

# Older Adults With Chronic Disease: Benefits of Group-Mediated Counseling in the Promotion of Physically Active Lifestyles

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In this 12-month trial standard exercise training was compared with a group-mediated cognitive-behavioral (GMCB) intervention with respect to effects on long-term adherence and change in physical function of older adults who were either at risk for or had cardiovascular disease. Participants (147 older men and women) were randomized to the 2 treatments. Outcomes included self-reported physical activity, fitness, and self-efficacy. The GMCB treatment produced greater improvements on all outcomes than did standard exercise therapy. Regardless of treatment assignment, men had more favorable change on the study outcomes than did women. Analysis of a self-regulatory process measure in the GMCB group revealed that change in barriers efficacy was related to change in physical activity and fitness. Results suggest that teaching older adults to integrate physical activity into their lives via GMCB leads to better long-term outcomes than standardized exercise therapy.

*Key words:* interventions, exercise, physical activity, older adults, standard exercise training

There is ample evidence that cardiovascular disease (CVD) is a principle threat to the physical function and independence of older adults (Fried & Guralnik, 1997). Despite the fact that structured exercise is the cornerstone of treatment in the rehabilitation of CVD, most insurance carriers support time-limited therapy (12 weeks), and rates of attrition are high (Burke, Dunbar-Jacob, & Hill, 1997; Dishman & Sallis, 1994). Moreover, once participants leave the structure of formal care, they quickly return to sedentary lifestyles. One explanation for this problem may be that traditional rehabilitation provides neither the motivation nor the instruction and practice in developing self-regulatory skills for behavior change toward an independent regimen of physical activity (Brawley, Rejeski, & Lutes, 2000). In view of this hypothesis, the objective of the present randomized clinical trial was to compare the effects of a traditional cardiac rehabilitation program (CRP) involving exercise training with a group-mediated cognitive-

behavioral (GMCB) intervention on change in older adults' physical activity and fitness, as well as self-efficacy for the performance of a mobility task.

## Promoting Adherence in Cardiac Rehabilitation

Over the past 20 years, there have been numerous developments in exercise programs for CVD that have had varying degrees of success in improving different components of health status (cf. Burke et al., 1997; Dusseldorp, van Elderen, Maes, Meulman, & Kraaij, 1999). Moreover, a number of investigators have used various behavioral and cognitive interventions within these programs to enhance compliance and/or adherence to rehabilitative therapy (Schneiderman, Antoni, Saab, & Ironson, 2001). Despite these refinements, little attention has been given to the systematic development of self-regulatory skills necessary for the promotion of adherence to an independent lifestyle of physical activity once patients leave the structure of formal exercise therapy. Brubaker and his colleagues (Brubaker et al., 2000) noted that even long-term center-based programs that follow guidelines of the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR; 1999) may not solve the problem of nonadherence because of multiple barriers that prevent access to and maintenance of behavior at the center (e.g., travel distance, schedule conflicts, cost, no reimbursement). Although low-cost home-based maintenance programs are an option that has been demonstrated to be as effective as center-based programs in improving and/or maintaining physical function and risk-factor profiles (e.g., Brubaker et al., 2000), the issue of attrition remains.

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### Enhancing Functional Capacity and Control Beliefs

The obvious importance of improved adherence to exercise therapy is the enhancement of desired outcomes. Whereas a number of clinical goals are sought through exercise therapy in cardiac rehabilitation, research clearly points to the benefits of improved functional capacity (Wenger, Froelicher, & Smith, 1995) and task-specific self-efficacy related to mobility (McAuley & Blissmer, 2000; Rejeski, Miller, Foy, Messier, & Rapp, 2001). Functional capacity, commonly quantified as metabolic equivalents (METs), is determined through a graded exercise test. MET level is an important factor in functional independence, vocational abilities, and the choice of appropriate recreational activities (AACVPR, 1999; American College of Sports Medicine, 2000; Wenger et al., 1995). Furthermore, MET levels have been found to be important to risk stratification (AACVPR, 1999) and survival analyses (Froelicher, Morrow, Brown, Atwood, & Morris, 1994; Mark et al., 1991). Self-efficacy for mobility has also been identified as an important psychosocial outcome of rehabilitation with older adults (Ewart, 1989). Recently, self-efficacy for mobility was found to be predictive of 30-month decline in functional abilities among older adults with knee pain (Rejeski et al., 2001). In a recent review of literature on self-efficacy and physical activity, McAuley and Blissmer (2000) pointed to the fact that self-efficacy cognitions are a determinant of participation in physical activity and are theorized to be related to such psychological consequences of physical activity as reduced depressive affect and increased physical self-esteem.

### The Current Study

We recently contrasted the effects of a GMCB intervention against a more traditional center-based exercise program on long-term adherence to physical activity in a community-based sample of older adults (Brawley et al., 2000). At a 9-month follow-up assessment, the average frequency for physical activity in the GMCB group was 5.9 days per week, whereas it was 2.5 days per week in the traditional group ( $p < .05$ ). Thus, it appears that the coupling of group and individual behavior-change counseling strategies with exercise can be effective in enhancing the long-term maintenance of physical activity.

