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SECONDARY INTERVENTION (JM FOODY, SECTION EDITOR)

Referral, Enrollment, and Delivery of Cardiac Rehabilitation for Women

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Abstract Coronary heart disease is the leading killer of women worldwide. Empirical literature documents substantial morbidity and mortality benefits for cardiac rehabilitation participants. Scientific advances have informed the development of evidence-based guidelines for improving the delivery of cardiac rehabilitation yet persistent themes surrounding the substandard referral and utilization rates by women continue unabated in the literature. This review provides an update of the current status of cardiac rehabilitation for women, including a brief overview of the latest findings regarding the unique presentations of heart disease in women. An innovative secondary prevention program, designed exclusively for women is described, and illustrates an attempt to modify a contemporary traditional cardiac rehabilitation program to improve attendance rates and health outcomes in women. Future research with large, diverse samples of women are essential for guiding gender-appropriate referral strategies, effective modifications to traditional center-based programs, and the efficacy of alternative cardiac rehabilitation care models for women.

Keywords Cardiac rehabilitation · Secondary prevention · Women · Coronary heart disease · Psychosocial · Depression · Age · Adherence

Introduction

Coronary heart disease (CHD), the leading killer of women, is a polygenic disease resulting from complex gene-environment interactions that are incompletely understood [1••, 2]. The phenotypic manifestations carry enormous personal and societal burdens in an increasingly diverse CHD population [3]. Nearly half a million American women are hospitalized annually with an acute coronary syndrome (ACS) with women twice as likely as men to have poor outcomes after coronary artery bypass graft (CABG) surgery, and 1.5 times more likely to die within a year of a myocardial infarction (MI) [1••]. Within 5 years after a first MI, 47 % of women will die. Preventing secondary cardiac events is essential to the evidence-based continuum of care for women with manifest CHD.

Secondary prevention, comprising comprehensive risk factor management in individuals with established CHD reduces subsequent events and improves survival [4••]. Cardiac rehabilitation/secondary prevention programs (CR/SPPs), internationally endorsed [4••, 5, 6••, 7, 8] and integrated in effectiveness-based guidelines for women [9••], reveal incontrovertible evidence of morbidity and mortality benefits [10–12]. Yet, few women comprise the CR/SP population [13]. Too few minority women or those with depressive symptoms attend CR/SP to permit effective evaluation in these subgroups [14, 15••, 16]. These health disparities highlight the imperative to evaluate novel personalized CR/SP care that is age-appropriate and sex-specific [13, 17, 18]. Rectifying the sex-specific disparities in CHD outcomes is a national priority [19••].

This review examines the current state of the science surrounding CR/SP interventions for women. First, an update on CHD in women is provided, followed by a summary of the status of CR/SP referral to and utilization by women. Finally, novel strategies for personalizing CR/SP for women are reviewed, and implications for practice and future research are addressed.

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Coronary Heart Disease in Women

Unique antecedents and consequences of CHD in women have implications for effective CR/SP interventions. Scientific advancements have provided a greater understanding of the sex differences in CHD but many unanswered questions remain. The reasons why particular subgroups of women have more angina, higher mortality, higher rehospitalization rates, or increasing prevalence of MI compared with men are unclear [20–22]. Hypothesized factors contributing to the poorer prognosis of women after MI than men include underlying biology and uniquely detrimental risk factors and clinical manifestations, older age at presentation with greater comorbidities, delayed health care seeking, and disparate treatments with evidence-based therapies. Prevalent CHD in women demonstrates racial disparities with Blacks having higher rates than Whites or Mexican Americans [1••]. That Black women bear a disproportionate share of CHD death and disability may reflect a lack of awareness of CHD [23] or their economic, psychosocial and treatment characteristics [24].

