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The Effects of a Tailored Cardiac Rehabilitation Program on Depressive Symptoms in Women: A Randomized Clinical Trial

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Abstract

Background—Depression is known to co-occur with coronary heart disease (CHD). Depression may also inhibit the effectiveness of cardiac rehabilitation (CR) programs by decreasing adherence. Higher prevalence of depression in women may place them at increased risk for non-adherence.

Objective—To assess the impact of a modified, stage-of-change-matched, gender-tailored CR program for reducing depressive symptoms among women with CHD.

Methods—A 2-group randomized clinical trial compared depressive symptoms of women in a traditional 12-week CR program to those completing a tailored program that included motivational interviewing guided by the Transtheoretical Model of behavior change. Women in the experimental group also participated in a gender-tailored exercise protocol that excluded men. The Center for Epidemiological Studies Depression (CES-D) Scale was administered to 225 women at baseline, post-intervention, and at 6-month follow-up. Analysis of Variance was used to compare changes in depression scores over time.

Results—Baseline CES-D scores were 17.3 and 16.5 for the tailored and traditional groups, respectively. Post-intervention mean scores were 11.0 and 14.3; Six-month follow-up scores were 13.0 and 15.2, respectively. A significant group by time interaction was found for CES-D scores

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($F(2, 446) = 4.42, p = .013$). Follow-up tests revealed that the CES-D scores for the traditional group did not differ over time ($F(2, 446) = 2.00, p = .137$). By contrast, the tailored group showed significantly decreased CES-D scores from baseline to post-test ($F(1, 223) = 50.34, p < .001$); despite the slight rise from post-test to 6-month followup, CES-D scores remained lower than baseline ($F(1, 223) = 19.25, p < .001$).

Conclusion—This study demonstrated that a modified, gender-tailored CR program reduced depressive symptoms in women when compared to a traditional program. To the extent that depression hinders CR adherence, such tailored programs have potential to improve outcomes for women by maximizing adherence. Future studies should explore the mechanism by which such programs produce benefits.

Keywords

depression; cardiac rehabilitation; motivational interviewing; women; transtheoretical model

Coronary heart disease (CHD) accounts for more deaths in women than any other cause in the United States (Lloyd-Jones et al., 2009) and globally (Mathers and Loncar, 2006). Despite an inconclusive, and conceivably, bi-directional causal association, mounting scientific evidence links depression to CHD (Barth et al., 2004; Nicholson et al., 2006; Thombs et al., 2006; van Melle et al., 2004). Depressive symptoms are pervasive in women with CHD (Frasure-Smith et al., 2009; Pilote et al., 2007; Todaro et al., 2005), particularly in younger women (Beckie et al., 2008; Mallik et al., 2005; Mallik et al., 2006; Swardfager et al., 2008; Whooley et al., 2008). Depression reportedly confers up to a 4-fold increased risk of CHD mortality (Frasure-Smith et al., 1999; Frasure-Smith et al., 1993) and more adverse cardiovascular (CV) outcomes in women than men (Mendes de Leon et al., 1998; Williams et al., 2002).

Patients with depressive symptoms have a 5-fold increased risk and women a 2-fold increased risk of noncompletion of cardiac rehabilitation (CR) (Wenger, 2008). Internationally, evidence supports the association between depression and poor behavioral compliance in CR patients, conceivably because depression thwarts motivation for behavior change (Caulin-Glaser et al., 2007; Glazer et al., 2002; Komorovsky et al., 2008). Nonadherence to secondary prevention including medication use and CR completion (Gehi et al., 2005; Kronish et al., 2006; Ziegelstein et al., 2000) exacerbates unfavorable CV outcomes associated with depressive symptoms (Carney et al., 2008; Frasure-Smith and Lesperance, 2006; Parashar et al., 2006; Wassertheil-Smoller et al., 2004). To characterize the dose-response relationship between CR session attendance and long-term outcomes, researchers found that among 30,000 elderly Americans with CHD, those who attended 36 sessions, compared to those who attended only 1 session, had a 47% lower risk of death and a 31% lower risk of acute myocardial infarction (AMI) (Hammill et al., 2010).