One limitation identified in this previous work was that it did not speak to the effects of a GMCB intervention on peak functional capacity and/or changes in perceptions of control. Given the importance of cardiac rehabilitation in geriatric medicine (Wenger et al., 1995) and the central role of physical activity in these programs, the current study compared a standard CRP with one that differed only in that it made use of a GMCB intervention that focused on the older adults' learning to develop a physically active lifestyle and the promotion of their independence in carrying out this lifestyle. The outcome variables of interest were changes in MET capacity, self-efficacy for mobility, and a 7-day physical activity recall. The experimental hypotheses tested were that the GMCB treatment would result in more favorable changes on the dependent variables of interest than would the standard CRP treatment. Studies have reported that women in cardiac rehabilitation have lower rates of attendance than men and experience less improvement on various psychosocial outcomes (Brezinka & Kitzel, 1995). Because these results have been questioned because of

selective sampling and other limitations in experimental methods (McEntee & Badenhop, 2000), a randomized block design was used with stratification by gender.

### Method

#### Participants

Participants for this study were recruited from the Piedmont Triad region of North Carolina. The sample was stratified by gender. Recruitment strategies consisted of mass mailings, mass media advertisements, and requests from local physicians targeting age-eligible older adults who either were at high risk for CVD or had documented evidence of CVD. All participants met the following inclusion criteria: (a) between the ages of 50 and 80 years; (b) either documented evidence of a myocardial infarction, percutaneous transluminal angioplasty, chronic stable angina, New York Heart Association Type I or Type II congestive heart failure, or cardiovascular surgery (coronary artery or valvular heart disease) in the past 6 months or self-reported presence of two or more major risk factors for CVD; (c) disability, defined as self-reported disability with walking a quarter of a mile, climbing stairs, lifting and carrying groceries, or performing other household chores such as cleaning and doing yard work; and (d) no active engagement in exercise or cardiac rehabilitation for the preceding 6 months. Self-reported exclusion criteria at screening included the following: (a) psychiatric illness, such as treatment for major depression or schizophrenia within the past 5 years; (b) severe symptomatic heart disease, such as evidence of unstable angina, New York Heart Association Type III or Type IV congestive heart failure, or exercise-induced complex ventricular arrhythmias; (c) severe systemic disease, such as chronic liver, kidney, or rheumatic disease; (d) active treatment for cancer; (e) hearing or sight impairments; (f) cognitive impairment; (g) alcohol consumption greater than 21 drinks per week or alcoholism; (h) inability to speak or read English; (i) the judgment of clinical staff; and (j) current participation in another medical intervention study.

Of 190 eligible participants (88 were found not to meet the inclusion-exclusion criteria), 147 were randomized via eight waves into either the CRP (37 men and 37 women) or the GMCB (40 men and 33 women) treatment group. Sixty-four participants in the CRP group and 64 in the GMCB group completed baseline testing and at least one follow-up assessment. Demographic and biometric characteristics of the participants are discussed in the Results section.

#### Measures

**MET level.** Each participant completed a symptom-limited maximal graded exercise test to assess peak oxygen uptake or symptom-limited MET capacity. Graded exercise test data were collected with a Medical Graphic (St. Paul, MN) CPX/D metabolic cart and a Trackmaster (Newton, KS) TS400 treadmill. The treadmill protocol consisted of 2-min stages with progressive increases in grade designed to elicit an increase of approximately 1 MET per stage. One MET is a measure of energy expenditure and is equivalent to an oxygen uptake of 3.5 ml/kg/min. Participants were instructed to walk on the treadmill until they could no longer continue because of generalized fatigue, shortness of breath, leg discomfort, or any other reason. The peak MET level each participant achieved during the treadmill test served as one outcome variable for this study.

**Self-efficacy.** Self-efficacy was assessed for the 6-min walk mobility task that was conducted in a gymnasium. Prior to completion of this performance task, participants were asked to rate their confidence in their ability to walk around the gymnasium two times without stopping. This measurement was repeated for anticipated distances of 4 laps, 6 laps, 8 laps, and 10 laps. For each level of difficulty, participants were presented with a confidence ladder drawn on a large poster board. The ladder had 10 steps ranging from 0 (*completely uncertain*) to 10 (*completely certain*).

Self-efficacy scores were calculated by summing confidence ratings across the five levels of difficulty and multiplying this result by 2 to produce a score that ranged from 0 to 100. This hierarchical measurement protocol is consistent with the standard protocol developed by Bandura (1986) to measure task-specific self-efficacy beliefs and is a recommended protocol identified in a current review of exercise-related self-efficacy measurement (cf. McAuley & Mihalko, 1998). This particular scale has been shown to have construct validity in two previous publications (Rejeski, Craven, Ettinger, McFarlane, & Shumaker, 1996; Rejeski, Ettinger, Martin, & Morgan, 1998).

*Self-reported physical activity.* The Physical Activity Recall (PAR) was used to assess self-reported physical activity and was conducted by experienced interviewers using an established structured format (Blair et al., 1985; Sallis et al., 1985) that has acceptable validity and reliability (Blair et al., 1985; Pereira et al., 1997). In this interview, participants recall specific activities to estimate the amount of time spent in each 24-hr period during the previous 7 days in sleep and four categories of activity intensity: light, moderate, hard, and very hard physical activity. Pilot testing in the current study produced a 1-week test-retest reliability for the PAR of .80.

For the purpose of this study, we were interested in the total number of minutes that participants spent in physical activity that was moderate or higher in MET demand ( $\text{mod}^+$  activity). This outcome was consistent with the physical activity goals of the interventions.

*Barriers efficacy.* A barriers self-efficacy scale was administered only to GMCB participants as a means of evaluating a key self-regulation process component of the social-cognitive framework for the intervention—that is, social problem solving necessary to address barriers that arise for older adults in their pursuit of an independent lifestyle of physical activity. The measure is a 14-item scale that has been found to be predictive of 6-month and 1-year adherence to aerobic exercise (Garcia & King, 1991). The measure was administered 45 days after randomization—so that participants had mastery experiences to rely on when completing the measure—and again at 90 days postrandomization, the end of the intensive phase of treatment. Scores on the measure were converted to a 100-point scale with higher scores indicating stronger efficacy to manage barriers. The Cronbach alpha reliability of the scale was excellent (.93).