Traditional CHD risk factors more prevalent and associated with greater mortality risk in women than in men include hypertension, diabetes, glucose intolerance, hypercholesterolemia, obesity, inactivity, and hypertriglyceridemia [1••, 25]. Metabolic syndrome (MetS), comprising atherogenic dyslipidemia, hypertension, abdominal obesity, insulin resistance, and inflammation [26], is more prevalent in women and a stronger predictor of CHD than in men [27]. The prevalence of obesity is a key contributor to the burgeoning epidemic of type 2 diabetes present in over 12 million American women.

Variance in clinical presentation may explain some of the sex disparities in mortality. Compared with men, women are more likely to have high-risk presentations and less likely to manifest central chest pain [28]. Ischemic symptoms in women, particularly in young Black women, include unusual fatigue, shortness of breath, chest discomfort, or frequent indigestion [29]. Older women, more often White, display fewer symptoms, smoke less, and manifest less obesity. Women not only have unique symptoms but also have less obstructive CHD along the spectrum of ACS [30]. Ischemic symptoms independently predict subsequent ACS in women despite normal coronary arteries, and plaque disruption is evident in almost 40 % of women with ACS and non-obstructive CHD [31]. Coronary angiography is used less often in women largely because their risk is underestimated, yet women have significantly higher mortality rates than did men, regardless of age [32]. Compared with men, women ≤45 years with MI are significantly more likely to present without chest pain and have higher in-hospital mortality [21]. What accounts for this excess risk is unclear, but the absence of chest pain may be more predictive of mortality in younger women with MI than in other similarly aged groups [21].

Glaring escalations in CHD mortality of young women are emerging, with rates increasing an average of 1.3 % annually between 1997 and 2002 among women aged 35 to 44 years [33]. Among over 10,000 hospitalized MI patients, the short-term death rates were much higher in younger women than in younger men [34]. Young women plausibly possess biological and genetic factors predisposing them to more aggressive CHD [35–38]. Consequences of the obesity epidemic, the dramatic increase in the MetS and diabetes, and disparate care with efficacious therapies portents an enormous future public health burden of CHD in young women predisposed to early onset MI [39–41].

Depressive symptoms are pervasive in women, particularly young women with CHD [42–44]. Depression and inflammation were independent predictors of nonfatal MI and cardiovascular death in women referred for coronary angiogram [45]. Inflammation is a plausible mechanism in the pathogenesis of CHD and depression although the antecedents and consequences of depression in women remain poorly understood. Collectively, the unique risk factors, comorbidities, and the high prevalence of CHD in women have received a disappointing lack of research [46, 47].

Cardiac Rehabilitation and Women

Contemporary American outpatient CR/SPPs (Phase II) typically comprise 12 weeks of medically supervised aerobic exercise supplemented with resistance training, and education and counseling for weight loss, nutrition, smoking cessation, and psychosocial issues [5]. These multidisciplinary risk factor management interventions are intended to slow the progression of CHD, improve cardiorespiratory fitness, and reduce future cardiac events [6••, 48]. Among 30,000 elderly Americans with CHD, patients attending all 36 prescribed CR/SP sessions compared with those attending only 1 session had a 47 % lower risk of death and a 31 % lower risk of MI 4 years after completion [49•]. Among Medicare beneficiaries (14 % women), only 12.2 % received 1 or more CR/SP sessions and high-dose users had lower 5-year mortality than lower-dose users [10]. Mortality benefits increased progressively with older age and were greater in women than in men of all ages.

The American College of Cardiology Foundation and the American Heart Association (AHA) have championed the development of evidence-based practice guidelines and performance measures for referral and enrollment to CR/SPPs meant to assist hospitals, office practices, and CR/SPPs to implement high quality patient care [50, 51••]. Most recent guidelines provide a Class I level recommendation (effective

and beneficial) for referral to CR/SPPs for patients with recent MI or ACS, chronic stable angina, heart failure, and after CABG, valve surgery, percutaneous coronary interventions (PCI), or cardiac transplantation [9••, 51••, 52–55]. Significant effort has been expended to improve enrollment and completion of CR/SPPs but without a referral to CR/SP by a health care provider all other barriers to participation are immaterial.

