

Cardiac Rehabilitation for Women across the Lifespan

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ABSTRACT

Cardiac rehabilitation improves function and compliance, and also reduces morbidity and mortality in female and male cardiovascular disease patients, but remains significantly underutilized. At every age, and especially in their senior years, female cardiovascular disease patients are under-referred relative to men. Lack of standardized referral processes, misconceptions by physicians and patients, and idiosyncrasies of female pathophysiology contribute to this pattern. Moreover, confounding factors of age, socioeconomic status, and sex-specific roles and responsibilities exacerbate the problem. This review summarizes barriers to cardiac rehabilitation for female cardiac patients, and highlights opportunities for increased participation and benefit.

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KEYWORDS: Aging; Cardiac rehabilitation; Cardiovascular disease; Coronary artery disease; Women

While the therapeutic rationale for cardiac rehabilitation is robust, it is commonly omitted from routine cardiovascular care.^{1,2} Cardiac rehabilitation improves aerobic/functional capacity and quality of life³⁻⁵ and decreases morbidity and mortality.^{1,4,6} In its absence, risk factor control and therapeutic compliance are usually less reliable, and sedentary behaviors more entrenched, contributing to the likelihood of worse prognoses over time. Cardiac rehabilitation is underutilized to a greater extent in women than men.^{7,8} This is fundamentally illogical because cardiac rehabilitation benefits both sexes.⁹⁻¹¹ In fact, given the increased longevity of women, as well as sex-specific aspects of cardiovascular disease and lifestyle behaviors, cardiac rehabilitation may provide even greater benefit to women.¹¹ Nonetheless, erroneous assumptions by providers and patients, and limitations in routine management of cardiovascular patients contribute to this common therapeutic omission.¹² This review

outlines key benefits of cardiac rehabilitation, as well as factors that commonly undermine participation.

SEX-SPECIFIC MANAGEMENT COMPLEXITIES

Cardiovascular disease evolves in large part from the insidious effects of cardiac risk factors, especially in context of genetic predisposition and the mounting toll of time. While men and women are both vulnerable, differences in how men and women's risk factors are managed often intensify risks among women. Cholesterol, blood pressure, and other risk factors are rarely treated as aggressively in women as they are in men.^{5,13-16} Part of this pattern relates to a common misperception that women are naturally protected from cardiovascular disease and risk factors by estrogen. However, hormonal cardioprotective benefits erode during menopause.^{17,18} Relative to men, cardiovascular disease in women typically emerges about 10 years later,¹⁹ but given their greater longevity, the cumulative impact of cardiovascular disease among women is ultimately even greater than men (Table 1).^{14,15} Furthermore, while many had once assumed that replacing estrogen during and after menopause could forestall or even eliminate the late surge of cardiovascular disease in women, several landmark trials indicate this is not the case.^{18,20,21} Despite its utility to lower cholesterol,²² hormone replacement therapy does not prevent

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47 cardiovascular disease and may increase morbidity and
48 mortality risks.^{14,18,22,23}

49 Cardiovascular disease diagnosis and care also are often
50 less rigorous and efficient for female patients in comparison
51 with men.^{5,13-16} Symptoms are, for example, relatively more
52 ambiguous, contributing to a pat-
53 tern wherein women are less
54 likely to be referred for assess-
55 ment.²⁴ Moreover, for those
56 women who are assessed, cardio-
57 vascular disease detection is often
58 confounded by idiosyncrasies of
59 female pathophysiology, resulting
60 in greater misdiagnosis.^{25,26}

61 Women also are less likely to
62 receive evidence-based proce-
63 dures and medications, and their
64 outcomes tend to be worse.¹³ Con-
65 sistentlly, fewer women are re-
66 ferred to and enroll in cardiac re-
67 habilitation, and for those who do
68 enroll, attrition is high.^{4,27} Such
69 dynamics are often further com-
70 pounded by age-related frailties,
71 socioeconomic constriction, and
72 transportation challenges that commonly correspond to
73 sex.¹⁴ For reasons that tend to compound one another, it is
74 often assumed that cardiac rehabilitation is not worth the
75 trouble for female patients.