### Trial Design

Prior to participation in the intervention, participants visited the laboratory on three separate occasions for baseline assessments and completion of an informed consent. During the first screening visit, a blood sample was collected from each participant, questionnaires were administered, and participants completed a 6-min walk test. During the second screening

visit, each participant endured a symptom-limited graded exercise test, had his or her height and weight measured, and had his or her body fat assessed using a three-site skin-fold caliper method. The third screening visit was conducted 1 week after the second screening visit. During this third visit, participants underwent a 7-day recall interview and received feedback on blood test values and treadmill test results.

When the three screening visits were completed, participants were randomized into one of the two treatments, stratified by gender. The groups consisted of a traditional CRP and a GMCB intervention. Certified exercise leaders who were trained to deliver the two interventions according to specific protocols led the groups. Their leadership underwent constant evaluation by study investigators to preserve treatment fidelity. Follow-up assessments were made following the 3-month intensive phase of the trial and again at 12 months. The exercise therapy portion of the center-based sessions was identical for both treatments and was consistent with guidelines outlined by AACVPR (1999).

*CRP treatment.* The CRP treatment arm consisted of center-based training that included walking and upper body strength training. Participants exercised 3 days per week for a period of 3 months. Thus, formal staff contact occurred for 36 sessions during the intensive phase. Each exercise session consisted of four phases: a warm-up (5 min), an aerobic stimulus phase (30–35 min), an upper extremity strength training phase (15–20 min), and a cooldown phase that included stretching exercises (5 min). During the aerobic stimulus phase, participants walked at an intensity of 50% to 85% of heart rate reserve, [(symptom-limited maximum heart rate – resting heart rate)  $\times$  desired percentage] + resting heart rate. After 20 min of exercise, participants' heart rates and electrocardiogram readings were recorded using a Physio-Control (Redmond, WA) Lifepak9 cardiac monitor defibrillator.

The upper extremity strength-training phase consisted of five resistance exercises using small hand weights designed to increase strength in the muscles of the arms and shoulder girdle. The exercises included overhead dumbbell press, overhead triceps extension, biceps curl, upright row, and side bends. Participants were asked to perform one set of 10 repetitions of each exercise. In addition to exercise therapy, weekly minilectures were given on topics that related to modification of risk factors for CVD.

*GMCB treatment.* Table 1 outlines the total staff contact hours and how they were accumulated during the trial for each treatment. Participants in the GMCB treatment arm received the same total number of staff contact hours as those in the CRP, but this was delivered over a period of 9 months. Furthermore, participants were trained in the same forms of exercise as prescribed for the CRP condition and received the minilectures given to the CRP treatment group. In contrast to the CRP, the goal of the GMCB condition was to gradually wean participants from dependency on the staff

Table 1  
Comparison of Formal Staff Contacts by Treatment Group

Group	Contacts
CRP	<p><i>Months 1–3:</i> One hour of group exercise therapy three times each week plus mini-educational lectures on topics for the rehabilitation of patients with cardiovascular disease (e.g., drug therapy, nutrition). The total number of contact hours for the active intervention was 36.</p> <p><i>Months 4–12:</i> No further formal staff intervention contact.</p>
GMCB	<p><i>Months 1–2:</i> Two 1-hr sessions of group exercise therapy each week plus the same educational lectures that were delivered to the CRP group—16 hr total. Group-based counseling for 20–25 min following each exercise therapy session—an upper limit of 7 hr total.</p> <p><i>Month 3:</i> A 1-hr session of group exercise therapy each week plus the same educational lectures that were delivered to the CRP group—4 hr total. Group-based counseling for 20–25 min following each exercise therapy session—an upper limit of 1.5 hr total.</p> <p><i>Months 4–9:</i> One-hour booster sessions at the center during Months 4, 6, and 9 with follow-up group counseling sessions for 30 min—4.5 hr total. Two phone contacts during Months 4, 5, and 6 and one phone contact during Months 7, 8, and 9—an upper limit of 3 hr.</p> <p>Thirty-six total staff contact hours across the active intervention.</p> <p><i>Months 9–12:</i> No further formal staff intervention contact after the 9th month.</p>

Note. CRP = cardiac rehabilitation program involving traditional exercise training; GMCB = group-mediated cognitive-behavioral intervention.

and group program toward independent self-regulation of physical activity. For the 1st and 2nd months, participants engaged in center-based exercise therapy two times each week. During the 3rd month, center-based training was reduced to one time per week. In each of these months, planned home-based activity by the participant provided the additional sessions of exercise for a frequency equivalent to the CRP treatment; however, GMCB participants were encouraged to be active on most, if not all, days of the week.

Following each exercise therapy session, participants engaged in a 20- to 25-min period of instruction and counseling regarding learning and using self-regulatory tools in order to maintain long-term physical activity and to preserve functional independence. For instance, during the 1st month, participants were asked to identify their primary motivations for becoming more active, and group leaders emphasized the risk of disability with aging. In addition, participants were introduced to the concept of self-monitoring of overall physical activity by using Accusplit (San Jose, CA) DIGI-WALKER SW-200s, which measure the number of steps taken. DIGI-WALKER values were recorded on activity logs. Participants were taught how to record the frequency (days per week), intensity (heart rate and rating of perceived exertion), time, and type of physical activity performed in activity logs. Also, during this period, individual and group goal setting for physical activity was discussed. Participants were instructed on how to set appropriate goals and how to deal with failure to meet goals.

