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Predicting Cardiac Rehabilitation Attendance In A Gender-tailored Randomized Clinical Trial

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Keywords

Attendance; Exercise; Cardiac rehabilitation; Women

Coronary heart disease (CHD) is the leading cause of death in women¹ and those with myocardial infarction (AMI) have higher mortality rates than men.² Cardiac rehabilitation (CR) programs comprising prescriptive exercise, health education, and counseling, yield compelling improvements in CHD morbidity and mortality of participants.^{3–8} Despite recommendations in clinical practice guidelines⁹ and the undisputed benefits,^{10,11} CR is vastly underutilized by women.^{5,6,11–15} This underutilization has not improved in over a decade¹⁶ and women who enroll demonstrate poor attendance.^{17–22}

Patient-oriented, system-level, and environmental factors partially account for poor attendance of eligible candidates for CR.^{18,23} Lack of physician endorsement of CR is the leading system-level predictor of poor attendance^{11,24–27} while female gender is the chief patient-level predictor.^{13,17,20,27–31} Other factors associated with poor attendance include less education,^{28,30,32} advanced age,^{18,20,24,29,33–35} being socioeconomically disadvantaged and minority status,^{14,17} sedentary lifestyle,^{29,33,34} obesity,^{36–38} tobacco consumption,^{36,38,39} anxiety,^{40,41,42} being unmarried,^{38,42} deficient social support⁴⁰ and transportation barriers.^{11,23,25,38} Depression is linked to lowered CR attendance in some studies^{37,39,43–46} but not others.^{41,47} Others posit that women find exercise tiring and painful,¹¹ dislike public or mixed-gender exercise,¹⁵ and perceive unmet emotional needs in CR.⁴⁸

The growing acknowledgement of gender-specific cardiovascular health needs⁴⁹ highlights the need for effective risk reduction interventions for women. Investigators have called for strategies addressing underserved CR populations, such as women, who are least likely to avail themselves of CR services.⁵⁰ Gender-specific programs, tailored to individual readiness to change may be more effective than traditional CR programs in meeting women's unique needs.^{18,48,49,51–53} This study addressed 2 research questions. First, to what extent is attendance in women influenced by a motivationally enhanced, gender-tailored CR program compared to that of women attending traditional CR, and second, what are the useful baseline sociodemographic and clinical predictors of attendance of the exercise and education components of CR?

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METHODS

Attendance data from women participating in a single-blind randomized clinical trial (RCT) were used in this study. The RCT used 2 treatment groups of women both receiving a 12-week CR program, with 1 group receiving a gender-tailored, behavioral enhancement. The study design, recruitment details, and baseline data of a subset of this cohort are described elsewhere.^{23,51,54} The institutional review boards of the university and the participating hospital approved the study. The study recruiter screened all physician-referred patients for study eligibility. Monetary reimbursement for study-related travel and time investments were reviewed. After consent signing and before randomization, the research assistant (RA) conducted the comprehensive evaluation (CE), collected baseline psychosocial and physiological data, and scheduled an exercise tolerance test (ETT) within 1 week. Data collection, taking about 1.5 hours, was performed in the CR facility. The statistician provided treatment assignment sheets that were placed in opaque envelopes, sealed, and delivered to the project director (PD). After completing the ETT, the PD opened the sealed envelope to reveal the group assignment. To ensure balance between the 2 interventions across time to accommodate a maximum of 8 ECG-monitoring units per group, a biased coin randomization procedure⁵⁵ was used.

Participants

Participants were recruited from those referred to an outpatient CR program in Southeastern United States between January 2004 and March 2008. The inclusion criteria were 1) women >21 years 2) diagnosed with a AMI, angina, or having undergone coronary artery bypass graft (CABG) surgery or percutaneous coronary intervention (PCI) within the last year; and 3) able to read, write, and speak English. The exclusion criteria were 1) health insurance coverage for less than 36 ECG-monitored exercise sessions, 2) cognitive impairment, 3) inability to ambulate, or 4) insertion of an automatic internal cardiac defibrillator (AICD) in the last year.²³ We randomly allocated women to either the traditional CR (n=111) or the gender-tailored program (n=141) (Figure 1).

Interventions

Traditional Intervention—The traditional CR program, nationally certified by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), was delivered by female nurses and exercise physiologists (EP) using a case management model. The exercise protocol consisted of aerobic exercise and resistance training 3 days per week for 12 weeks. Exercise consisted of a 5 minute 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 ETT. Resistance training included wall-pulleys and hand weights followed by 5 minutes of cool-down exercises. Women in this group 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.