76 Nevertheless, coronary heart disease is highly prevalent
77 among women and men, and prevalence in women eventu-
78 ally surpasses men due to their relatively greater longev-
79 ity.^{14,19} Cardiac rehabilitation moderates pathophysiology
80 and sequelae of coronary heart disease, in addition to the
81 destabilizing effects it has on other age-related infirmities
82 that are pervasive in the older coronary heart disease pop-
83 ulation. Furthermore, cardiac rehabilitation may be uniquely
84 beneficial for women in addressing cardiovascular disease

CLINICAL SIGNIFICANCE

- Cardiovascular disease is the leading cause of death among women in the US.
- Although cardiac rehabilitation is recommended for cardiac patients following a cardiovascular event or procedure, it remains an underutilized therapy for both men and women.
- Women are significantly under-referred for cardiac rehabilitation when compared with men; an issue compounded by age, race, and socioeconomic status.

processes that are relatively more common in women than
men. Microvascular myocardial ischemia exemplifies a dis-
ease that is more frequent among women, and which is not
ameliorated by revascularization (Figure 1).^{26,28} As a rig-
orous, structured program that fosters exercise, proper med-

ication use, and healthful lifestyle,
cardiac rehabilitation provides a
therapeutic opportunity that fills a
therapeutic gap.

Takotsubo cardiomyopathy and
heart failure with preserved ejection
fraction also are more likely to oc-
cur among women.^{29,30} In each in-
stance, cardiac rehabilitation pro-
vides therapeutic utility, that is, it
constitutes a means to moderate
pathophysiological and lifestyle
factors that contribute to these sex-
specific disease patterns.

PHYSIOLOGICAL BENEFITS

Whereas many precepts of cardio-
vascular care had once centered
on the assumption that revascular-

ization was the crux of therapy, greater emphasis is now
placed on the biological foundation of the disease irrespec-
tive of revascularization. In this context, cardiac rehabilita-
tion has evolved from its original iteration as a program that
facilitated a patient's safe mobilization after sustaining an
acute myocardial infarction or undergoing coronary artery
bypass surgery, to a program that targets steps to signifi-
cantly modify the biological and behavioral underpinnings
of cardiovascular disease.

Cardiac risk factors constitute the key elements predis-
posing patients to the pathophysiology of atherosclerosis
and other dimensions of cardiovascular disease. Left uncon-
trolled, risk factors predispose cardiovascular patients to
recurrent events and re-hospitalization, irrespective of re-
vascularization. Hyperlipidemia, diabetes, hypertension, to-
bacco abuse, and other risk factors impart harmful effects in
women and men, with no justification to treat risk factors
differently according to sex.^{13,14} Nonetheless, multiple stud-
ies demonstrate relative undertreatment of risk factors in
women.^{13,31,32} Cardiac rehabilitation affords opportunities
to modify risk factors in a systematic manner, improving
endothelial health and other critical aspects of healthful
physiology that serve to mitigate atherosclerosis and im-
prove cardiovascular stability (Table 2).

While only some risk factors tend to be conceptualized
as modifiable (ie, diabetes, hypertension, smoking), even
the so-called nonmodifiable risk factors (age, sex, family
history) can be improved with healthful lifestyle choices.
Exercise, diet, and socialization are among the elements that
can help mitigate many of the so-called inexorable effects of
aging. However, men and women of all ages can potentially
benefit from cardiac rehabilitation: younger adults with ed-

Table 1 CDC Heart Disease Facts for Women in the US

Heart disease is the leading cause of death for women in the US.
Of all deaths among women in 2006, more than 1 in every 4 died from heart disease.
Approximately the same amount of women die each year from heart disease when compared with men.
In a 2005 survey, 36% of women did not perceive themselves at risk for heart disease.
In 2006, about 6.9% of all white women, 8.8% of black women, and 6.6% of Mexican American women were living with coronary heart disease.
Almost two thirds of the women who die suddenly of coronary heart disease have no previous symptoms.