Referral to Cardiac Rehabilitation

Referral to CR/SP is an official communication between provider and patient to recommend and carry out a referral order to an early outpatient CR/SPP [51••]. Despite international endorsement of CR/SP, referrals of eligible patients to CR/SP continue to hover around 18 % [56] and even fewer eligible women utilize these programs [13]. An AHA Presidential Advisory on the referral, participation, and delivery of CR/SP highlighted the numerous factors associated with attendance [6••]. Although none exclusively targeted women, a Cochrane review of interventions to expand the reach of CR/SP and increase referral, enrollment, and adherence was unable to provide practice guidelines for women because they are underrepresented in the studies reviewed; tailored approached for increasing the likelihood of success were recommended [57].

Automatic referral strategies have been successful for increasing referral rates from between 34 % to 85 % and enrollment rates from between 19 % to 78 % [58]. Canadian researchers investigating the effectiveness of various referral strategies to CR/SP reported that the combination of automatic referral via discharge order or electronic record plus health care provider liaison visits resulted in an 8-fold (73.5 %) increase in the likelihood of self-reported referral to CR/SP. This strategy was far superior to referral strategies left to the discretion of the physician or to automatic referral or provider liaison alone [59••]. Equally important, regardless of referral strategy, once referred, CR/SP participation rates were consistently above 80 % of prescribed sessions. Even though CR/SP services were covered by insurance, only 27 % of the sample comprised women.

Automatic hospital orders, individualized CR/SP orientation sessions, and a motivational interviewing counseling style were effective in promoting enrollment of women to an American CR/SPP [17]. Women held the opinion of their physicians in high regard, often delaying decision-making until the provider confirmed the importance of CR/SP. Despite few investigations of effective referral strategies specific to women, raising physician and patient awareness of the significant benefits of CR/SP before hospital discharge and during office visits are critical for achieving optimum health following a cardiac event. Canada has released a policy statement recommending systematic referral of all eligible patients to CR/SP [60] and American performance measures recommend either written or electronic referrals [51••]. An AHA science advisory calls for health care providers to implement a coordinated effort to educate and promote CR/SP to eligible patients and to facilitate referral and enrollment [61••]. Rewarding hospitals and physicians, and instituting referral to CR/SP as a quality indicator of cardiac care might also improve utilization [51••].

Cardiac Rehabilitation Participation

Even with a CR/SP referral, women participate and complete less frequently than men. Factors influencing CR/SP participation are complex and several are unique among women [62]. Patient-oriented, medical, and healthcare system factors variably account for poor CR/SP attendance among eligible women (Table 1) [6••, 17]. Chief among the predictors of dismal attendance is lack of physician endorsement of CR/SP [62, 63] and female sex [13, 64]. Women particularly underrepresented in CR/SP include the elderly, obese, sedentary, unmarried, nonwhite, and women who smoke and have more co-morbidities, less social support and education, competing family obligations, transportation barriers, and incomplete medical insurance coverage [13, 17, 65, 66]. Some women find CR/SP exercise tiring and painful [62], and dislike public or mixed-gender exercise.

Women with CHD not only manifest particularly adverse psychosocial profiles and suboptimal social support but they also report gender-specific CR/SP preferences and needs [42]. Socioeconomically disadvantaged women are particularly plagued with psychosocial stressors that interfere with the CHD self-management [44]. Depressive symptoms are linked to suboptimal CR/SP attendance and women have a 2-fold increased risk of noncompletion [14, 15••, 67]. Evidence supports the link between depression and poor CR/SP compliance conceivably because depression thwarts motivation for behavior change [14, 16].