Gender-Tailored Intervention—The gender-tailored exercise protocol was identical to that of the traditional CR program except that participants exercised exclusively with women in their cohort and the time of the intervention was restricted to 1 time slot when the traditional CR facility was closed. The intervention, guided by the Transtheoretical Model (TTM) of behavior change⁵⁶ and delivered with a motivational interviewing (MI) counseling style,^{57,58} was administered by female research nurses and EPs (Figure 2). Details of the intervention are described elsewhere.⁵¹ Women were assessed for their motivational readiness to change 3 behaviors (healthy eating, exercise, stress) at weeks 1

and 6. The TTM expert system assessment,⁵⁹ developed by Pro-Change Behavior Systems™ (Kingston, RI), provided an individualized 5-page report tailored on TTM constructs (stage of change, decision balance, self-efficacy, and processes of change) providing feedback to facilitate forward stage movement that was subsequently reinforced by their case manager. Participants received 1-hour individualized MI sessions at weeks 1 and 6 with a clinical psychologist or a clinical nurse specialist (CNS) formally trained in MI. The CNS and psychologist facilitated psychoeducational classes focused on gender-based practice guidelines, relaxation exercises, and social support. Classes took place on 10 consecutive Wednesdays in a private room prior to the exercise session.

Measures

Psychosocial Predictors—The SF-36 Health Survey assessed perceived health status.⁶⁰ The SF-36v2™ comprises 36 questions measuring health perceptions on 8 subscales. Subscales are totaled and transformed to a 0-100 scale with higher scores representing better perceived health.

Quality of life (QOL) was evaluated using the Self-Anchoring Striving Scale (SASS)⁶¹ depicted as a 10-step ladder. Participants indicate their present life satisfaction by circling the appropriate ladder rung. The Multiple Discrepancies Theory Questionnaire (MDT)⁶² has 8 items that evaluate perceived discrepancies between current QOL and a set of internal standards. These discrepancies are between what one has and wants, relevant others have, the best one has had in the past, expected to have 3 years ago, expects to have after 5 years, deserves, and needs.

The State Anxiety Inventory (STAI-S)⁶³ includes 20 items where respondents specify how they currently feel. The total score can range from 20 to 80 with higher scores indicating more anxiety. Normative values for women 50-60 years old are 32.2 ± 8.7 .

The Center for Epidemiological Studies Depression Scale (CES-D),⁶⁴ a 20-item rating scale, measured depression. Scores range from 0 to 60 with higher scores reflecting greater depressive symptoms. A score of 16 is typically the cut-off score for an elevated level of depressive symptoms.

Social support was determined using the ENRICH Social Support Instrument (ESSI), a 7-item measure assessing 4 attributes of social support: emotional, instrumental, informational, and appraisal.⁶⁵ Items are summed for a total score, with higher scores indicating greater social support.

The Herth Hope Index (HHI),⁶⁶ a 12-item scale, assessed the level of hope. Summative scores can range from 12 to 48, with a higher score denoting greater hope.

The Life Orientation Test (LOT), a measure of optimism, is a 10-item self-report measure. Scores can range from 0 to 24.⁶⁷

Physiological Predictors—Body mass index (BMI) was calculated as weight (kg)/height (m²). Using the modified Bruce protocol for the ETT,⁶⁸⁻⁷⁰ exercise capacity was expressed in units of metabolic equivalents (MET) where a MET equals 3.5 ml oxygen uptake per kg per minute.

Smoking status was assessed by self-report and confirmed by urine cotinine, a measure of exposure to nicotine. Specimens were screened by immunoassay at a threshold level of 25 ng/ml cotinine. If positive, it was confirmed by gas chromatography (MedTox Laboratories, St. Paul, MN).

Sociodemographic Predictors—Age and marital status were obtained on a form created for the study.

Outcome Measure—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, reflecting the number of sessions completed, divided by the number of prescribed sessions. This was done because the gender-tailored intervention had 10 education sessions compared to 8 in the traditional group.

Data Analysis

Data were analyzed using SPSS, Version 17, for Windows (SPSS, Inc., Chicago, Illinois). Descriptive statistics included means, standard deviations, correlations, and percentages. Categorical variables were compared using the χ^2 test and continuous variables were compared using the *t* test. Urine cotinine levels were log transformed. We first examined the bivariate correlations between the attendance variables and theoretically plausible predictor variables. The baseline variables previously identified in the literature, and assessed in the current study: age, BMI, marital status, smoking status, anxiety, depression, social support, quality of life, optimism, and subscales of the SF-36 (vitality, mental and general health) were examined as predictors of attendance. Marital status was dummy coded with married women as the reference group. Women who were separated or divorced were collapsed into one category, single and never married women represented another category, and the widowed comprised the final category.

Hierarchical multiple regression was used to construct models for predicting CR attendance. After first controlling for group membership, we evaluated patient characteristics that are readily available to health care providers (eg, age, smoking status) as potential predictors. Psychosocial variables requiring indirect assessment (eg, anxiety, depression) were then evaluated. Separate analyses were conducted on exercise and education attendance. All tests were 2-tailed and evaluated for statistical significance using an alpha criterion of .05.

RESULTS

With a mean age of 63 years (SD=12, range, 31-87 years) most women were Caucasian (82%), married (53%), retired (47%) with $\geq$ high school education (92%). Seventeen percent were African American and 16% of Caucasians considered themselves Hispanic. The groups were not different at baseline on marital status, education, previous CR attendance, work status, race, risk factors or co-morbidities. Urine cotinine levels ranged from 25-2500 ng/mL with a median of 25 ng/mL. The groups did not differ in baseline psychosocial variables (all with acceptable reliabilities; Table 1). All participants reported poor health perceptions on all SF-36 subscales compared to national norms for women experiencing a myocardial infarction within the past year⁶⁰ particularly on the physical functioning, the role functioning-physical, and the vitality subscales. Fifty one percent of the sample had CES-D scores of $\geq$ 16.