The mechanisms connecting depression to increased CHD risk are multi-faceted. The hypothesized biological mechanisms of the co-existence of depression and CHD include lower heart rate variability (Carney et al., 2005), heightened sympathetic nervous system activity (Watkins et al., 2006), exaggerated platelet reactivity (Bruce and Musselman, 2005), impaired endothelial function (Sherwood et al., 2005), cardiac disease severity (Lett et al.,

2008), and elevated inflammatory biomarkers (Lesperance et al., 2004; Vaccarino et al., 2007). European and American clinical practice guidelines, including those specific to women, recommend screening for and treating depression in CHD patients (Mosca et al., 2007; Piepoli et al., 2010).

Randomized clinical trials of European and North American CHD patients, none specifically designed for women, have found only modest improvements in clinical outcomes with pharmacological and psychotherapeutic interventions for treating depression (Berkman et al., 2003; Lesperance et al., 2007; van Melle et al., 2007). The Enhancing Recovery in Coronary Heart Disease (ENRICHD) trial found insignificant morbidity or mortality benefit among 2481 American AMI patients treated with cognitive behavioral therapy and antidepressants. While the intervention led to significant improvements in depression compared with usual care, the between-group differences were modest (Berkman et al., 2003).

Despite international endorsement of CR as a model for secondary prevention (Balady et al., 2007; Piepoli et al., 2010) and strong evidence of improved morbidity and mortality with CR participation (Smith et al., 2006; Suaya et al., 2009; Wenger, 2008), worldwide, only 15% to 20% of eligible women utilize these programs (Allen et al., 2004; Bethell et al., 2009; Scott et al., 2002; Suaya et al., 2007). Women particularly underrepresented in CR include the elderly, the obese, nonwhites, and those with greater co-morbidity, lower exercise capacity, less social support, competing family obligations, and incomplete medical insurance coverage (Casey et al., 2008; Sanderson and Bittner, 2005; Suaya et al., 2007). The challenges of recruiting women to the current study are presented elsewhere (Beckie et al., 2009).

Gender disparities persist with women exhibiting greater depression and engaging in less exercise compared to their male counterparts with CHD (Hunt-Shanks et al., 2009). In spite of methodological limitations of observational designs that include few women, aerobic exercise in CR seemingly has anti-depressive effects for engaged participants (Lavie and Milani, 2006; Lavie et al., 1999; Milani and Lavie, 2007; Milani and Lavie, 1998). Though some lament that gender-tailored risk reduction approaches for women are largely absent (Lloyd, 2009), Australian researchers have championed the concept of gender-specific tailoring in CR programs (Daly et al., 2002). Davidson and colleagues described a pilot study of an 8-week CR program tailored to the psychological and social needs of 48 women with CHD (Davidson et al., 2008). They failed to find significant changes in psychosocial variables in this feasibility study but qualitative data revealed unique problems women face following an acute cardiac event.

The current study was undertaken to address the recognized need to redesign CR programs to meet the specific psychosocial needs of women (Scott et al., 2002) as well as the paucity of randomized trials of CR programs tailored for women. Examining the therapeutic benefits of innovative CR interventions for women is warranted in light of their high prevalence of depression, their poor CR completion rates, and their higher mortality compared to men. The present study sought to extend previous research by examining the effects of a modified CR

for women (henceforth referred to as “tailored”) compared to traditional CR for reducing depressive symptoms.

Methods

This two-group, single-blind, randomized clinical trial compared physiological (e.g., weight, lipid profile, cardiorespiratory fitness) and psychosocial outcomes (e.g., anxiety, perceptions of health, social support) among women completing a traditional 12-week CR program to women completing a tailored program guided by the transtheoretical model (TTM) of behavior change delivered using motivational interviewing therapeutic methods. The maintenance of the improved outcomes 6 months following completion of the intervention was also examined. Details of the recruitment procedures and the interventions are described elsewhere (Beckie, 2006; Beckie et al., 2009) and summarized below. The Institutional Review Boards of the University of South Florida and the participating hospital approved the study protocol.

Specific Aims

The specific aim, addressed here, was to test the effects of a tailored CR intervention compared to traditional CR for reducing depressive symptoms in women with CHD. It was hypothesized that women completing the tailored CR program would demonstrate greater improvements in depressive symptoms compared with women completing traditional CR. We also hypothesized that women completing the tailored intervention would demonstrate greater maintenance of improved depressive symptoms by the 6-month follow-up compared with women completing traditional CR.