During Month 2, discussion focused on the concept of becoming an independent exerciser and how to plan home-based exercise that is safe and effective. Counseling between clinic staff and participants was coupled with group-motivated, peer-initiated solutions on how to maintain an active lifestyle and how to promote functional independence. Records of these solutions were kept and eventually provided to group participants for use in the home-based phase of the trial. During this period, strategies were discussed on how to overcome barriers and lapses related to physical activity. Also, the importance of group support to promote a program of independent physical activity as well as accompanying solutions and strategies jointly developed by staff and participants were reinforced.

During Month 3, group discussions focused on the recognition that, as individuals and as a group, participants had reached a stage of rehabilitation in which they could view themselves as physically active, independent older adults. At this stage, discussions focused on how to use environmental cues to facilitate activity goals, develop plans to deal with common barriers, and recognize signs of relapse and how to avoid or deal with relapse when it occurred. Also, attention was given to raising awareness of the progress that participants had achieved over the past 3 months, the importance of developing and maintaining their own independent activity programs, and the plans they developed for the 1st month of independence from center-based activity. In sum, participants prepared themselves for independence and were weaned from the structured group environment.

Months 4–9 represented the home-based phase of the trial. During this phase, staff contact with participants in the GMCB condition was limited (i.e., 7.5 total hr) in comparison with the center-based phase of the trial (i.e., 28.5 total hr). This limited contact was accomplished through the combination of booster exercise sessions, phone contacts, newsletters, and by participants' mailing their completed monthly mail-back activity cards (described below) to the center. A booster exercise session was held at the center during Months 4, 6, and 9, whereas participants received two phone calls from the staff during Months 4, 5, and 6 and received one phone call during Months 7, 8, and 9. The purpose of the booster sessions and the phone calls was to discuss the progress of each participant's exercise program, to identify potential barriers, and to use either the group setting (booster sessions) or individual contact (phone calls) to develop strategies to overcome barriers and lapses. Newsletters were mailed to participants at the end of Months 4–9. The newsletters contained educational information regarding CVD, exercise, and nutrition and provided updates on the GMCB participants who were in each specific wave. In addition, the newsletters also contained a blank mail-back activity card with a stamped

envelope to be returned to the center. The participants recorded their goals, and the frequency and duration of exercise for each week of the previous month on the mail-back cards. In addition, they recorded their total steps for each week and whether they planned to maintain, decrease, or increase their activity for the next month. Finally, they identified barriers to their activity in the previous month and recorded how they planned to overcome these barriers. Completed cards were then mailed back to the center. During Months 9–12, participants engaged in home-based activity completely independent of contact initiated by the staff. However, participants were told that contact initiated by them was welcome. In summary, this phase of the trial provided participants with the maximum opportunity to engage in independent exercise and was structured so that the relationship between the participants and staff was collaborative in nature rather than directive.

*Attendance.* Attendance to structured exercise therapy sessions (i.e., the first 3 months) was recorded for each participant in the study to determine whether compliance with the frequency component (a goal of at least 3 days of exercise per week) of the exercise prescription was similar between the GMCB and CRP conditions as well as between male and female participants. Given the fact that the number of center-based sessions offered was different between the CRP and GMCB groups, different approaches were used to assess adherence between the two conditions. For the CRP treatment, the percentage of adherence was defined as the number of sessions that the participant attended divided by the number of sessions offered at the center, multiplied by 100. For example, if a participant attended 18 sessions out of 36 offered, his or her percentage of adherence would be  $(18/36) \times 100$ , or 50%. In several instances, participants completed their exercise sessions at home because of family or personal conflicts. These sessions were counted in the overall rates of adherence for the CRP group.

Among GMCB participants, both center-based sessions and planned home-based exercise were used to evaluate whether adherence matched the frequency goal of at least 3 days per week. For instance, during Month 1, if a participant attended 6 out of 8 sessions offered and engaged in home-based exercise at least once each week, his or her percentage of adherence for Month 1 would be determined as follows:  $(10/12) \times 100 = 83.3\%$ . Similarly, if he or she attended 7 out of 8 sessions offered during Month 2 and engaged in home exercise once each week, his or her percentage of adherence for Month 2 would be  $(11/12) \times 100 = 91.6\%$ . During Month 3, if he or she attended 3 out of 4 sessions offered and engaged in home-based exercise twice each week, his or her percentage of adherence would be  $(11/12) \times 100 = 91.6\%$ . Finally, the average of the 3 months was calculated to arrive at an index of overall adherence:  $(83.3 + 91.6 + 91.6)/3 \times 100 = 88.8\%$ .

### Statistical Analyses

All descriptive statistics are reported as means and standard deviations or as frequencies. For the main analyses, we used mixed model analyses of covariance (ANCOVAs) and an intention-to-treat principle to test the effects of interest on each outcome variable: MET level, self-efficacy for mobility, and minutes of mod + physical activity as determined by the PAR. We used a random effect for the subjects factor to allow for within-subject correlation of the repeated measurements. Predictor (independent) variables included treatment, gender, time (3 and 12 months), the value of the response at baseline, and baseline age. Adjusted means and their standard errors were calculated with the treatment by time interaction in the models. We used the square-root transformation of PAR mod<sup>+</sup> values for analysis because those data were not normally distributed. In addition, although our analyses were conducted on the adjusted posttreatment means, in this article we include means and standard errors for adjusted difference scores to assist the reader in interpreting the data. The treatment groups were compared at baseline using a *t* test for continuous variables, a Fisher's exact test for all categorical variables except income, and a Cochran–Armitage trend test for income.