Predictors of Attendance

The traditional group participants attended a mean of 28 ± 12 of a possible 36 prescribed exercise sessions compared to 32 ± 9 for the gender-tailored group participants (Table 2). The mean percent attendance of the education sessions was greater in the gender-tailored group (87 ± 24) than in the traditional group (56 ± 30). Separate regression equation models were constructed to predict CR attendance. After controlling for group assignment, 4 variables (age, BMI, smoking status, and marital status) were tested as predictors of exercise

attendance. Only smoking status and marital status along with anxiety were significant. The model for predicting exercise attendance from baseline variables, controlling for group assignment, is expressed in 2 steps (Table 3).

Group assignment accounted for about 5% of the variance in exercise attendance ($R^2 = .049$, $F(1, 250) = 12.755$, $P < .001$). The gender-tailored intervention was predicted to increase attendance by 4 to 5 sessions. The baseline characteristics accounted for approximately 17% of the variance in exercise attendance. ($R^2 \Delta = .168$; $F(5, 245) = 10.494$, $P < .001$). A smoker was predicted to attend 4 fewer sessions, and, if divorced/separated, a woman was predicted to attend 6 fewer sessions. For every 10-point increase on the State Anxiety Inventory (STAI-S), a woman was predicted to attend 1 to 2 fewer sessions.

A second regression model was constructed to predict education attendance using the same set of baseline variables (Table 4). Group assignment accounted for about 24% of the variance in education attendance ($R^2 = .238$, $F(1, 250) = 77.942$, $P < .001$). Referring to the coefficients in Table 4, Step 2, the intercept (61.398) suggests that a woman in the traditional group who was married, did not smoke, and with a normal level of anxiety (STAI-S score of 32.2⁶³) was predicted to attend 61% of prescribed education sessions (5 of the 8 sessions). A similar woman in the gender-tailored group was predicted to attend $61.398 + 30.69 = 92.09\%$ (9 of 10 sessions).

The baseline characteristics accounted for approximately 9% of the variance in education attendance ($R^2 \Delta = .085$; $F(5, 245) = 6.115$, $P < .001$). A smoker was predicted to attend 1 less session (approximately 11% of 8 sessions). If, divorced/separated, a woman was predicted to attend 1 less session (approximately 14% of 8 sessions). For every 10-point increase on the STAI-S, a woman was predicted to attend 2 to 3 fewer sessions.

DISCUSSION

Our study demonstrated that compared to the traditional CR, the gender-tailored intervention positively influenced exercise attendance by 4 sessions and education attendance by 31%. The results are particularly noteworthy given the relatively inflexible schedule of the gender-tailored program with a single time option for the education and exercise sessions compared to multiple options available in the traditional program. A gender-tailored, stage-of-change matched intervention represents an effective attendance-enhancing strategy for women referred to CR. Several plausible explanations for the observed results are explored.

First, the gender-tailored intervention departed from the typically well-intentioned prescriptive approach to CR by using the MI strategies of guiding, respecting patient autonomy, and patient-centered collaboration. Used in consort with the TTM, we found that women facing lifestyle changes were particularly ambivalent about engaging in new behaviors such as exercise. The TTM strategies were valuable in overcoming the perceived negative aspects of healthy behavior change. By listening to their preferences and addressing obstacles encountered in the change process, women were more engaged in activating their own motivations. Women were assisted in recognizing the discrepancy between their unhealthy behaviors and their deeply held values. Eliciting participant preferences, acknowledging their stage of readiness to change, and the therapeutic alliance inherent in MI, is likely responsible for the greater attendance in the gender-tailored group.

Second, CR often requires multiple behavior modifications. While women may be ready to change one behavior, they are conceivably ambivalent about modifying others. After women were assessed for their readiness to change behaviors, they were encouraged to prioritize an agenda for change. Questions were posed to elicit reasons for their selected goals, the importance of that change in their lives, and their confidence in succeeding. Voicing their

rationale for change may help to tip the decision balance in favor of following through with a greater commitment to healthy behaviors. Finally, the social support obtained from women in their cohort may have contributed to addressing their psychosocial needs.

In our quest to determine baseline characteristics that predicted attendance we found smoking status, marital status, and anxiety were important predictors. Interestingly, anxiety was less predictive of education than of exercise attendance. Perhaps, participating in exercise is more anxiety-provoking for sedentary women because many were unfamiliar with exercise equipment and voiced concern about their safety when using it. Conversely, participating in psychoeducation sessions, an extension of social activities familiar to women, involved shared responses to CHD in a nurturing environment.

Lower attendance by smokers may be partly due to their perceptions of judgmental attitudes toward tobacco by healthcare providers. The influences of divorce/separated marital status on attendance could range from time constraints to denial or resistance. Conceivably, marital disruption negatively impacts the capacity for social engagement, access to resources, and support received for positive lifestyle changes.