A systematic review of randomized clinical trials (RCT) of the effects of psychological interventions for CHD patients (26 % women) found evidence for small to moderate reductions in depression and anxiety but no evidence for reduced mortality, or risk for revascularization or non-fatal MI [68]. While there were fewer cardiac deaths among treated patients, there was no consistent evidence of a positive effect on quality of life (QOL) or other psychological outcomes. Several guidelines [4••, 9••, 52, 53, 69] recommend routine screening of CHD patients for depressive symptoms. However, this recommendation has been challenged due to lack of evidence for the effectiveness of depression treatments in

Table 1 Factors influencing cardiac rehabilitation participation by women

Factor	Potential solution
A. Patient-oriented [6••, 13, 17, 64–66]	
1. Uninterested or uninformed of CR benefits, believe CR is unnecessary, or that home exercise is sufficient	• Determine knowledge deficits, dispel myths, respect values and preferences, clearly inform and educate patient and family
2. Short hospital stay, poor recall of discharge information	• Clear discharge instructions, promote CR, coordinate continuous care, shared decision making
3. Low educational attainment, low health literacy	• Determine understanding of CHD, preferences, and goals and provide health-literacy appropriate materials
4. Inadequate self-efficacy and confidence	• Determine stage of readiness to change behavior, explore ambivalence using motivational interviewing counseling style
5. Racial/ethnic minority	• Deliver culturally-sensitive care
6. Extremes of age	• Personalize program for young and elderly women
7. Psychosocial stressors, anxiety, social isolation, divorced or widowed, caregiving obligations	• Screen and assess for psychological distress particularly depression, anxiety, anger, marital distress and deliver counseling interventions for stress management and coping skills
8. Work-related obligations	• Flexible facility hours and meeting times
9. Dislike mixed-gender CR groups, perceive exercise as painful and tiring	• Consider sex-specific sessions with creative aerobic and resistance exercise options or home-based, community programs
B. Medical factors [6••, 61••, 69]	
1. Depression	• Screen and consult with clinical psychologist
2. Limiting co-morbidities or musculoskeletal limitations	• Individualize aerobic and resistance exercise program
C. Healthcare System factors [6••, 61••, 62]	
1. Lack of referral, weak endorsement	• Automatic referral systems in hospital
2. Competing priorities among healthcare professionals	• Identify a CR/SP champion and coordinator, implement performance measures
3. Time-consuming enrollment process	• Streamline referral and enrollment process
4. Lack of CR program within 60 minutes from home, limited parking and transportation access	• Home-based programs, telemedicine, internet, mobile phone, community program delivery options
5. Hours of operation	• Increase coverage and resources for center-based programs

improving cardiovascular outcomes [70, 71]. Despite the underrepresentation of women in CR/SP clinical trials and little data to guide practice, practitioners are advised to assess women for psychological distress including depression, hostility, social isolation, and marital/family distress [72••].

Intensive public education efforts by the AHA, the American College of Cardiology and the National Heart, Lung, and Blood Institute have led to an increased awareness of CHD as the leading cause of death among women from 30 % in 1997 to 54 % in 2009 [23]. Black and Hispanic, compared with White women, had less awareness, posing continuing challenges for education campaigns [73]. Young compared with older women were less motivated to alter CHD risk behaviors plausibly related to psychosocial challenges or failure to perceive themselves at risk [74]. Family care-giving and career demands reduced motivation for change whereas worried and knowledgeable women were more motivated to modify their risk factors. According to Wenger, how we translate CHD awareness into personalization of risk and risk reduction in women is the next behavioral research frontier [75].

In short, current evidence consistently demonstrates that women are neither referred to nor participate in CR/SP interventions or research trials at the same rates as men. Designing and evaluating evidence-based supplemental or alternative approaches to traditional CR/SPPs through shared decision making that provides women with access to effective secondary prevention interventions are critical. In this vein, several novel alternative approaches to CR/SP, only one of which was specifically designed for women, are reviewed.