Participants

Participants were recruited from those referred to an outpatient CR program in Florida between January 2004 and March 2008. The inclusion criteria were women > 21 years (1) diagnosed with an acute myocardial infarction (AMI), angina, or having undergone coronary artery bypass graft (CABG) surgery or percutaneous coronary intervention (PCI) within the last year; and (2) able to read, write, and speak English. The exclusion criteria were (1) health insurance coverage for less than 36 monitored exercise sessions; (2) cognitive impairment; or (3) inability to ambulate.

Participant Recruitment, Blinded Assessment, and Randomization

Participants were recruited primarily through automatic physician standing orders in one community hospital. Additional recruitment strategies included distribution of recruitment brochures and posters, recruitment letters to relevant physician practices, community outreach initiatives, and media advertisements. A physician referral to CR was required to initiate the screening protocol. The recruiter screened 1681 women for study eligibility and conducted individualized orientations for eligible women. After obtaining written informed consent and before randomization, a trained research assistant conducted the comprehensive evaluation and collected all baseline psychosocial and physiological data in a private room in the CR facility. The statistician provided computer-generated treatment assignment sheets that were placed in sequentially numbered, opaque envelopes and sealed. Upon completion

of baseline data collection, the project director opened the sealed envelope to reveal the group assignment. A biased coin randomization procedure (Efron, 1971) was used to ensure balance between the interventions across time to accommodate a maximum of 8 electrocardiogram monitoring units per group. Outcome data were collected 1 week (week 13) and 6 months (week 37) after completion of CR by the same research assistant blinded to group assignment.

Interventions

Traditional Intervention—The traditional CR program, nationally certified by the American Association of Cardiovascular and Pulmonary Rehabilitation, was supervised by female nurses and exercise physiologists using a case management model. The monitored exercise protocol involved aerobic exercise and resistance training 3 days per week for 12 weeks. Exercise consisted of 5 minutes of warm-up and 35–45 minutes of aerobic exercise (treadmill walking, cycling, or rowing) with exercise heart rates maintained at 60%–85% of maximal heart rate calculated from their baseline exercise tolerance test (ETT). Resistance training included wall-pulleys and hand weights followed by 5 minutes of cool-down exercises. Exercise training protocols were progressed in duration and intensity weekly according to the participant's response to exercise, and rate of perceived exertion. Traditional group participants were free to choose any scheduled mixed-gender exercise session between 8 AM and 4 PM. Education classes focusing on CHD risk factor modifications were provided by the CR personnel at 5 different times on 8 consecutive Mondays in the CR facility.

Tailored Intervention—The exercise protocol for this intervention was identical to that of traditional CR except that participants exercised exclusively with women in their cohort and the intervention delivery was restricted to one time slot when the CR facility was closed to non-participants to minimize crossover contamination. The multiple behavior change intervention, guided by the tenants of TTM (Prochaska et al., 1994) and motivational interviewing (Rollnick et al., 2008) was implemented by female research nurses and exercise physiologists. At baseline, 13 and 37 weeks, women were assessed for their stage of motivational readiness to change healthy eating, physical activity, and stress management. The TTM computer-based expert system assessment (Prochaska et al., 2005), developed by Pro-Change Behavior Systems™ generated an individualized report tailored on TTM constructs. Baseline reports provided normative feedback on current stage of change, decision balance, self-efficacy, and processes of change. Participants received follow-up reports allowing them to see how they compared to the population and how much progress they had made since the previous assessment regarding TTM constructs being applied appropriately for each behavior; recommendations for stage-specific strategies to assist them with motivational stage progression were provided. Participant's assigned case managers reinforced the use of these strategies. Participants also received a multiple-behavior stage-based manual developed collaboratively between the investigators and Pro-Change Behavior Systems™.