Previous research found that patients less likely to complete CR were obese, smokers, female, with poor exercise capacity.³⁶ Consistent with our findings, Sanderson and Bittner³⁷ found a trend for poor CR completion of women who were smokers. Confirming previous work,^{39,42} we found that variables such as BMI and exercise capacity were not significant predictors of attendance. Perhaps the absence of men in our study led to a restricted range on these variables. While depression has been reported as a deterrent to CR completion,^{37,39,46} we, like others,⁴¹ found anxiety but not depression to predict attendance. Like previous investigators^{41,42} who measured both depression and anxiety, we found these 2 constructs strongly correlated ($r=.670$, $P<.001$).

Limitations

Some limitations should be kept in mind when considering the results reported here. First, the psychosocial data collected were obtained from self-reports; these data may reflect bias in reporting certain beliefs or feelings. Second, the convenience sample was of moderate size and unrepresentative of the national population of the United States. Therefore, our results should be generalized with caution. Third, the experimental exercise sessions were scheduled when the CR facility was closed to minimize crossover contamination. While perhaps reducing the “reach” of the study, we believe that maintaining treatment integrity takes precedent. Fourth, the study design limits the ability to isolate the effect of any one of the multifaceted intervention components on attendance. It is, therefore, unknown which component led to the statistically significant effect on attendance. That the intervention used motivational interviewing, stage-matching, gender-tailoring, and social support may have synergistically improved attendance. Finally, the effects of omitted variables (eg, personality traits, and beliefs about the appropriateness of exercise for women) are unpredictable. Their absence could lead to misleading conclusions regarding the relative importance of the characteristics examined here.

CONCLUSIONS

Gender-tailored CR interventions hold promise for improving attendance. The rigorous testing of theory-based platforms for secondary prevention could better serve women at risk for recurrent cardiac events. Improved understanding of the baseline characteristics that reliably predict attendance in CR may guide us in targeting women for specialized intervention to avert non-completion.

CONDENSED ABSTRACT**PURPOSE**

This study compared attendance of women participating in a motivationally enhanced, gender-tailored cardiac rehabilitation (CR) program with women attending a traditional outpatient CR program. We also sought to determine the significant baseline predictors of attendance of the exercise and education components of the interventions.

METHODS

Data from 252 women with CHD in the randomized clinical trial, *the Women's-Only Cardiac Rehabilitation Program*, were used in this study. The experimental design used 2 treatment groups; both receiving a comprehensive, 12-week, CR program, with 1 group receiving a gender-tailored, stage-of-change matched, behavioral enhancement using individualized motivational interviewing.

RESULTS

Compared to women in the traditional CR program, women in the gender-tailored program attended significantly more of the prescribed exercise (90% versus 77%) and education sessions (87% versus 56%). Group assignment accounted for about 5% of the variance in exercise attendance ($F(1,250) = 12.755, P < .001$) and about 24% of the variance in education attendance ($F(1,250) = 77.942, P < .001$). After controlling for group assignment, the baseline characteristics of smoking status, marital status, and anxiety accounted for about 17% of the variance in exercise attendance ($F(5,245) = 10.494, P < .001$). Smoking status and marital status were significant baseline predictors of education attendance ($F(5,245) = 6.115, P < .001$) after controlling for group assignment.

CONCLUSIONS

The long-standing, poor attendance of women in CR continues to be an unresolved international challenge. Gender-tailored, stage-matched, CR programs hold promise for enhancing attendance to prescribed protocols. Additional research examining the efficacy of gender-sensitive, motivationally-enhanced CR for women compared to generic CR programs is warranted.

CONDENSED ABSTRACT

This randomized clinical trial found that compared to traditional cardiac rehabilitation, women participating in a motivationally enhanced, gender-tailored cardiac rehabilitation program had improved attendance of both the exercise and education sessions. Significant baseline predictors of attendance, after controlling for group assignment, were smoking status, marital status, and anxiety level.

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REFERENCES

1. Lloyd-Jones D, Adams R, Carnethon M, et al. Heart disease and stroke statistics--2009 Update. A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2009;119:e21-181. [PubMed: 19075105]