Innovative Cardiac Rehabilitation Program Delivery for Women

Novel strategies to address issues relevant to women, an underserved segment of CR/SP populations, are warranted in light of their adverse psychosocial profiles and their poor completion rates. Efficacious CR/SP programs tailored to individual characteristics may be more effective than traditional CRSPPs in meeting the needs of women. Using a 2-group RCT, Beckie and colleagues were the first to examine

the physiological and psychosocial outcomes among women completing a traditional CR/SPP compared with women completing a motivationally-enhanced, gender-specific CR/SPP [76]. The multiple-behavior change intervention, guided by the tenants of the Transtheoretical Model [77] and motivational interviewing [78] involved assessing women's stage of motivational readiness to change healthy eating, physical activity, and stress management at baseline, after CR/SP completion and at a 6-month follow-up. A clinical psychologist or a clinical nurse specialist (CNS) formally trained in motivational interviewing conducted 1-hour individualized psychotherapeutic sessions at weeks 1, 6, and 12. The CNS and psychologist facilitated psychoeducational sessions for 10 consecutive weeks focused on gender-based practice guidelines, relaxation exercises, and social support. The exercise protocol was similar to the traditional CR/SP intervention except for the exclusion of men. Traditional CR/SP, 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.

Of the 252 women randomly allocated, 236 (94 %) completed the 3-month intervention and 225 (90 %) completed a 6-month follow-up. The mean age was 63 years (range 31–87), 17 % were Black, 16 % were Hispanic, and 82 % were Caucasian. Fifty percent of participants had a PCI and 33.7 % had CABG surgery; fewer were treated medically for stable angina (11 %) or an MI (5 %). Women completing the tailored CR/SP intervention had greater improvement in QOL scores compared with those completing traditional CR/SP. Improved QOL scores were sustained at the 6-month follow-up in the tailored group, whereas those in traditional CR/SP were essentially unchanged over time [79••]. These effects remained while controlling for group differences in education and exercise attendance, suggesting that mechanisms other than, or in addition to, exercise and education likely accounted for the improvements in QOL in the tailored group. The gender-exclusive social support exchanged between women receiving exercise training and psychoeducational sessions as a cohesive cohort might have fostered motivation for change through shared support for behavior change and psychosocial need fulfillment. This finding contributes to the state of the science regarding CR/SP for women, as it represents the first RCT that examines the effects of a sex-specific CR/SP intervention on QOL outcomes.

Significantly greater reductions in depressive symptoms among women completing the tailored CR/SPP compared with those completing traditional CR/SP were also achieved [15••]. While depressive symptom scores for the traditional group were unchanged over time, the tailored group showed significantly decreased scores from baseline to the 6-month follow-up. Despite the slight rise from CR/SP completion to the 6-month follow-up, depressive symptom scores remained significantly below baseline. To the extent that depression hinders healthy behavior change, the rise in depressive symptoms when the intervention was withdrawn is of concern and warrants further study. The tailored intervention also improved 4 dimensions of health (measured by the SF-36 Health Survey)—vitality, social functioning, general health, and mental health [80]. The traditional CR/SPP produced no change from baseline to completion on the mental health, vitality, and general health SF-36 subscales. Women in the tailored program made greater gains on all subscales than did women in the traditional CR/SPP. Improved perceptions of health in women completing CR/SP might foster their informal endorsement of these programs to women who are ambivalent about attending CR/SP.

The tailored intervention produced significant reductions in high sensitivity C-reactive protein (hsCRP), tumor necrosis factor alpha (TNF-α), interleukin-6 (IL-6), and intracellular adhesion molecule-1 (ICAM-1), while the traditional program led to lower hsCRP and IL-6 only [81]. After CR/SP completion, for the combined study group, hsCRP and TNF-α decreased 40 % from baseline, and IL-6 levels were reduced 55 % with a more modest 15 % reduction in ICAM-1. Both groups lost weight and improved peak exercise capacity and treadmill time after CR/SP whereas only the tailored group improved their lipid profile [81].

This study identified issues that warrant further research. First, younger compared with older women manifested significantly more adverse physiological and psychosocial profiles at baseline [42]. Compared with older women, young women had worse health perceptions, depressive symptoms, anxiety, optimism, and QOL. They were also significantly more dyslipidemic and overweight with more pack years smoked. Second, although the purpose of the trial was to test the efficacy of the intervention rather than examine referral strategies, women who did not participate in CR/SP had numerous system-level and patient-level barriers [17]. Women who were more anxious, who smoked tobacco, and who were separated and divorced, were least likely to attend CR/SP [65]. Yet, compared with traditional CR/SP, the tailored intervention resulted in significantly greater attendance for both the exercise, and the group education sessions, and significantly higher completion rates. The baseline depressive symptom scores were much higher in those who failed to complete CR/SP compared with the completers [15••].