## Results

Demographic, disease, and comorbidity characteristics on the participants at the initial screening visits are shown in Table 2, partitioned by treatment group. These data illustrate that the study sample consisted of a group of older men and women, who were overweight or obese, and who were heterogeneous regarding income. Approximately 75% of this sample had documented heart disease. Seventy percent of this sample had hypertension, nearly 50% had arthritis, and a small percentage of the sample (19%) had diabetes. Randomization was effective for assignment to treatment in that there were no statistical differences between treatment

Table 2  
Descriptive Characteristics of GMCB and CRP Treatment Conditions at Baseline

Variable	GMCB		CRP	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	64.73	7.18	64.87	6.76
Body mass index (kg/m <sup>2</sup> )	29.18	4.91	28.73	5.75

  

Variable	GMCB		CRP	
	<i>n</i>	%	<i>n</i>	%
Gender				
Men	37	50.0	40	54.8
Women	37	50.0	33	45.2
Smoking status				
Never	25	34.7	35	48.6
Past	44	61.1	30	41.7
Current	3	4.2	7	9.7
Arthritis				
No	31	43.1	36	49.3
Yes	38	52.8	32	43.8
Don't know	1	1.4	2	2.7
No answer	2	2.8	3	4.1
Hypertension				
No	19	26.4	18	24.7
Yes	51	71.8	53	72.6
Don't know	1	1.4	2	2.7
No answer	1	1.4	0	0
Heart disease				
No	15	21.4	18	26.1
Yes	55	78.6	51	73.9
Circulation problems				
No	59	83.1	52	75.4
Yes	12	16.9	17	24.6
Diabetes				
No	56	77.8	60	82.2
Yes	15	20.8	12	16.4
Don't know	1	1.4	1	1.4
Any cancer				
No	51	76.1	48	68.6
Yes	16	23.9	22	31.4
Income category				
< \$10,000	1	1.4	5	6.9
\$10,000–\$24,999	13	17.8	11	15.1
\$25,000–\$49,999	21	28.8	28	38.4
> \$50,000	31	42.5	28	38.4
No answer	7	9.6	1	1.4

Note. CRP = cardiac rehabilitation program involving traditional exercise training; GMCB = group-mediated cognitive-behavioral intervention.

groups on demographic, disease, and comorbid characteristics reported in the table.

### Study Attrition

Of the 147 participants who were randomized into the trial, 128 completed baseline assessments and at least one of the follow-up assessments. Among the 19 participants who were lost to attrition, 9 of these individuals left the study because of personal or family illness. Four individuals left the study because of psychological complications. One participant left the trial because of job demands, and 5 persons left the study because of noncompliance with the interventions. As a whole, 6 participants were lost from the CRP group after intervention onset. Although 13 participants were lost from the GMCB group, 5 of these individuals left the study before the intervention began. This drop out was due, in large part, to complications with personal health or family illness ( $n = 4$ ). Thus, attrition during the treatments was 6 patients from the CRP and 8 patients from the GMCB group. Our statistical analyses made use of all of the available follow-up information collected at 3- and 12-month assessments by using a maximum-likelihood approach to estimate the model parameters. This method enables missing data to be dependent on baseline and other observed data and provides unbiased estimates if the data are missing at random.

### Adherence to the Intensive Phase of the Intervention

The intensive phase of the intervention involved the first 3 months of the trial. In fact, all of the intervention contact with the standard CRP arm occurred during this period. Because the standard CRP included 3 days of physical activity each week, we compared the frequency with which this goal was met by men and women in both treatment groups. This measure of adherence was expressed as a percentage of the total number of sessions attended for the first 3-month block of time. Analysis of these data using analysis of variance produced statistically significant effects for gender,  $F(1, 100) = 6.17, p < .05$ , and treatment,  $F(1, 100) = 15.04, p < .05$ . Examination of the means associated with these effects revealed that men ( $M = 88.54\%$ ,  $SE = 2.34\%$ ) had significantly better compliance than women ( $M = 80.22\%$ ,  $SE = 2.39\%$ ), whereas participants in the GMCB treatment ( $M = 90.88\%$ ,  $SE = 2.65\%$ ) had better adherence than those in the standard CRP ( $M = 77.88\%$ ,  $SE = 2.04\%$ ). The interaction term was not significant.

### Outcomes

Tables 3, 4, and 5 contain the raw means and standard deviations for participants in each treatment condition across time for each of the study outcomes. This information is presented together with least squares means (and standard errors) and change scores (and standard errors) that reflect adjustment for the baseline values of age and the baseline values of the dependent measure used in that analysis. Inspection of these data suggest that, with the exception of METs and self-efficacy scores for women in the CRP treatment condition, both men and women in each treatment arm made positive change from baseline on all three outcome variables at both the 3- and 12-month assessment. It is also clear that, with

Table 3  
Raw and Adjusted Posttest Means and Adjusted Change Scores for the Square Root of PAR Mod<sup>+</sup> by Treatment Group

Gender and measure	Assessment period						
	Baseline value	3 months			12 months		
		Raw	Adjusted	Change	Raw	Adjusted	Change
GMCB							
Men							
<i>M</i>	1.38	2.70	2.52	1.25	2.24	2.20	0.93
<i>SD</i>	0.97	0.87	0.13	0.13	0.81	0.14	0.14
Women							
<i>M</i>	0.84	1.81	1.98	0.71	1.51	1.66	0.39
<i>SD</i>	0.75	0.78	0.13	0.13	1.27	0.14	0.14
CRP							
Men							
<i>M</i>	1.59	2.21	2.22	0.95	1.86	1.90	0.63
<i>SD</i>	1.00	0.98	0.13	0.13	0.95	0.13	0.13
Women							
<i>M</i>	1.03	1.55	1.68	0.41	1.59	1.36	0.09
<i>SD</i>	0.91	0.82	0.14	0.14	1.20	0.14	0.14