CDC = Centers for Disease Control and Prevention. Modified from the CDC Women and Heart Disease Fact Sheet: http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_women_heart.htm.²⁵

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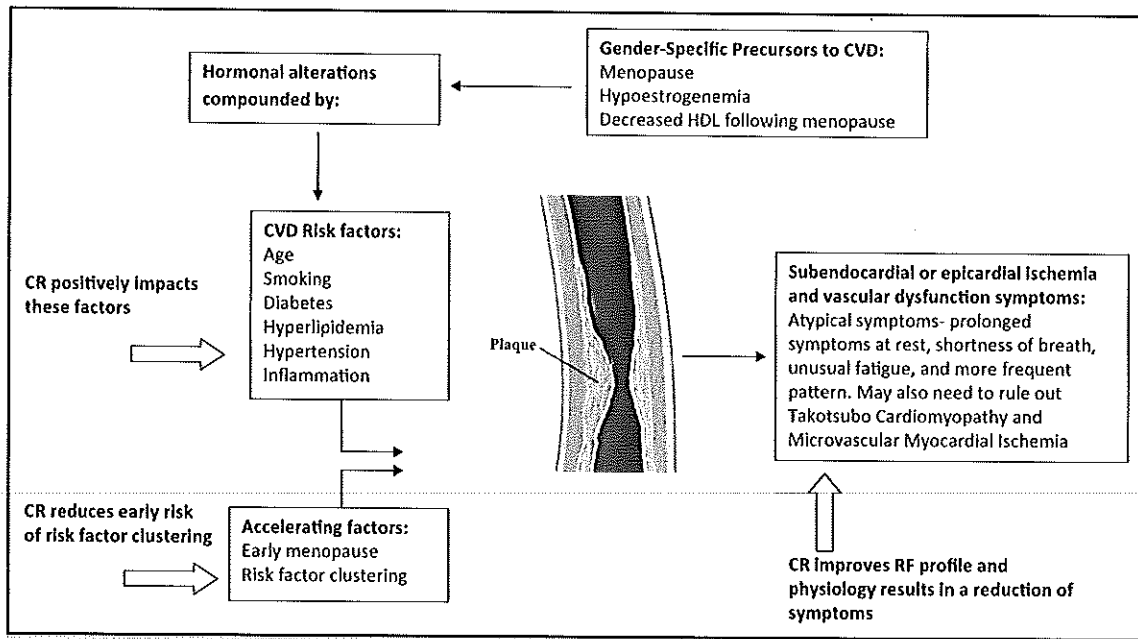


Figure 1 Model of microvascular disease in women. CVD = cardiovascular disease; CR = cardiac rehabilitation; HDL = high-density lipoprotein; RF = risk factor.

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education and training to modulate risk factors, middle-aged adults with reduced progression of cardiovascular disease, and older adults with strategies to moderate disease as well as vulnerabilities to frailty and functional limitation.

Women are particularly likely to benefit as they advance from middle age to older years. Younger women tend to have higher levels of protective high-density lipoprotein (HDL) cholesterol than men, due in part to the beneficial effects of estrogen. However, after menopause, HDL cholesterol significantly decreases in women, and its cardioprotective effects diminish. Independent of the shifts in HDL, low-density lipoprotein (LDL) levels often remain lower in women than men at any age.³³⁻³⁵ Based on these differences in LDL, many women do not qualify for statin therapy based on traditional National Cholesterol Education Program treatment cutpoints.³⁶

Nonetheless, most acute myocardial infarction and other cardiovascular instability occur in women whose LDL cholesterol falls within the bounds of what the National Cholesterol Education Program considered a "normal range."¹⁴ Related research highlights utility of the ratio of total cholesterol to HDL as a better means to assess lipid-based risk in women.^{14,37} Likewise, markers of inflammation such as high-sensitivity C-reactive protein³⁸ better distinguish risk in women. Amidst these progressing insights, the Heart Protection Study showed significant mortality and morbidity benefits with use of simvastatin, including those with LDL below 100 mg/dL.³⁹ Cardiac rehabilitation promulgates expanded perspectives on cholesterol management, educating patients, and serving as an educational resource for referring physicians, expanding emphasis on LDL management, and helping to invigorate compliance.

Cardiac rehabilitation also fosters improved exercise capacity.^{11,14,16} Such functional gains not only reinforce capacity to moderate risk factors, but also to directly improve cardiovascular physiology.^{5,16} Both aerobic and strength capacities contribute to cardiovascular well-being^{16,40,41} with associated benefits including reduced inflammation, improved autonomic balance, increased insulin sensitivity, increased metabolic rate, and many other components of healthy cardiovascular physiology.^{28,42,43}

Exercise therapy is rarely straightforward. Initial training goals are typically complicated by deconditioning, as well as frequent behavioral inertia. Many adults, and particularly older women, lack ingrained exercise behavior as a part of routine self-care. Cardiac rehabilitation provides a critical aspect of monitoring and education as exercise commences and advances, and serves as a key mechanism for safety and long-term adherence (Table 3).