A clinical psychologist or a clinical nurse specialist, formally trained in motivational interviewing, conducted 60-minute individualized psychotherapeutic sessions at weeks 1, 6,

and 12. The efficacy of motivational interviewing is grounded in the spirit of collaboration rather than authoritarian, evoking rather than instilling intrinsic motivation, and honoring autonomy to choose (Miller and Rollnick, 2002). Change talk, the individual's verbalized arguments for change, is deemed integral to inducing commitment to change. There is robust evidence for the predictive ability of change talk for improving outcomes (Miller and Rollnick, 2009; Miller and Rose, 2009). The clinical psychologist used the therapeutic methods of motivational interviewing to elicit and reinforce participant's statements of reasons and need for change, with the goal of evoking an increasingly strong commitment to change behavior. The sessions were audiotaped and 10% were randomly selected for assessment of fidelity. Two trained coders independently assessed for treatment fidelity according to the Motivational Interviewing Treatment Integrity coding instrument (Moyers et al., 2005). The clinical nurse specialist and psychologist facilitated psychoeducational sessions focused on gender-based practice guidelines, behavior-change strategies, relaxation exercises, and social support. These sessions were conducted on 10 consecutive Wednesdays in a private room prior to the exercise session.

Psychological Outcome—The 20-item Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977) measured depressive symptoms. Participants reported the frequency of occurrence of depressive symptoms during the past week ranging from 0 (< a day) to 3 (most of the time [5–7 days]). Scores range from 0 to 60 with higher scores reflecting greater depressive symptoms. Used extensively in CHD populations (Beckie et al., 2008; Dunn et al., 2006; Scholz et al., 2006; Swardfager et al., 2008), a score of 16 is typically the cut-off score for an elevated level of depressive symptoms. Evidence of concurrent validity, construct validity and reliability of the CES-D has also been provided for community samples (Radloff, 1977). Cronbach's alpha in the current study at all three time points was over .90.

Physiological Measures—Blood pressure was measured with one calibrated Accutor plus automated oscillometric monitor (Datascop, Mahwah, NJ) according to established guidelines (Pickering et al., 2005). Body mass index (BMI) was calculated as weight (kg)/height (m²). Body fat composition was determined using skinfold measurements taken at three sites (suprailium, triceps, and thigh). Percentage of body fat was calculated from standardized tables (Jackson et al., 1980). Following established guidelines and using the modified Bruce protocol for the symptom-limited ETT (Gibbons et al., 2002), exercise capacity was expressed in units of metabolic equivalents. Medication consumption and/or changes were reviewed with the participants and documented at each exercise session.

Attendance Measures—Exercise attendance, recorded at each session for hospital billing purposes, was calculated as the number of sessions attended out of a possible 36 prescribed sessions. Education attendance was expressed as a percentage of the number of sessions completed because the tailored intervention comprised 10 and the traditional intervention consisted of 8 education sessions.

Data Analysis

Data were analyzed using SPSS statistical software (version 17, SPSS, Chicago, Illinois). An a priori power analysis was conducted to estimate the sample size needed to test the group by time interaction hypothesis central to this study. Assuming an α of .05, $f = .10$, and an average correlation between time points of $r = .65$, it was estimated that 200 participants per group ($N = 400$) would provide power of .80 for testing the interaction. Although recruitment continued over the period of funding, a change in the number of patients being referred to CR at our recruitment sites, limited our enrollment efforts. The final sample size obtained was 252. Descriptive baseline characteristics of the randomized groups were tabulated as means and standard deviations or as percentages. Analysis of variance was used to assess changes in depression scores among the 225 women with complete data at all 3 time-points. All tests were 2-tailed and evaluated for statistical significance using an α of .05 as the criterion.

Results

Participants

A total of 252 women were randomly allocated to either the traditional CR or the tailored program with 225 women having complete CES-D scores at all data-collection time points. Figure 1 provides the flow of participants through each stage of the study. As shown in Table 1, baseline characteristics were not different by group. With a mean age of 63 years (range = 31–87 years) most participants were white (82%), married (53%), retired (47%) with high school education (92%). The inclusion criteria for CR included women who had undergone a PCI (50%) or CABG surgery (33.7%), were being treated medically for stable angina (11%), or had sustained an AMI (5%). Baseline consumption of evidence-based CV medications did not differ between those in traditional CR compared to those in the tailored group. Participants were not different on measures of obesity or blood pressure (see Table 2). At baseline, 17% of participants in traditional CR were taking antidepressants, compared to 23% in the tailored group. Consumption of antidepressant medications remained constant over the study period.