The 2 CR/SP groups of this clinical trial differed along 2 dimensions. First, the tailored intervention comprised an amalgamation of behavior change strategies bundled into 1 program. Unique to this program was the stage-of-change assessment with individualized stage-appropriate feedback

and individualized sessions using motivational interviewing. Second, the social dynamic of the tailored group was altered by the exclusion of men from all sessions. Absent additional research isolating the effects of each facet, the most beneficial ingredients of the intervention are speculative. Whether treatment effects observed would persist beyond 6 months are also unknown. Theoretically-based behavior change strategies and counseling styles may be more effective for women who are ambivalent about adherence to therapeutic regimens. The loss of professional contact after completing CR/SP is then conceivably less detrimental to behavioral and psychological gains achieved during active intervention.

Although not specifically designed for women, a few innovative CR/SPP models have been examined. Home-based models may be an effective and realistic alternative for women with significant barriers to attending structured outpatient programs [82]. A systematic review of 12 RCTs comprising primarily low-risk males found little evidence of a difference in either short-term or long-term outcomes between patients receiving home-based or center-based CR/SP [83•]. Additional research is warranted to determine the long-term effects of home-based programs whether as a supplement or an alternative to center-based programs for women of broad age groups and risk categories for adverse events.

Novel healthcare models using mobile phones, internet, and communication technologies to deliver CR/SP services to patients in their homes are being investigated [84, 85]. An innovative RCT of patients who did not attend CR (30 % women) revealed that a pedometer-based telephone intervention increased self-reported physical activity despite no significant between-group differences in psychosocial status after adjusting for baseline values [86]. Clearly, CR/SP non-participants are open to alternatives to center-based CR/SP. Individually tailored, internet-based, or telephone-based interventions could provide women with tools for setting goals and improving risk factors for CHD through behavioral self-management.

Maintenance of Cardiac Rehabilitation Benefits

The progressive nature of CHD requires persistent management of behavioral risk factors, yet the impact of CR/SP can quickly fade after completion. Notwithstanding the documented effectiveness of CR/SP, sustained improvements are poor and maintenance of behavior change after the intervention is withdrawn has received relatively little attention [87]. A study randomizing CR/SP completers (38 % women) to a cognitive behavioral intervention or usual care found that women were more likely to discontinue exercise than were men [88]. With no between-group differences in exercise behavior, only 29 % of intervention and 27 % of usual care participants met physical activity guidelines at 12 months.

A 6-month telephone-based exercise counseling program compared with usual care targeting maintenance of exercise among CR/SP completers demonstrated no between-group differences at 6 months but significant differences at 12 months largely because exercise declined in the control group [89]. Moreover, only 20 % of participants were women with attrition rates double that of men. These studies convey that even with intervention, there is significant recidivism in exercise and other health behaviors and few women are involved. Maintenance of CR/SPP benefits deserves significantly more attention to determine the appropriate dose and timing of such interventions and the most effective delivery method. Because the transition from center-based CR/SPPs to long-term maintenance in the community is challenging for women, personalized strategies for successful risk factor reduction are needed. Relapse prevention strategies merit exploration because efforts to sustain maintenance of gains achieved in CR/SP have produced less than desired results.

Future Directions

This review highlights the recurring themes of dismal referral and completion rates of women in CR/SP programs, and the underrepresentation of women in CR/SP research. In the current climate of evidence-based practice, it is imperative that research advances are translated into clinical practice for improving secondary prevention for women. Too few women of diverse age and ethnic groups are included in CR/SP studies to adequately determine the effectiveness of particular delivery methods in these underserved groups. Further research with large, diverse samples of women are essential for guiding gender-appropriate referral strategies, effective modifications to traditional center-based CR/SPPs, and the efficacy of alternative CR/SP care models in broader clinical contexts (Table 2).

