial is that a 12-week telephone-based PA intervention provided by volunteer peer coaches produced significantly greater increases in MVPA in cancer survivors relative to a contact control condition also led by peers. These results are consistent with and extend previous research that has indicated volunteer peer mentors can effectively increase PA among sedentary adults with no history of cancer (Buman et al., 2011; Castro et al., 2011). Such findings suggest professional staff-led interventions, which are costly and often not feasible in community settings, are not necessary to achieve desired behavior change and increases in MVPA. Results of our previous pilot study demonstrated that volunteer peer coaches can increase PA in cancer survivors in a single group longitudinal design (Pinto et al., 2008). The current study extends these results by using an RCT design. Additionally, we extended the reach of our intervention beyond one state to six NE states. Furthermore, we found that cancer survivors randomized to the peer-led intervention showed significantly greater increases across multiple MVPA outcomes. Specifically, participants in the PA plus RTR arm had increased MVPA at both 12 and 24 weeks on both subjective (7-Day PAR) and objective (accelerometer) measures of PA. In addition, those in PA plus RTR condition were more likely to meet ACSM guidelines for PA and to improve their motivational readiness for behavior change at 12 weeks. To our knowledge, this is the first trial to demonstrate that a peer coaching intervention can increase PA in cancer survivors.

Our results are noteworthy in that they are likely to have greater “real-world” application through the engagement of a large community-based organization (i.e., ACS), which has an established program (RTR) aimed at helping breast cancer survivors navigate the cancer treatment and recovery experience. Previous research has shown that increased PA after cancer can lead to improved physical and emotional health (Schmitz et al., 2010). Thus, the addition of a PA intervention to an established program could increase both the value of the program to participants as well as its potential to positively impact their long-term health outcomes. Integration of a PA intervention component into community-based programs also represents a potentially efficient and cost-effective method of identifying and recruiting both coaches and participants in PA trials because it builds on existing infrastructure and leverages programs that have established positive reputations in the community. In addition, the mechanisms to communicate with participants and deliver the intervention (via volunteer peer coaches) are already in place. Indeed, in many such programs, including RTR, community-based coaches are trained to understand and address the issues survivors face during their cancer experience. In particular, peer coaches have developed skill sets with regard to talking with cancer survivors about various challenging health concerns, have built rapport with those to whom they provide coaching, and are in position to deliver an evidence-based intervention with minimal additional training and cost to the program. Such an intervention focused on increasing PA is also consistent with recommendations of ACS (Rock et al., 2012), and thus the adoption of the intervention into programs is likely to be supported by the organization.

Another strength of this study is the inclusion of both subjective and objective measures of PA, as recommended by Haskell (2012). Other intervention studies have relied solely on self-reported PA (Morey et al., 2009), which may be subject to over- and underestimation of actual engagement (Hekler et al., 2012). In our study, we found concordance between self-reported PAR and objectively measured accelerometer PA data at both 12 and 24 weeks, suggesting the fidelity of our intervention was strong, adding confidence that our results are valid. The correlations between subjective and objective measures of PA in the present study were moderate, but higher than those reported in other studies (Hekler et al., 2012; Shuval et al., 2012). It is clear the self-reported exercise exceeded objectively measured activity at all time points. This is not an unusual occurrence (Marcus et al., 2007; Marcus et al., 2013) because each technique uses different measurement approaches (Dale, Welk, & Matthews, 2002). Despite these differences, intervention effects on exercise assessed by both techniques (recall and objective data) were significant at both time points, thereby increasing confidence in our results.

An important outcome is that 41% of the participants in the PA plus RTR arm met ACSM guidelines for PA at the end of the intervention period. Compared with only 5.4% of the controls meeting the guidelines at 12 weeks, these findings underscore that the intervention not only increased absolute levels of MVPA over time but also raised them to levels that may positive impact overall physical health. Thus, coaches clearly were effective in communicating the importance of meeting guidelines and the potential health benefits of doing so. It is possible that coaching about PA may generalize to other health behaviors, potentially having a greater impact on overall health (Prochaska, Spring, & Nigg, 2008).