Intervention Attendance

Traditional group participants attended a mean of 30 ± 10 of the 36 prescribed exercise sessions compared to 34 ± 7.6 for the tailored group participants ($F(1, 223) = 7.322, p = .007$). The mean percent attendance of the education sessions was also greater in the tailored group (89 ± 21) than in the traditional group (62 ± 30) ($F(1, 223) = 63.843, p < .001$). Eleven percent ($n=12$) of the traditional group participants compared to 3% ($n=4$) of the tailored group failed to complete the 13-week assessment. Participants not completing the 6-month follow-up assessment included 2.8% ($n=4$) of the tailored compared to 6.3% ($n=7$) of traditional CR participants. Thus, 225 participants (92, traditional group; 133, tailored group) had complete data at all three time-points. The baseline mean CES-D score for participants not returning for follow-up was significantly higher than for those completing the study (25.2 ± 12.4 vs 16.9 ± 11.1 ; ($F(1, 250) = 12.981, p < .001$)).

Depression Scores by Intervention Group

Depression data are summarized in Figure 2. At baseline, mean CES-D scores were 17.3 ± 11.7 and 16.5 ± 10.3 for the tailored and traditional CR groups, respectively. Post-CR mean scores were 11.0 ± 9.4 for the tailored group compared to 14.3 ± 10.3 in the traditional CR group. At the 6-month follow-up these scores were 13.0 ± 9.9 for the tailored group and 15.2 ± 10.8 for the traditional CR group. A significant group by time interaction showed that changes in depression were different for the two groups ($F(2, 446) = 4.42, p = .013, \eta^2 = .019$). Follow-up tests revealed that the mean scores for the traditional group did not differ over time ($F(2, 446) = 2.00, p = .137, \eta^2 = .009$). By contrast, the tailored group showed a significant decrease in CES-D scores from baseline to post-CR ($F(1, 223) = 50.34, p < .001, \eta^2 = .184$) and despite the slight rise from post-CR to the 6-month follow-up, CES-D scores remained significantly lower than baseline ($F(1, 223) = 19.25, p < .001, \eta^2 = .079$). To investigate the potential confounding influence of attendance dose on depressive symptom scores, a multiple regression model was constructed for predicting post-intervention depression scores from baseline depressive symptoms, group assignment, education attendance and exercise attendance. Controlling for these factors, the influence of group assignment on depressive symptoms remained significant. Thus, the significantly lower post-intervention depressive symptom scores in the tailored group compared to the traditional group were not due to the better attendance observed in the tailored group.

Discussion

The primary finding reported here is a greater reduction in depressive symptoms among women who completed a tailored CR program compared to those completing a traditional CR program. Improvements were sustained at the 6-month follow-up in the tailored group while those in traditional CR were essentially unchanged from baseline. This effect remained while controlling for education and exercise attendance; thus, mechanisms other than, or in addition to exercise and education, likely account for the observed improvement in depressive symptoms in the tailored group. Hence, a qualitative distinction between the tailored intervention and traditional CR is bolstered. To our knowledge, this is the first randomized trial to report the effectiveness of a theoretically-driven CR intervention tailored for women on improving depressive symptoms.

Observational studies of CR exercise training, with or without adjunct psychosocial interventions, have reported reductions in depressive symptoms (Lavie et al., 1999; Lavie et al., 1999; Milani et al., 1996). Limitations of observational studies, including absence of placebo controls and unmasked assessors, potentially overestimate the effectiveness of exercise for improving depressive symptoms. It is equally plausible that individuals with few depressive symptoms are more apt to engage in physical activity and participate in secondary preventions programs. The putative bidirectional, or mutually reinforcing, relationship between depression and exercise is supported by evidence that exercise accounts for nearly half the association between depression and CV events (Whooley et al., 2008).

The two CR groups in the current study differed along two dimensions. First, the intervention tailored for women comprised an amalgamation of behavior change strategies

bundled in one program. Unique to this program was the stage-of-change assessment with individualized stage-appropriate feedback and individualized sessions using motivational interviewing, a therapeutic method for enhancing motivation for change, by exploring and resolving participant's ambivalence. Second, the social dynamic of tailored group was altered by the exclusion of men from all sessions. Absent additional research isolating the effects of each facet, we can but speculate about the most beneficial ingredients of the intervention for improving depressive symptoms.