Traditional CR/SP as currently conceptualized might benefit from a paradigm shift from a classic one-size-fits-all intervention to one congruent with women's environmental, social, and psychological circumstances, and driven by their needs, preferences, values, and priorities. Improved fitness might be the therapeutic goal for some women while weight management and stress reduction are priorities for others. Given that CR/SP programs are comprised largely of men and that women predominate in weight loss interventions, a greater emphasis on weight loss goals might improve participation by women. Women largely control the decision-making power of whether to engage in health behaviors. Until additional research data are available to guide practice, substantial efforts to educate women,

Table 2 Research priorities for cardiac rehabilitation/secondary prevention for women

Conduct scientific research to
• Determine the most effective referral strategies for women while in hospital and during office visits
• Examine the effectiveness of alternative CR/SP formats within center-based programs
• Examine the efficacy of home-based programs for different age groups of women
• Explore the most efficacious components of typically multicomponent CR/SP programs (exercise, education, counseling, social support) for improved physiological and psychosocial outcomes
• Identify the maximum dose of exercise required for eliciting a meaningful change in fitness for women
• Determine the most effective interventions for weight loss in obese and overweight women
• Examine the effects of alternatives to continuous electrocardiogram monitoring for various subgroups of women
• Replicate theoretically-driven sex-specific CR/SP programs for women of diverse ages and cultures
• Determine long-term physiological and psychosocial outcomes of CR/SP
• Investigate the most effective strategies for the maintenance of CR/SP benefits
• Examine the utility of web-based, telephone, mobile phone technologies for delivering CR/SP to subgroups of women

healthcare providers, and the community about the benefits of CR/SP is needed.

While referral to CR/SPPs is the responsibility of the entire health care team, specifying an enthusiastic advocate to champion current practice guidelines is recommended [61••]. Secondary prevention ought to be prescribed as emphatically as evidence-based medications to dispel potential myths that CR/SP is optional for improved health. Misperceptions of CR/SP as predominantly exercise-based programs for men may need to be remedied for women with CHD who are typically obese and sedentary. Women require information and skills in disease self-management that empower them with confidence and self-efficacy after CR completion. The scientific literature documents impressive short-term gains in positive behavior change during CR/SP with far less evidence of sustained maintenance of these behaviors.

Cognitive-behavioral techniques including goal setting, feedback and reinforcement, self-efficacy enhancement, problem solving, relapse prevention, and motivational interviewing predominated in studies of effective behavioral interventions to improve physical activity and dietary habits [90••]. Self-monitoring of food intake and exercise behavior as well as computer-assisted reminders and other electronic communication to support behavior change are also recommended [90••, 91]. However, the optimal number and timing of visits or contact that is necessary to sustain behavior change for specific subgroups is unclear [92•]. A greater understanding of the intrinsic motivations for behavior change (health benefits, satisfaction, and pleasure) vs the extrinsic motivations (following physician advice) in women is vital.

Conclusion

Despite enormous efforts to advance the awareness of CHD in women and the significant health benefits achieved through contemporary center-based CR/SP participation, far less impressive achievements have been made for improving the referral and participation rates of women. The gender-specific barriers to traditional CR/SP participation, including lack of referral, competing family obligations, transportation limitations, psychological distress, and socioeconomic disadvantage are recurring themes in the literature and continue to go relatively unaddressed on a national scale. An urgent need to design, implement, and evaluate effective evidence-based secondary prevention interventions for women continues to exist. Multidisciplinary researchers are urged to examine innovative secondary prevention models of care that are age-appropriate, culturally sensitive, and personalized to women's psychosocial and physiological characteristics. The majority of women not engaged in CR/SP deserve affordable and personalized strategies to achieve the AHA goals of reducing CHD deaths by 20 % by 2020 [19••].

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