Frailty is a related concept. Older adults with frailty are inherently susceptible to worse outcomes once cardiovascular disease occurs.⁴² Cardiac rehabilitation provides opportunity to implement exercise therapy and risk factor modification that can interrupt and possibly even reverse this typical progression and clinical decline. For a frail adult, even minimal exercise routines (eg, walking or stretching) are often tantamount to high exercise intensity; cardiac rehabilitation provides critical supervision and teaching of both aerobic and strengthening exercises that provide substantial benefit.⁵ Notably, even small increases in functional capacity after cardiac rehabilitation participation decrease cardiovascular mortality and morbidity.¹⁶ In fact, studies show 13% mortality reduction per metabolic equivalent increase in functional capacity.⁴⁴

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Table 2 Benefits of Cardiac Rehabilitation for Women

161
162
163 Physiological
164 Risk Factor Modification
165 Enhanced blood glucose regulation
166 Improved blood pressure control
167 Weight reduction
168 Improved blood lipids
169 Smoking cessation
170 Decrease hospitalization and recurrent events
171 Increased overall functional capacity including:
172 Strength
173 Aerobic capacity
174 Balance
175 Flexibility
176 Increased bone density
177 Maintained autonomic control during menopause
178 Improved endothelial function
179 Decrease markers of inflammation
180 Medication management
181 Decreased frailty
182 Decreased pain
183 Psychological
184 Risk factor education and awareness
185 Improved perceptions of health and health outcomes
186 Decreased anxiety and depression
187 Enhanced vitality
188 Self-efficacy development
189 Increased quality of life
190 Feelings of social inclusion
191 Formation of meaningful relationships
192 Development of social and support network

PSYCHOLOGICAL BENEFITS

195 Alongside physiological risks, psychological distress is
196 significant in the etiology and prognosis of cardiovascu-
197 lar disease.⁴⁵⁻⁴⁷ Men and women have historically ex-
198 pressed fears and apprehension differently from one an-
199 other, and the impact of affect on cardiovascular disease
200 may be greater in women than men.^{48,49} Participation in
201 cardiac rehabilitation has been shown to significantly
202 decrease anxiety among women, and increase their over-
203 all quality of life (Table 2).^{5,11} Likewise, cardiac reha-
204 bilitation reduces depression and depression-related mor-
205 tality.^{45,47} Patient-centered treatment used in cardiac
206 rehabilitation programs helps improve women's percep-
207 tions of health, identify specific fears or habits, and create
208 individualized management plans.⁵⁰
209 Social deprivation has been labeled as one of the greatest
210 determinants of risk,⁴ even to the point of superseding
211 traditional cardiac risk factors,¹⁴ and cardiac rehabilitation
212 responds to this need. Women report feelings of social
213 inclusion during cardiac rehabilitation, and ascribe high
214 value to the relationships they develop with staff and other
215 participants.⁵¹ While some institutions are studying the util-
216 ity of computerized networking and telephone systems to
217 recreate some aspects of cardiac rehabilitation monitoring

and feedback at less cost, the fact that so many patients
value cardiac rehabilitation's social dimensions needs to be
preserved as an essential component of care.

Research has shown that women, in particular, are often
reluctant to engage in cardiac rehabilitation programs due to
feelings of embarrassment, insecurities of body image, lack
of exercise experience, presence of comorbidities, or just
old age.^{4,12} Additionally, studies have shown that women
frequently have less self-efficacy with regard to exercise,
decreased tolerance for physical activity, and reluctance to
exercise to the point of pain or fatigue.^{4,12} Cardiac rehabil-
itation provides opportunity to overcome these apprehen-
sions and cultivate durable exercise behaviors.