From a transtheoretical viewpoint, mismatch in stages of behavior change with the health professional approaching from an action-oriented perspective and the participant merely contemplating change, is destined to evoke resistance. Rather than seeking to instill knowledge or behaviors in a one-size-fits-all fashion, the transtheoretical approach recognizes that not all participants enrolled in CR arrive with equivalent motivational readiness to change. Ambivalence to change even while seeking (or being nudged by loved ones) secondary prevention treatment is common. For individuals less ready to change, the TTM offers stage-appropriate strategies such as importance and confidence ratings and decision balance for forward stage progression.

Motivational interviewing is most appropriate for individuals most ambivalent about or resistant to behavior change. Approaching participants with empathy regarding their reasons for maintaining the status quo rather than pushing ahead are potentially more useful for forward stage progression leading to better outcomes. Fostering motivation for change in a supportive environment in consort with TTM strategies are reasonable explanations for the observed reduction in depressive symptoms for the intervention recipients. Motivationally-tailored strategies and the therapeutic alliance inherent in motivational interviewing conceivably act as mediators between, or work synergistically with, other treatments (e.g., exercise, education) to reduce depressive symptoms.

The progressive nature of CHD requires persistent management of behavioral risk factors. While some studies report that the impact of stage-based interventions begin to fade by the six-month follow-up, the sustained reduction of depressive symptoms we observed in the tailored group at follow-up is plausibly due to greater confidence and self-efficacy generated as a consequence of achieving intrinsic commitment for change. With participants rather than the health professionals voicing arguments for change and assuming greater responsibility for moving in the direction of change, the loss of professional contact in the follow-up period is conceivably less detrimental to behavioral and psychological gains achieved during active intervention. Further study is needed to dismantle and examine the potential mediators of how motivational interviewing works and with whom. Perhaps individuals entering the change process at a very early stage (precontemplation or contemplation) or those moving through the stages at a slower pace might benefit from extended but fading motivational interviewing booster sessions.

Finally, the social support exchanged between women receiving exercise training and psychoeducational sessions as a cohesive cohort conceivably amplified the motivational intervention through shared change talk, support for behavior change, and psychosocial need fulfillment. The genderexclusive social dynamic may have fostered improved depressive

symptoms nurturing greater intimacy and companionship in contrast to women in traditional CR who were not necessarily with a familiar peer group from week to week.

The generalizability of our findings should be applied with caution as the convenience sample of women were predominantly Caucasian and obtained from a single south eastern American city. Although enrollment was limited to women with insurance coverage for CR, there is no apparent reason that the findings would not be applicable to similar women in other countries with socialized health care systems. Furthermore, in the American health care system, patients have up to one year after an acute cardiac event to enroll in CR with insurance coverage. While this may have increased the heterogeneity of our sample, all of our participants enrolled in CR within 3 months after their cardiac event. A second limitation is the reliance on self-reports of depressive symptoms. These data may, thus, reflect bias in reporting certain beliefs or feelings. Third, depressive symptoms are influenced by a combination of genetic risk factors interacting with environmental triggers. While we did not examine genetic risk factors, these ought to have been equally distributed via randomization. Fourth, it is not possible to determine if treatment effects found would persist beyond the 6-month follow-up period. Finally, the bundling of components in the tailored condition precluded our ability to assess their relative influence on depressive symptoms. Motivational interviewing, TTM tailoring, gender-exclusive exercise, education, and social support may have synergistically or additively led to improved depressive symptoms.

After an acute cardiac event, women have worse health outcomes and more depressive symptoms during the first year of recovery than do men, particularly those with low social support (Leifheit-Limson et al., 2010). Gender-sensitive models of secondary prevention might better serve women at high risk for recurrent cardiac events potentially worsened by depression. Given the well-recognized negative effects of depressive symptoms on the acquisition and maintenance of health behaviors, and the gender disparities in CR completion rates, tailored interventions for women that foster social support and reduce depressive symptoms hold promise for improving attendance and completion rates of women referred to CR. The unique attributes of the intervention tailored for women reported here are convincing explanatory candidates for the observed improvements in depressive symptoms. These findings need to be replicated in other cultures and health care systems.