Note. Adjusted means and adjusted change scores were adjusted for baseline of the dependent measure used in that analysis and baseline age. Raw means include only participants who have baseline data and data from at least one follow-up. The difference in raw means and the adjusted changes can differ because of marginal interactions between adjusting variables and participants with missing data at one follow-up. PAR = Physical Activity Recall; mod<sup>+</sup> = moderate or higher intensity of physical activity; GMCB = group-mediated cognitive-behavioral intervention; CRP = cardiac rehabilitation program involving traditional exercise training.

few exceptions, the peak change occurred at 3 months with a small reduction from the 3-month to the 12-month assessment. Most important, it is clear that the effect of the physical activity interventions on the three outcomes was stronger for the GMCB group than the traditional CRP group.

Mixed model ANCOVAs detected significant treatment main effects for MET capacity,  $F(1, 91) = 4.56, p = .04$ ; self-efficacy,  $F(1, 102) = 4.58, p = .03$ ; and the square root of PAR mod<sup>+</sup>,  $F(1, 102) = 4.55, p = .03$ . The average level at follow-up for the GMCB treatment arm was higher for all three outcomes as compared with the CRP treatment arm (for MET capacity,  $M = 5.86, SE = \pm 0.12$ , vs.  $M = 5.49, SE = \pm 0.12$ , effect size = 0.48; for self-efficacy,  $M = 66.70, SE = \pm 1.90$ , vs.  $M = 60.94, SE = \pm 1.90$ , effect size = 0.41; and for the square root of PAR mod<sup>+</sup>  $M = 2.09, SE = \pm 0.10$ , vs.  $M = 1.79, SE = \pm 0.10$ , effect size = 0.36). Converting to the original scale for PAR mod<sup>+</sup>, this corresponds to adjusted means of 4.39 hr and 3.21 hr of mod<sup>+</sup> activity per week, an increase from baseline of approximately 103 min for the CRP group and 148 min for the GMCB group.

It is interesting to note that after adjusting for the covariates in our models, none of the correlations for change across time between the three outcome variables were statistically significant ( $ps > .05$ ; self-efficacy and MET,  $r = .07$ ; PAR mod<sup>+</sup> and MET,  $r = -.08$ ; and PAR mod<sup>+</sup> with self-efficacy,  $r = .16$ ). Thus, in this study, change in these outcome measures was independent of one another.

There were also significant gender main effects for all three outcome measures: MET,  $F(1, 91) = 6.47, p = .01$ ; self-efficacy,  $F(1, 102) = 9.37, p < .01$ ; and square root of PAR mod<sup>+</sup>,  $F(1,$

102) = 13.65,  $p < .01$ . On average, across both the 3- and 12-month assessments, men had significantly higher levels on all outcomes than women (MET capacity,  $M = 5.91, SE = \pm 0.12$ , vs.  $M = 5.44, SE = \pm 0.13$ ; self-efficacy beliefs,  $M = 68.17, SE = \pm 1.87$ , vs.  $M = 59.48, SE = \pm 2.04$ ; and the square root of PAR mod<sup>+</sup>,  $M = 2.21, SE = \pm 0.10$ , vs.  $M = 1.67, SE = \pm 0.10$ ). Converting to the original scale, we found that these correspond to adjusted means of 4.90 hr and 2.80 hr of mod<sup>+</sup> activity per week. There were no significant gender by treatment, treatment by time, gender by time, or gender by treatment by time interactions for any of the models tested ( $p > .05$ ).

### Self-Regulation Process

A barriers efficacy measure was administered to GMCB participants to examine whether improvements in their confidence to manage barriers to an independent lifestyle of activity were related to changes in the outcome measures. Residualized change scores (controlling for baseline) were created for both the barriers scale and each outcome measure. In the case of the barriers scale, change involved the 90-day scores minus the 45-day scores (initial assessment), whereas for each outcome measure the change was 12-month values minus prerandomization assessments (baseline). Correlational analyses revealed that positive changes on the barriers scale during the last 45 days of intensive treatment were related to positive 12-month change in both METs ( $r = .52, p < .01$ ) and scores for PAR mod<sup>+</sup> ( $r = .36, p = .04$ ). Of interest, change in self-regulatory barriers efficacy was unrelated to change in task-specific self-efficacy for mobility.

Table 4  
*Raw and Adjusted Posttest Means and Adjusted Change Scores for Metabolic Equivalents by Treatment Group*

Gender and measure	Assessment period						
	Baseline value	3 months			12 months		
		Raw	Adjusted	Change	Raw	Adjusted	Change
GMCB							
Men							
<i>M</i>	5.85	6.75	6.16	0.83	6.61	6.03	0.70
<i>SD</i>	1.30	1.45	0.16	0.16	1.38	0.16	0.16
Women							
<i>M</i>	4.60	5.01	5.69	0.36	4.80	5.55	0.22
<i>SD</i>	0.98	1.27	0.16	0.16	1.14	0.16	0.16
CRP							
Men							
<i>M</i>	5.63	5.92	5.80	0.47	5.76	5.66	0.33
<i>SD</i>	1.31	1.45	0.15	0.15	1.26	0.15	0.15
Women							
<i>M</i>	4.99	5.20	5.32	-0.01	5.34	5.18	-0.15
<i>SD</i>	1.09	1.16	0.16	0.16	1.30	0.16	0.16

*Note.* Adjusted means and adjusted change scores were adjusted for baseline of the dependent measure used in that analysis and baseline age. Raw means include only participants who have baseline data and data from at least one follow-up. The difference in raw means and the adjusted changes can differ because of marginal interactions between adjusting variables and participants with missing data at one follow-up. GMCB = group-mediated cognitive-behavioral intervention; CRP = cardiac rehabilitation program involving traditional exercise training.