2. Jneid H, Fonarow GC, Cannon CP, et al. Sex differences in medical care and early death after acute myocardial infarction. *Circulation* 2008;118:2803–2810. [PubMed: 19064680]
3. Wenger NK. Current status of cardiac rehabilitation. *J Am Coll Cardiol* 2008;51:1619–1631. [PubMed: 18436113]
4. Thomas RJ, King M, Lui K, et al. AACVPR/ACC/AHA 2007 performance measures on cardiac rehabilitation for referral to and delivery of cardiac rehabilitation/secondary prevention services endorsed by the American College of Chest Physicians, American College of Sports Medicine, American Physical Therapy Association, Canadian Association of Cardiac Rehabilitation, European Association for Cardiovascular Prevention and Rehabilitation, Inter-American Heart Foundation, National Association of Clinical Nurse Specialists, Preventive Cardiovascular Nurses Association, and the Society of Thoracic Surgeons. *J Am Coll Cardiol* 2007;50:1400–1433. [PubMed: 17903645]
5. Smith SC Jr, Allen J, Blair SN, et al. AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by the National Heart, Lung, and Blood Institute. *Circulation* 2006;113:2363–2372. [PubMed: 16702489]
6. Leon AS, Franklin BA, Costa F, et al. Cardiac rehabilitation and secondary prevention of coronary heart disease: an American Heart Association scientific statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity), in collaboration with the American association of Cardiovascular and Pulmonary Rehabilitation. *Circulation* 2005;111:369–376. [PubMed: 15668354]
7. Balady GJ, Williams MA, Ades PA, et al. Core components of cardiac rehabilitation/secondary prevention programs: 2007 update: a scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. *J Cardiopulm Rehabil Prev* 2007;27:121–129. [PubMed: 17558191]
8. Williams MA, Ades PA, Hamm LF, et al. Clinical evidence for a health benefit from cardiac rehabilitation: an update. *Am Heart J* 2006;152:835–841. [PubMed: 17070142]
9. Mosca L, Banka CL, Benjamin EJ, et al. Evidence-based guidelines for cardiovascular disease prevention in women: 2007 update. *Circulation* 2007;115:1481–1501. [PubMed: 17309915]
10. Kottke TE, Faith DA, Jordan CO, Pronk NP, Thomas RJ, Capewell S. The comparative effectiveness of heart disease prevention and treatment strategies. *Am J Prev Med* 2009;36:82–88. [PubMed: 19095166]
11. Grace SL, Gravely-Witte S, Kayaniyl S, Brual J, Suskin N, Stewart DE. A multisite examination of sex differences in cardiac rehabilitation barriers by participation status. *J Womens Health (Larchmt)* 2009;18:209–216. [PubMed: 19183092]
12. Allen JK, Scott LB, Stewart KJ, Young DR. Disparities in women's referral to and enrollment in outpatient cardiac rehabilitation. *J Gen Intern Med* 2004;19:747–753. [PubMed: 15209588]
13. Witt BJ, Jacobsen SJ, Weston SA, et al. Cardiac rehabilitation after myocardial infarction in the community. *J Am Coll Cardiol* 2004;44:988–996. [PubMed: 15337208]
14. Evenson KR, Johnson A, Aytur SA. Five-year changes in North Carolina outpatient cardiac rehabilitation. *J Cardiopulm Rehabil* 2006;26:366–376. [PubMed: 17135857]
15. Clark AM, Barbour RS, White M, MacIntyre PD. Promoting participation in cardiac rehabilitation: patient choices and experiences. *J Adv Nurs* 2004;47:5–14. [PubMed: 15186462]
16. Audelin MC, Savage PD, Ades PA. Exercise-based cardiac rehabilitation for very old patients (> or =75 years): focus on physical function. *J Cardiopulm Rehabil Prev* 2008;28:163–173. [PubMed: 18496314]
17. Suaya JA, Shepard DS, Normand SL, Ades PA, Prottas J, Stason WB. Use of cardiac rehabilitation by Medicare beneficiaries after myocardial infarction or coronary bypass surgery. *Circulation* 2007;116:1653–1662. [PubMed: 17893274]
18. Scott LA, Ben-Or K, Allen JK. Why are women missing from outpatient cardiac rehabilitation programs? A review of multilevel factors affecting referral, enrollment, and completion. *J Womens Health (Larchmt)* 2002;11:773–791. [PubMed: 12632591]