Priorities for future research include isolating the effects of individual components of the typically bundled CR interventions for specific sub-groups. Understanding the mechanisms underlying stage-of-change matching, motivational interviewing, as well as gender-specific social support, education, and exercise may foster the design of more effective personalized interventions. Elucidating the mechanisms inherent in tailored interventions for women has potential to amplify the motivational momentum achieved during active interventions designed to sustain health behaviors.

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What is already known about the topic?

- Women are at increased risk for depression after an acute coronary event;
- Individuals with depressive symptoms have a 5-fold increased risk of noncompletion of cardiac rehabilitation;
- Women have a 2-fold increased risk of noncompletion of cardiac rehabilitation;
- Women, who are more likely to be depressed than men after a coronary event, require particular attention for depressive symptoms and risk of noncompletion of secondary prevention regimens.

What this paper adds

- A randomized clinical trial of a modified cardiac rehabilitation intervention for women, an underserved population, addressing depressive symptoms and program completion;
- The tailored intervention was guided by the tenets of the Transtheoretical Model (TTM) of behavior change and delivered with motivational interviewing therapeutic methods.
- The unique attributes of the intervention tailored for women are convincing candidates for the observed improvements in depressive symptoms and such cardiac rehabilitation interventions hold promise for improving attendance and completion rates of women referred to cardiac rehabilitation.

Figure 1.
Flow of Study Participants January 2004–March 2008

Figure 2.
 Depressive Symptom Scores by Intervention Group
 Data shown as means (standard error)
 Group by time interaction: $F(2,466) = 4.42, p=.013$

Table 1Baseline Characteristics by Randomization Group^a

Characteristic	Traditional CR n=92	Tailored CR n=133
Age, Mean (SD), y	64±11	63 ±11
Race or ethnicity		
African American	17 (18)	20 (15)
Non-hispanic white	56 (61)	94 (71)
Hispanic	18 (20)	18 (14)
Asian	1 (1)	1 (1)
Education		
High school or less	38 (41)	57 (43)
Some college	40 (43)	44 (33)
Baccalaureate degree	8 (9)	23 (17)
Graduate degree	6 (7)	9 (7)
Marital Status		
Married	50 (54)	73 (55)
Single never married	7 (8)	5 (4)
Divorced/Separated	20 (22)	29 (22)
Widowed	15 (16)	26 (20)
Work Status		
Retired	48 (52)	66 (50)
Full-time/Part-time	28 (30)	35 (26)
Disabled/not working	16 (17)	32 (24)
Diagnostic eligibility for cardiac rehabilitation		
Percutaneous coronary intervention (PCI)	39 (42)	74 (56)
Coronary artery bypass graft surgery (CABG)	37 (40)	39 (29)
Stable angina	12 (13)	13 (10)
Myocardial infarction (MI)	4 (4)	7 (5)

Abbreviations: CR, cardiac rehabilitation

^a Continuous variables are reported as (mean ± standard deviation; categorical variables are presented as number (%)). Chi-square test and t test for discrete and continuous variables, respectively; P> .05 for all.

Table 2Baseline Clinical Characteristics by Randomization Group ^a

Characteristic	Traditional CR n = 92	Tailored CR n = 133
Systolic blood pressure, mm Hg	130 ± 17	125 ± 19
Diastolic blood pressure, mm Hg	73 ± 11	71 ± 10
Resting heart rate, bpm	71 ± 10	71 ± 11
Percent body fat	37 ± 6	37 ± 6
Body mass index, kg/m ²	31 ± 7	31 ± 7
Weight, pounds	179 ± 41	180 ± 43
Waist circumference, cm	100 ± 15	100 ± 16
Pack years smoked	16 ± 22	18 ± 25
Peak exercise capacity, METS	5 ± 2	6 ± 3
Peak Treadmill time, minutes	8 ± 3	8 ± 4
Medications, n (%)		
Beta blockers	77 (84)	108 (81)
Statins	83 (90)	117 (88)
Aspirin	81 (88)	112 (84)
Clopidogrel	53 (58)	89 (67)
Angiotensin-converting enzyme inhibitor	27 (29)	58 (44)
Antidepressant	16 (17)	31 (23)

Abbreviations: CR, cardiac rehabilitation; CES-D, center for epidemiologic depression scale; HDL, high-density lipoprotein; LDL, low-density lipoprotein; METS, metabolic equivalents.

^aContinuous variables are reported as (mean ± standard deviation); categorical variables are number (%).