CONTEMPORARY BARRIERS TO CARE

Physician Barriers

Although many physicians understand and appreciate the
benefits of cardiac rehabilitation, few understand, despite
overwhelming evidence, that more women die from cardio-
vascular disease each year than men.^{31,32} Other studies
demonstrate that physicians often misunderstand cardiovas-
cular disease risks in women, and that this corresponds with
poor referral to cardiac rehabilitation. Furthermore, many
providers assign a lower level of risk to their female pa-
tients, and omit the most appropriate treatments, including
referral to cardiac rehabilitation.^{31,32} This is particularly
unfortunate as many studies have shown that the physician's

Table 3 Exercise Prescription for Women in a Typical 12-
week Cardiac Rehabilitation Program

Aerobic activity
Exercise mode utilizes large muscle groups
Treadmill, lower extremity ergometry, elliptical, etc.
5-10 minute warm-up session
Conducted to gradually increase the heart rate into the
target heart rate range and warm up the muscles
Training goal is 30-45 minutes of aerobic activity, either
continuous or in 10-minute bouts, at the target heart rate
range
For those with significantly reduced capacity, exercise is
maintained for as long as tolerable, with several minutes
of rest between each attempt
5-10 minute cool-down session
A low-intensity exercise to gradually recover from the
exercise session
Stretching exercises with a focus on proper technique and
breathing
Strength training
Strength training sessions 2 times per week
Exercises include 8-12 repetitions of 8-10 different
exercises using available equipment (cable systems,
dumbbells, ankle weights, etc.) or simple body weight for
those who cannot endure additional weight

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218 endorsement of cardiac rehabilitation is a significant predic- 218
 219 tor of female participation.^{4,12} 219
 220

221 **Patient Barriers**

222 Women also frequently demonstrate misunderstanding of 222
 223 cardiovascular disease and risk factors.¹² The misperception 223
 224 that women are naturally protected from cardiovascular 224
 225 disease is widespread, even among older women who are 225
 226 aware of other liabilities (such as osteoporosis) associated 226
 227 with eroding estrogen effects. Even while the American 227
 228 Heart Association's Go Red for Women Campaign has 228
 229 made great strides in educating patients and health care 229
 230 providers about the fact that cardiovascular disease is a 230
 231 reality for women, few women understand the implications 231
 232 of their own risk factors and the related vulnerability to 232
 233 disease. Ironically, breast cancer continues to command 233
 234 such disproportionate attention as a women's health prior- 234
 235 ity, while cardiovascular disease mortality in women is 235
 236 10-fold that of cancer, with persistent omissions of care that 236
 237 could potentially mitigate cardiovascular disease risks.¹⁶ 237

238 Unfortunately, many social and cultural facets tend to 238
 239 contribute to these patterns of incomplete care. Women 239
 240 more often leave their appointments or the hospital without 240
 241 a meaningful understanding of their health outcomes or 241
 242 treatment options.^{4,52} Not only are exchanges with provid- 242
 243 ers foreshortened by time constraints, but it has been re- 243
 244 peatedly demonstrated that, compared with men, women 244
 245 find it more difficult to ask questions and advocate on their 245
 246 own behalf, undercutting critical opportunities for learning 246
 247 and intervention.⁵³⁻⁵⁵ 247

248 Furthermore, because cardiovascular disease tends to oc- 248
 249 cur as part of a continuum of aging among women (as 249
 250 compared with the more precipitous nature of cardiovascu- 250
 251 lar disease among middle-aged men), many merely ascribe 251
 252 their cardiovascular problems to old age and assume treat- 252
 253 ment is unnecessary. 253
 254

255 **Lack of a Standardized Referral Process**

256 Due to the lack of structured referral processes, most cardiac 256
 257 patients are discharged from hospitals without a meaningful 257
 258 understanding of the options for and benefits of attending a 258
 259 cardiac rehabilitation program.^{12,52} Cardiac rehabilitation 259
 260 originally included a Phase I component, that is, an in- 260
 261 patient program that mobilized patients from bed and also 261
 262 emphasized education and training goals that facilitated 262
 263 transition to home as well as to outpatient cardiac rehabil- 263
 264 itation (where training, education, and social support con- 264
 265 tinued). However, over the past 5 years, Phase I cardiac 265
 266 rehabilitation has withered amidst progressively abbreviated 266
 267 hospitalizations and ever-increasing discharge complexities. 267
 268 Discharge is now usually formulated among hospitalist phy- 268
 269 sicians, primary care providers, physician assistants, medi- 269
 270 cal trainees, nurses, physical therapists, and nutritionists, 270
 271 with planning that is often experienced as disjointed and 271
 272 confusing. Whereas many assume that Phase I cardiac re- 272
 273 habilitation is less important due to advances in surgery, 273
 274