Although the results of this trial are positive, there are limitations that warrant consideration. First, our study was conducted solely with female breast cancer survivors. Thus, the generalizability of the findings to survivors of other cancers and male cancer survivors are unknown at this point. On the one hand, the intervention is not disease- or gender-specific, so it is plausible that this intervention would also benefit male survivors or those with cancers other than breast. Indeed, other PA trials have been shown to be equally effective with both men and women and across different disease sites (Morey et al., 2009). Second, we powered our trial on the effect size obtained in the pilot study (Pinto et al., 2008), which showed a larger effect size ($d = 0.97$) than found in a review of exercise interventions for cancer survivors (Speck et al., 2010). Third, there are limitations to general-
izability in that the response to mailed letters inviting women treated for breast cancer to participate was poor, suggesting some limitations to the uptake of this intervention. Among those who responded, a subgroup reported exercising with some regularity and were excluded (23.8%). The response to solicitation for coach volunteers was also not as high as expected, and may limit intervention implementation (reasons for the nonresponses were not obtained). Fourth, we did not assess fitness. The current study was not designed to impact fitness or other biomedical outcomes; rather, we sought a “real-world” application of an already tested, evidence-based PA intervention delivered to cancer survivors by peer coaches. Another concern is the finding that significant differences in MVPA found at 12 weeks were not maintained to the same extent at 24 weeks. It is plausible that RTR control participants joined other structured exercise programs after the 12-week assessment and their mean MVPA increased at 24 weeks. The effects may also be attributable to the fact that the weekly telephone calls to both groups ended at 12 weeks. Thus, it is perhaps not surprising that the positive gains in the PA plus RTR group were attenuated over time. However, this finding does suggest an area of future research because exercise maintenance is critical to the management of cardiovascular disease and other chronic conditions among cancer survivors, as well as potentially for cancer survival (Holmes, Chen, Feskanich, Kroenke, & Colditz, 2005; Irwin et al., 2011). Maintenance of outcomes is also fundamental to inform the transition of evidence-based behavior interventions into practice (Glasgow, Klesges, Dzewaltowski, Bull, & Estabrooks, 2004). Finally, this trial was powered on the effects on self-reported MVPA found in the pilot study (Pinto et al., 2008) and the large effect size that we found in this prior work is higher than the small-to-moderate effect size found in PA interventions for cancer survivors (Speck et al., 2010).

Our goals were not to test peer mentoring for exercise versus other structured exercise programs (e.g., Buman et al., 2011), but to test the effects of peer mentoring on participants’ self-reported MPVA versus those who did not receive the PA counseling but had equal frequency of contact with the peer mentors. Hence, we instructed the RTR control group not to join a structured exercise program for the first 12 weeks. It is plausible that these instructions may have led some control participants to artificially constrain their PA during the 12-week intervention phase.

The present findings underscore the potential for a large-scale dissemination project in collaboration with a large, national, community-based organization such as ACS. Such a project may have wider application for difficult-to-reach populations, including those living in rural areas, minorities, those with less education, and the medically underserved. A telephone-based intervention may also appeal to older or physically impaired individuals who may find it difficult to travel to more traditional, clinic-based PA intervention programs. A recent review has acknowledged that peer-delivered PA interventions are an overlooked opportunity for PA promotion (Ginis, Nigg, & Smith, 2013). The authors pointed out that, in the larger health care context, PA prescriptions are probably left best to physicians, physical therapists, and fitness professionals, while peers are probably best suited for the delivery of PA interventions in a way that others in the health care system may neither have the time nor the training to provide. Before launching a dissemination project, however, future research should explore options for improving efficiency, optimal methods of delivery, and cost effectiveness. For example, although telephone-based interventions may be effective in modifying PA levels, maintenance of this delivery mode over time may not be feasible or cost effective. However, prompts and reminders have been found to be effective to sustain behavior change (Lombard, Lombard, & Winett, 1995). Thus, other methods of communication that can help survivors maintain gains in MVPA and do not require individual coach’s time, such as text messages, emails, and so forth, should be considered.

Conclusions

The results suggest that peer coaches identified through existing community-based programs can effectively deliver counseling and increase PA in cancer survivors compared with control group participants who received equal frequency of contact with peer coaches, RTR print materials, and were instructed not to join a structured exercise program for the first 12 weeks. Such peer-led interventions have the potential for large-scale dissemination and may positively impact survivors’ health behaviors and overall health, particularly among difficult-to-reach populations. Future research focusing on strategies to maintain gains in PA through existing and emerging technologies and time-saving modes of communication may optimize impact.

References