19. Jeger RV, Jorg L, Rickenbacher P, Pfisterer ME, Hoffmann A. Benefit of outpatient cardiac rehabilitation in under-represented patient subgroups. *J Rehabil Med* 2007;39:246–251. [PubMed: 17468794]
20. Halm M, Penque S, Doll N, Beahrs M. Women and cardiac rehabilitation: referral and compliance patterns. *J Cardiovasc Nurs* 1999;13:83–92. [PubMed: 10098008]
21. Cortes O, Arthur HM. Determinants of referral to cardiac rehabilitation programs in patients with coronary artery disease: a systematic review. *Am Heart J* 2006;151:249–256. [PubMed: 16442885]
22. Focht BC, Brawley LR, Rejeski WJ, Ambrosius WT. Group-mediated activity counseling and traditional exercise therapy programs: effects on health-related quality of life among older adults in cardiac rehabilitation. *Ann Behav Med* 2004;28:52–61. [PubMed: 15249259]
23. Beckie TM, Mendonca MA, Fletcher GF, Schocken DD, Evans ME, Banks SM. Examining the challenges of recruiting women into a cardiac rehabilitation clinical trial. *J Cardiopulm Rehabil Prev* 2009;29:13–21. [PubMed: 19158582]
24. King KM, Humen DP, Smith HL, Phan CL, Teo KK. Predicting and explaining cardiac rehabilitation attendance. *Can J Cardiol* 2001;17:291–296. [PubMed: 11264562]
25. Ades PA, Waldmann ML, Polk DM, Coflesky JT. Referral patterns and exercise response in the rehabilitation of female coronary patients aged greater than or equal to 62 years. *Am J Cardiol* 1992;69:1422–1425. [PubMed: 1590231]
26. Lieberman L, Meana M, Stewart D. Cardiac rehabilitation: gender differences in factors influencing participation. *J Womens Health* 1998;7:717–723. [PubMed: 9718540]
27. King KM, Humen DP, Smith HL, Phan CL, Teo KK. Psychosocial components of cardiac recovery and rehabilitation attendance. *Heart* 2001;85:290–294. [PubMed: 11179268]
28. Evenson KR, Rosamond WD, Luepker RV. Predictors of outpatient cardiac rehabilitation utilization: the Minnesota Heart Surgery Registry. *J Cardiopulm Rehabil* 1998;18:192–198. [PubMed: 9632320]
29. Thomas RJ, Miller NH, Lamendola C, et al. National Survey on Gender Differences in Cardiac Rehabilitation Programs. Patient characteristics and enrollment patterns. *J Cardiopulm Rehabil* 1996;16:402–412. [PubMed: 8985799]
30. Ades PA, Waldmann ML, McCann WJ, Weaver SO. Predictors of cardiac rehabilitation participation in older coronary patients. *Arch Intern Med* 1992;152:1033–1035. [PubMed: 1580707]
31. Caulin-Glaser T, Blum M, Schmeizl R, Prigerson HG, Zaret B, Mazure CM. Gender differences in referral to cardiac rehabilitation programs after revascularization. *J Cardiopulm Rehabil* 2001;21:24–30. [PubMed: 11271654]
32. Audelin MC, Savage PD, Ades PA. Changing clinical profile of patients entering cardiac rehabilitation/secondary prevention programs: 1996 to 2006. *J Cardiopulm Rehabil Prev* 2008;28:299–306. [PubMed: 18784538]
33. Worcester MU, Murphy BM, Mee VK, Roberts SB, Goble AJ. Cardiac rehabilitation programmes: predictors of non-attendance and drop-out. *Eur J Cardiovasc Prev Rehabil* 2004;11:328–335. [PubMed: 15292767]
34. Cooper AF, Jackson G, Weinman J, Horne R. Factors associated with cardiac rehabilitation attendance: a systematic review of the literature. *Clin Rehabil* 2002;16:541–552. [PubMed: 12194625]
35. Blackburn GG, Foody JM, Sprecher DL, Park E, Apperson-Hansen C, Pashkow FJ. Cardiac rehabilitation participation patterns in a large, tertiary care center: evidence for selection bias. *J Cardiopulm Rehabil* 2000;20:189–195. [PubMed: 10860201]
36. Sanderson BK, Phillips MM, Gerald L, DiLillo V, Bittner V. Factors associated with the failure of patients to complete cardiac rehabilitation for medical and nonmedical reasons. *J Cardiopulm Rehabil* 2003;23:281–289. [PubMed: 12894002]
37. Sanderson BK, Bittner V. Women in cardiac rehabilitation: outcomes and identifying risk for dropout. *Am Heart J* 2005;150:1052–1058. [PubMed: 16290995]