218 interventions, and medications that stabilize patients more 218
 219 quickly, its omission undercuts a critical opportunity for 219
 220 initiating risk-factor modification, exercise training, and 220
 221 coordination of care. Standardization of cardiac rehabilita- 221
 222 tion referral may help restore key elements of excellent 222
 223 care, minimize rehospitalization, and improve patient 223
 224 satisfaction. 224

225 Installation of automatic referral policies and use of 225
 226 automated telephone calls following discharge have been 226
 227 proposed, as well as the requirement of physicians to doc- 227
 228 ument an explanation in the absence of referral.^{4,12} Still, 228
 229 these issues remain confounded by business complexities of 229
 230 American health care and the metrics by which quality care 230
 231 is defined. As illogical as it may seem, cardiac rehabilitation 231
 232 is not considered essential. While use of beta-blockers or 232
 233 other therapies are required components in the care of acute 233
 234 myocardial infarction, implementation of cardiac rehabili- 234
 235 tation is far more variable and personal. 235
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237 **Disparities of Care**

238 Health care disparities are commonly conceptualized in 238
 239 terms of race and socioeconomic barriers, but decreased 239
 240 rates of cardiac rehabilitation referral highlight disparity 240
 241 relative to sex. Gaps of care are compounded by sex com- 241
 242 bined with race and socioeconomic impediments.^{1,10,52} 242
 243 White women, for example, are twice as likely to receive a 243
 244 referral as non-Whites, and significantly more likely to be 244
 245 referred than Hispanic female patients.^{1,4,10} 245

246 Low socioeconomic status and level of education overlap 246
 247 with the issues of racial disparities with respect to finances 247
 248 and education, and exacerbate issues of under-referral in 248
 249 otherwise eligible patients.^{1,10,12,52,56} Women are more fre- 249
 250 quently faced with conflicting financial priorities, and are 250
 251 therefore unable or unwilling to allocate limited financial 251
 252 resources to cardiac rehabilitation (eg, copayments, trans- 252
 253 portation) over other expenses.^{4,12,56} Women earning under 253
 254 \$20,000 per year are significantly less likely to receive a 254
 255 referral or enroll than women with a greater income, even 255
 256 when controlling for age and education.^{4,10} 256
 257

258 While the earliest cardiac rehabilitation literature in the 258
 259 1960s was oriented toward men as a means to facilitate 259
 260 return to the male-dominated workplace of those times,⁵⁷ 260
 261 women are now more often in the workforce and potentially 261
 262 the primary financial provider for their family.⁵⁸ Rather than 262
 263 addressing these contemporary pressures, cardiac rehabili- 263
 264 tation is more often dismissed by patients and health care 264
 265 providers as a low priority relative to work and additional 265
 266 caregiving responsibilities to spouses, children, or grand- 266
 267 children. Nonparticipation among women is aggravated by 267
 268 sex-specific feelings of guilt that many experience if they 268
 269 put issues of their own health before the needs of their 269
 270 family.^{4,12} Furthermore, because women often outlive their 270
 271 spouse, they are more likely to become dependent upon 271
 272 their adult children, and many are reluctant to burden them 272
 273 with transportation needs required for their participation in 273
 274 most cardiac rehabilitation programs. 274

FUTURE RECOMMENDATIONS

Based on its efficacy and safety, the American College of Cardiology and American Heart Association have made cardiac rehabilitation a Class I recommendation for cardiac patients.⁴ Yet, underuse of this vital therapy remains a glaring discrepancy, particularly in women.

Improving physician understanding and assessment of cardiovascular disease risk in women through educational opportunities and guideline awareness may help alleviate this difference. Furthermore, utility of wellness behaviors can be better promulgated for all patients, including those who are at low risk; that is, providing low-risk patients with the knowledge and tools necessary to maintain a healthy lifestyle across the lifespan could significantly reduce disease risk and prolong independence with advanced age.³²

In conclusion, cardiac rehabilitation is the standard of care for cardiac patients, and this standard should be upheld for all women at risk for or diagnosed with cardiovascular disease, regardless of age, race, or socioeconomic status. More research is needed on the potential to increase female participation in cardiac rehabilitation by leveraging custom-tailored programming to address the unique physical and psychological factors that affect prospective participants.

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