## Discussion

To our knowledge, this is the first investigation to directly evaluate the effects of a group-mediated lifestyle behavior change intervention for promoting long-term improvement in physical function among older adults who were either at risk for or had documented CVD. In contrast to a usual care control condition, the comparison group involved 3 months of state-of-the-art cardiac rehabilitation therapy. The results of this study offer clear evidence that teaching older adults how to integrate physical activity into their lives via a GMCB intervention leads to improved outcomes when contrasted with standard rehabilitative therapy (CRP).

### *Treatment Effects*

The significant average treatment effects observed at 3 and 12 months in favor of the GMCB intervention demonstrated that, after we controlled for the influence of age and baseline differences, this lifestyle behavior change approach to rehabilitation was superior to the standard-care CRP in affecting all three major outcomes: MET capacity, recalled physical activity (PAR mod<sup>+</sup>), and self-efficacy for mobility. Of interest, observed changes in the three outcome measures were largely independent of one another.

*Change in level of physical activity and fitness.* The GMCB intervention in these older adults resulted in better long-term adherence to a physically active lifestyle and greater improvement in fitness than the standard CRP treatment. These findings are similar to those recently observed in a previous intervention of this

type with asymptomatic, sedentary older adults (Brawley et al., 2000).

Another group of researchers who have contrasted standard exercise programming with a lifestyle intervention has been Dunn and her colleagues (Dunn et al., 1999). In a 24-month study of middle-aged adults (ages 30 to 60 years), these investigators found that both treatments were equally effective, but not different from one another, in increasing physical activity and improving functional capacity. The lifestyle intervention in the Dunn et al. study was based on the conceptual model of stages of change and involved teaching various cognitive-behavioral strategies within this framework during group meetings. However, in their study, group processes were not formalized in any systematic manner nor were the groups conducted in conjunction with exercise training.

A second study that is particularly relevant to the current investigation involved middle-aged and older adults in cardiac rehabilitation (Carlson et al., 2001). Specifically, these investigators compared the effects of electrocardiograph-monitored facility-based exercise therapy with a modified exercise program of independent home-based exercise. The modified program differed from the facility-based approach in three ways: (a) a systematic reduction in the total number of facility-based sessions, (b) ongoing weekly education-support, and (c) behaviorally based education that emphasized how to overcome barriers to independent exercise. Whereas the modified program did lead to higher rates of independent exercise, the two groups had identical changes in functional capacity. Limitations of this study included the fact that

Table 5  
*Raw and Adjusted Posttest Means and Adjusted Change Scores for Self-Efficacy by Treatment Group*

Gender and measure	Assessment period						
	Baseline value	3 months			12 months		
		Raw	Adjusted	Change	Raw	Adjusted	Change
GMCB							
Men							
<i>M</i>	61.06	74.39	71.04	15.03	75.56	71.04	15.03
<i>SD</i>	22.94	17.67	2.54	2.53	15.59	2.59	2.59
Women							
<i>M</i>	45.56	52.29	62.36	6.35	61.04	62.35	6.34
<i>SD</i>	22.93	22.22	2.56	2.56	18.21	2.67	2.67
CRP							
Men							
<i>M</i>	65.94	65.94	65.29	9.28	64.44	65.29	9.28
<i>SD</i>	19.14	19.45	2.45	2.45	20.31	2.51	2.51
Women							
<i>M</i>	47.79	61.31	56.61	0.60	53.52	56.60	0.59
<i>SD</i>	28.68	17.83	2.63	2.63	15.95	2.73	2.73

*Note.* Adjusted means and adjusted change scores were adjusted for baseline of the dependent measure used in that analysis and baseline age. Raw means include only participants who have baseline data and data from at least one follow-up. The difference in raw means and the adjusted changes can differ because of marginal interactions between adjusting variables and participants with missing data at one follow-up. GMCB = group-mediated cognitive-behavioral intervention; CRP = cardiac rehabilitation program involving traditional exercise training.

it was only 6 months in duration and analyses were not based on the principle of intent to treat.

With respect to the present trial, the consistent and favorable effects observed for the GMCB treatment may be due, in part, to differences in the age of our cohort as compared with those of the two aforementioned investigations. However, it is important to note that the group-mediated cognitive-behavioral intervention in our trial involved systematically planned group processes that were conducted immediately following exercise training. This procedure enabled us to reinforce exercise class behaviors immediately and to engage participants in targeted counseling within the context of the group with which they personally identified. Moreover, various cognitive and behavioral strategies were experienced under the guidance of the interventionists during center-based exercise. The benefits of this systematically applied group approach appear to be substantial. Future research should contrast counseling about physical activity that occurs independent of exercise training with parallel individual and group approaches that are integrated with exercise training (Rejeski & Focht, 2002).