38. Marzolini S, Brooks D, Oh PI. Sex differences in completion of a 12-month cardiac rehabilitation programme: an analysis of 5922 women and men. *Eur J Cardiovasc Prev Rehabil* 2008;15:698–703. [PubMed: 18981927]
39. Casey E, Hughes JW, Waechter D, Josephson R, Rosneck J. Depression predicts failure to complete phase-II cardiac rehabilitation. *J Behav Med* 2008;31:421–431. [PubMed: 18719990]
40. Conn VS, Taylor SG, Abele PB. Myocardial infarction survivors: age and gender differences in physical health, psychosocial state and regimen adherence. *J Adv Nurs* 1991;16:1026–1034. [PubMed: 1939915]
41. Grace SL, Abbey SE, Shnek ZM, Irvine J, Franche RL, Stewart DE. Cardiac rehabilitation II: referral and participation. *Gen Hosp Psychiatry* 2002;24:127–134. [PubMed: 12062136]
42. Farley RL, Wade TD, Birchmore L. Factors influencing attendance at cardiac rehabilitation among coronary heart disease patients. *Eur J Cardiovasc Nurs* 2003;2:205–212. [PubMed: 14622628]
43. Turner SC, Bethell HJ, Evans JA, Goddard JR, Mullee MA. Patient characteristics and outcomes of cardiac rehabilitation. *J Cardiopulm Rehabil* 2002;22:253–260. [PubMed: 12202845]
44. Glazer KM, Emery CF, Frid DJ, Banyasz RE. Psychological predictors of adherence and outcomes among patients in cardiac rehabilitation. *J Cardiopulm Rehabil* 2002;22:40–46. [PubMed: 11839996]
45. Ziegelstein RC, Fauerbach JA, Stevens SS, Romanelli J, Richter DP, Bush DE. Patients with depression are less likely to follow recommendations to reduce cardiac risk during recovery from a myocardial infarction. *Arch Intern Med* 2000;160:1818–1823. [PubMed: 10871976]
46. Caulin-Glaser T, Maciejewski PK, Snow R, LaLonde M, Mazure C. Depressive symptoms and sex affect completion rates and clinical outcomes in cardiac rehabilitation. *Prev Cardiol* 2007;10:15–21. [PubMed: 17215628]
47. Dunn SL, Stommel M, Corser WD, Holmes-Rovner M. Hopelessness and its effect on cardiac rehabilitation exercise participation following hospitalization for acute coronary syndrome. *J Cardiopulm Rehabil Prev* 2009;29:32–39. [PubMed: 19158585]
48. Jackson L, Leclerc J, Erskine Y, Linden W. Getting the most out of cardiac rehabilitation: a review of referral and adherence predictors. *Heart* 2005;91:10–14. [PubMed: 15604322]
49. Davidson P, Digiacomo M, Zecchin R, et al. A cardiac rehabilitation program to improve psychosocial outcomes of women with heart disease. *J Womens Health (Larchmt)* 2008;17:123–134. [PubMed: 18240989]
50. Reid RD, Morrin LI, Pipe AL, et al. Determinants of physical activity after hospitalization for coronary artery disease: the Tracking Exercise After Cardiac Hospitalization (TEACH) Study. *Eur J Cardiovasc Prev Rehabil* 2006;13:529–537. [PubMed: 16874141]
51. Beckie TM. A behavior change intervention for women in cardiac rehabilitation. *J Cardiovasc Nurs* 2006;21:146–153. [PubMed: 16601534]
52. Thompson DR. Cardiac rehabilitation: how can it be improved? *J Psychosom Res* 1995;39:519–523. [PubMed: 7490689]
53. Daly J, Sindone AP, Thompson DR, Hancock K, Chang E, Davidson P. Barriers to participation in and adherence to cardiac rehabilitation programs: a critical literature review. *Prog Cardiovasc Nurs* 2002;17:8–17. [PubMed: 11872976]
54. Beckie TM, Fletcher GF, Beckstead JW, Schocken DD, Evans ME. Adverse baseline physiological and psychosocial profiles of women enrolled in a cardiac rehabilitation clinical trial. *J Cardiopulm Rehabil Prev* 2008;28:52–60. [PubMed: 18277832]
55. Efron B. Forcing a sequential experiment to be balanced. *Biometrika* 1971;58:403–417.
56. Prochaska, JO.; Norcross, JC.; DiClemente, CC. *Changing for Good*. HarperCollins; New York: 1994.
57. Miller, WR.; Rollnick, S., editors. *Motivational Interviewing: Preparing people for change*. second ed.. Guilford; New York: 2002.
58. Rollnick, S.; Miller, WR.; Butler, CC. *Motivational Interviewing in Health Care: Helping Patients Change Behavior*. Guilford; New York: 2008.
59. Prochaska JO, Velicer WF, Redding C, et al. Stage-based expert systems to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. *Prev Med* 2005;41:406–416. [PubMed: 15896835]

60. Ware, JE.; Kosinski, M.; Dewey, JE. How to score version 2 of the SF-36 health survey. QualityMetric Incorporated; Lincoln, RI: 2000.
61. Cantril, H. The pattern of human concerns. Rutgers University Press; New Jersey: 1965.
62. Michalos, M. Global report on student well-being: Volume 1: Life satisfaction and happiness. Vol. 1. Springer-Verlag; New York: 1991.
63. Spielberger, CD.; Gorsuch, RL.; Lushene, RE. Manual for the state-trait anxiety inventory. Consulting Psychologists; Palo Alto: 1983.
64. Radloff L. The CES-D scale: A self-report depression scale for researching the general population. *Application of Psychological Measures* 1977;1:385–401.
65. Vaglio J Jr, Conard M, Poston WS, et al. Testing the performance of the ENRICH Social Support Instrument in cardiac patients. *Health Qual Life Outcomes* 2004;2:24. [PubMed: 15142277]
66. Herth K. Abbreviated instrument to measure hope: Development and psychometric evaluation. *J Advanced Nursing* 1992;17:1251–1259.
67. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J Pers Soc Psychol* 1994;67:1063–1078. [PubMed: 7815302]
68. Gibbons RJ, Balady GJ, Bricker JT, et al. ACC/AHA 2002 guideline update for exercise testing: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1997 Exercise Testing Guidelines). *Circulation* 2002;106:1883–1892. [PubMed: 12356646]
69. Finley CE, LaMonte MJ, Waslien CI, Barlow CE, Blair SN, Nichaman MZ. Cardiorespiratory fitness, macronutrient intake, and the metabolic syndrome: the Aerobics Center Longitudinal Study. *J Am Diet Assoc* 2006;106:673–679. [PubMed: 16647324]
70. Fletcher GF, Balady G, Froelicher VF, Hartley LH, Haskell WL, Pollock ML. Exercise standards. A statement for healthcare professionals from the American Heart Association. Writing Group. *Circulation* 1995;91:580–615. [PubMed: 7805272]

Figure 1.
Flow of participants in study (January 2004-March 2008)

Figure 2.
Logic model of predictors of cardiac rehabilitation attendance`

TABLE 1
BASELINE MEAN SCORES OF PSYCHOSOCIAL VARIABLES BY INTERVENTION GROUP (n=252)

Variable	Total Sample	Reliability	Traditional CR n=111	Gender-Tailored CR n=141	P value
SF-36 Subscales					
Physical Functioning	48.2 (24.7)	.89	48.1 (24.8)	48.4 (24.6)	.934
Role Functioning - Physical	43 (24.3)	.92	44.4 (24.9)	41.9 (23.8)	.431
Bodily Pain	52 (23.8)	.83	52.8 (24)	51.5 (23.7)	.666
General Health Perceptions	57.2 (20.1)	.80	56.6 (21.6)	57.6 (18.9)	.708
Vitality	45.8 (20.9)	.83	46.6 (22.5)	45.2 (19.5)	.599
Social Functioning	64.5 (27.2)	.82	66.9 (27.3)	62.6 (27)	.213
Role functioning - emotional	63.4 (28.6)	.90	64.6 (27.1)	62.4 (29.7)	.554
Mental Health	65.6 (22.1)	.87	67.1 (21.8)	64.4 (22.4)	.340
Quality of Life Measures					
Self-Anchoring Striving Scale	7 (2)	--	6.9 (1.9)	6.9 (2.1)	.943
MDT Questionnaire	34.7 (7.3)	.88	35.0 (6.6)	34.5 (7.8)	.577
Optimism (Life Orientation Test)	15.5 (4.5)	.79	15.5 (4.4)	15.5 (4.6)	.884
CES-D	17.8 (11.6)	.91	17.4 (10.7)	18.2 (12.3)	.572
State Anxiety Inventory	35.5 (12.4)	.94	35.1 (12.2)	35.7 (12.5)	.734
Herth Hope Index	39.4 (5.7)	.89	39.7 (5.5)	39.1 (5.8)	.371
ESSI	23.5 (5.6)	.91	24 (4.8)	23.1 (6.1)	.229
Self-Reported Stress, n (%)					
Family-related	123 (48.8)	--	52 (46.8)	71 (50.3)	.335
Work-related	62 (24.6)	--	29 (26.1)	33 (23.4)	.362
Finance-related	79 (31.3)	--	40 (36)	39 (25.5)	.099
Health-related	82 (32.5)	--	42 (37.8)	40 (28.4)	.073

Note: Continuous data are described as means (standard deviation); proportions are described as number (percentage).

Abbreviations: CR, cardiac rehabilitation; CES-D, Center for Epidemiologic Studies Depression Scale; MDT Questionnaire, multiple discrepancies theory questionnaire; ESSI, ENRICH social support instrument.

TABLE 2**ATTENDANCE OF EXERCISE AND EDUCATION BY INTERVENTION GROUP (n=252)**

Variable	Traditional CR n=111	Gender-Tailored CR n=141		Eta²
Mean number of 36 exercise sessions attended	28 (12)	32 (9)	F=12.755 (1,250), <i>P</i> <.001	.049
Mean percent of education sessions attended	56 (30)	87 (24)	F=77.942 (1,250), <i>P</i> <.001	.238

Abbreviation: CR, cardiac rehabilitation.

TABLE 3

PREDICTORS OF ATTENDANCE IN EXERCISE SESSIONS OF CARDIAC REHABILITATION (n=252)

Predictor	Unstandardized Coefficient	Error	Standard Standardized Coefficient
Step 1			
Intercept	27.703 [*]	0.988	
Group	4.716 [*]	1.320	.220
Step 2			
Intercept	30.736 [*]	1.979	
Group	4.561 [*]	1.218	.213
Smoker	-4.131 [*]	1.791	-.134
Marital status			
Married (reference)			
Never married	-3.016	2.629	-.067
Divorced/separated	-6.498 [*]	1.490	-.265
Widowed	.030	1.710	.001
Anxiety ^{††}	-.176 [*]	.050	-.205

Note: $R^2 = .049$ for Step 1; $\Delta R^2 = .168$ for Step 2 ($PS < .05$).

^{*} $P < .05$.

^{††} Scores on the State Anxiety Inventory (STAIS-S) are centered at the population norm for women at 32.2 for ease of interpretation.

TABLE 4

PREDICTORS OF ATTENDANCE IN EDUCATION SESSIONS OF CARDIAC REHABILITATION
(n=252)

Predictor	Unstandardized Coefficient	Standard Error	Standardized Coefficient
Step 1			
Intercept	55.631 [*]	2.624	
Group	30.965 [*]	3.507	.488
Step 2			
Intercept	61.398 [*]	5.461	
Group	30.690 [*]	3.360	.483
Smoker	-11.312 [*]	4.942	-.124
Marital Status			
Married (reference)			
Never married	.959	7.255	.007
Divorced/separated	-14.494 [*]	4.111	-.199
Widowed	1.920	4.718	.022
Anxiety ^{††}	-.243 [†]	.137	-.095

Note: $R^2 = .238$ for Step 1; $\Delta R^2 = .085$ for Step 2 ($PS < .05$). Attendance expressed as percentage of total sessions planned for each group.

^{*} $P < .05$

[†] $P < .10$.

^{††} Scores on the State Anxiety Inventory (STAIS-S) are centered at the population norm for women at 32.2 for ease of interpretation.