*Self-efficacy.* Self-efficacy beliefs have been related to the initiation of, adoption of, and adherence to exercise in older adults (McAuley & Katula, 1998). In addition, self-efficacy beliefs have been studied as determinants and mediators of clinical and functional outcomes and, to a lesser extent, as meaningful cardiac rehabilitation outcomes themselves (e.g., Berkhuisen et al., 1999; Kaplan, Atkins, & Reinsch, 1984; Toshima, Kaplan, & Ries, 1990). Ewart (1989) reported favorable changes in the self-efficacy beliefs of acute myocardial infarction patients following various short-term interventions (i.e., cardiac counseling following

a treadmill test; exercise behavior for activities most similar to treadmill exercise and in resistance training in Phase 2 cardiac rehabilitation). Finally, Berkhuisen et al. (1999) recently examined change in self-efficacy as a primary outcome following cardiac rehabilitation. Their results revealed improvement in self-efficacy both for functioning and for controlling symptoms after just 6 weeks of either a high- or low-frequency CRP.

In the present trial, we also examined self-efficacy as a major outcome following long-term self-regulation. A goal of the GMCB treatment was to encourage more independent physical activity by adopting the behavior change skills that encourage success at such self-regulation. The larger increases in self-efficacy beliefs for mobility found in the GMCB treatment as compared with the standard CRP treatment clearly underscore important changes in perception that occurred as a result of the counseling intervention. Parallel changes in both self-reported weekly physical activity and MET capacity indicate that participants achieved successful mastery of engaging in more activity, a primary determinant of changes in efficacy beliefs (Bandura, 1997).

#### *Differential Gender Effects*

Although reviews of the CRP literature (e.g., Dusseldorp et al., 1999) have concluded that there are gender differences in outcomes following CRP treatment, the reasons for the differential effects have frequently been attributed to (a) selective referral and entry to CRP treatment, (b) poor sampling procedure, and (c) differential trial responsiveness as reflected by higher study attrition and/or lower attendance to treatment (cf. Ades, Waldmann,

Polk, & Coflesky, 1992; Brezinka & Kittel, 1995; McEntee & Badenhop, 2000). Ultimately, such problems result in fewer women than men who contribute to overall effects.

In contrast, the gender effects observed in the current trial were not confounded by study limitations previously reported in the literature. Care was taken to randomly assign equal numbers of both genders to treatment, and there was no differential attrition by either treatment assignment or gender. Men in both conditions experienced significantly greater change on all outcomes than women.

What is unknown is the cause of these gender differences. The groups were of mixed gender, randomly assigned to treatment, ruling out a dominant gender effect due to within-group membership, and there were no differences in age, body mass index, disease, risk factors for disease, other comorbidities (e.g., arthritis), or selective attrition. Also, there were no gender differences due to the potential barriers to lifestyle change such as income, education (i.e., control via random assignment), skills, or knowledge (i.e., provision of general elements common to both treatments and genders; cf. Mosca, McGillen, & Rubenfire, 1998). Questions to address in the future concern whether men are driven by different motives than are women. Do older men (i.e., ages 65 and above) have a greater investment in their physical function than do older women of a similar age? Are these men more motivationally ready to begin an independent lifestyle of physical activity than their female counterparts (cf. Rejeski, Brawley, McAuley, & Rapp, 2000)? For example, if women begin CRP or GMCB treatments with lower self-efficacy beliefs and poorer function, the intervention may require different goals as well as a different timeline for weaning women from group participation to independent activity (cf. Rejeski et al., 2000).

### *Social Problem Solving: A Key to Success?*

Although the GMBC treatment involved a number of different cognitive and behavioral strategies, a central aspect of the intervention was group-mediated problem solving and behavioral homework. These activities were designed to increase participants' confidence in their abilities to create and maintain an independent lifestyle of physical activity and to adapt to any challenges that they encountered. As the analyses of the barriers efficacy scale for the GMCB participants demonstrate, positive change in self-regulatory efficacy was correlated with long-term changes in both self-reported physical activity and MET capacity.

### *Summary and Implications for Practice*

The results of this investigation demonstrated that a GMCB approach to the promotion of physical activity among older adults who either had evidence of or were at risk for CVD produced more favorable effects than standard CRP exercise training. Major strengths of the present study are that it was a randomized controlled trial that used intention-to-treat analyses of older adults' responses to a physical activity intervention. The intervention was theoretically driven, and the sampling framework allowed for the comparison of gender differences (Dusseldorf et al., 1999; King, Rejeski, & Buchner, 1998). The maintenance of independent physical activity, as facilitated by the GMCB intervention, addresses King's (1994) challenge to use the strengths of the group to deliver

physical activity without creating dependency on the group. Last, to the best of our knowledge, this is the only study with older adults in which self-regulatory efficacy in the target intervention has been prospectively related to functional outcomes.

The results of this study offer an enhancement to current exercise programming for cardiac rehabilitation and other traditional center-based exercise approaches delivered to older adults (cf. Brawley et al., 2000). The limitations of these traditional models are twofold. First, they provide neither the motivation nor the instruction and practice in developing self-regulatory skills for behavior change that are important if older adults are to be expected to adopt and maintain an independent regimen of lifestyle physical activity. In this regard, brief closed group counseling sessions offer the opportunity to normalize relapse, to problem solve with respect to barriers, and to foster the motive or desire to make physical activity an integral part of daily life. Second, the implicit assumption of traditional exercise programming is that desired outcomes such as enhanced self-efficacy beliefs are a direct result of changes in physiological function. However, this is a conclusion that inadvertently ignores the participant's experience. The implicit assumption in the traditional approach suggests that participants see the link between training and valued activities of daily living without training and practice that actively couple both behaviors. By contrast, the GMCB intervention had participants consciously plan for and practice this link. Thus, our results suggest that there is benefit to integrating specific therapeutic processes (e.g., targeted homework assignments) with exercise training when the goal is to have participants adopt lifestyle activity change as part of their everyday behavior and generalize the effects of this training to their performance of functional tasks in daily life.

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