Gender Differences in Cardiac Rehabilitation Outcomes: Do Women Benefit Equally in Psychological Health?

Jürgen Barth, Ph.D.,* Andreas Volz, B.S.,* Jean-Paul Schmid, M.D., Sonja Kohls, Ph.D., Roland von Känel, M.D., Hansjörg Znoj, Ph.D., and Hugo Saner, M.D.

Abstract

Background: Psychological factors are important in the etiology and prognosis of coronary heart disease (CHD). Cardiac rehabilitation (CR) aims to reduce psychological distress, besides other somatic risk factors. Studies have shown that CR is effective in reducing psychological distress, but little is known about gender-specific outcome differences. Our objective was to examine whether women and men benefit equally from outpatient CR in terms of reduction in psychological distress and whether women show more impaired psychological health at baseline of CR than do men.

Methods: We enrolled 441 CHD patients (mean age 58 ± 11 years, 79.8% men) who underwent a 12-week outpatient CR program. Psychological dimensions, namely, anxiety, depression, vital exhaustion, social inhibition, and negative affect, were assessed at baseline and post-CR. Multivariate analysis of variance (MANOVA), controlling for age, disease severity, and exercise capacity, was applied to test for gender-specific differences at baseline and change between baseline and post-CR. In addition, gender-specific effect sizes were calculated for the change on psychological dimensions.

Results: Women and men did not differ on any psychological measure at baseline of CR. The effect sizes show small to moderate treatment effects on the psychological dimensions assessed. Gender had a significant impact on change on the dimensions vital exhaustion (F = 5.040, df = 1, p < 0.05) and social inhibition (F = 5.74, df = 1, p < 0.05). Women showed larger change on social inhibition and smaller change on vital exhaustion than men.

Conclusions: Women and men do not differ in the extent of psychological distress at baseline of CR, which could be explained also by the exclusion of highly distressed women from treatment. CR is less effective among women with regard to vital exhaustion and more effective with regard to social inhibition compared with men in a sample of low distressed patients.

Introduction

Cardiovascular diseases (CVD), especially chronic heart disease (CHD), are the leading cause of death in women and men, accounting for 30% of all deaths worldwide.† Barring important behavioral and medical risk factors, such as smoking, dyslipidemia, hypertension, diabetes, or obesity, the impact of psychological distress on the etiology and prognosis of CHD has been demonstrated in numerous studies. The empirical evidence is particularly strong for depression, vital exhaustion, anxiety, and type D personality characteristics, namely, social inhibition (SI) and negative affect (NA).§ Cardiac rehabilitation (CR) is, therefore, intended not only to change behavioral patterns and medical risk factors of CVD but also to reduce psychological distress. Studies have shown varying results for the efficacy of CR in reducing psychological distress, but overall the meta-analysis of Duseldorp et al.‖ provided evidence for CR to be efficacious in terms of changing lifestyle, psychosocial functioning, and somatic parameters in CHD patients.

There is an abundance of evidence supporting the differences in the development and course of CHD between men and women, as well as the variation in the efficacy of CR. The incidence of CHD is three to four times higher for men than for...
women in developed countries. Although the incidence of CHD is much higher among men, women with CHD have a higher mortality rate, as well as more medical and mental comorbidities (e.g., depression). The higher incidence rates of CHD among males explain why CR patients are also predominantly men. Moreover, some studies have shown that females with CHD are less likely to be enrolled in CR programs after a cardiac event than their male counterparts, especially in outpatient CR. Lastly, female patients received less aggressive treatment than males with a diagnosis of CHD.

Studies on CR programs with explicit psychological treatment are scarce, and more importantly, results are inconsistent. Some authors found lower effects of CR programs for women than for men on psychological outcomes. This provided a main argument why women did not obtain equal mortality benefits from psychological treatments in CR in the long term. Consequently, it has been proposed that CR programs especially tailored to address the psychological and social needs of women would be necessary to improve the outcome among women with CHD. However, only some randomized controlled CR trials with gender-specific intervention showed better outcomes in general compared with treatments without this specification. In contrast to this, some authors reached the conclusion of general comparable efficacy of CR across gender or even higher efficacy for women than for men. Therefore, the debate continues about which treatment options might specifically fit women’s needs to improve clinical outcomes and decrease mortality.

Given the present inconsistency of CR effects on psychological distress in men and women, we aimed to study differences in psychological health between men and women before CR. We further explored the benefits of CR in reducing psychological distress in men and women after CHD. As different effects can vary by age and health status, we controlled for these variables in this study.

Materials and Methods

Patients and recruitment

The study protocol was approved by the ethical committee of the State of Bern, Switzerland. All patients provided written informed consent at study entry. Patients included in the analysis are part of the ongoing longitudinal Swiss Heart and Mind Study (SHMS). All patients attended a 12-week comprehensive outpatient CR program tailored to CHD patients and conducted according to the European guidelines for CR. Patients were referred to the program 2-4 weeks after an acute coronary event, cardiac decompensation, percutaneous intervention, or heart surgery. A brief description of the program is provided. Demographic variables (gender, age) and medical history (severity of disease, risk factor profile, ejection fraction) were assessed at baseline. Physical parameters (body mass index [BMI], exercise capacity, blood pressure, and heart rate) and psychological measures were assessed at baseline and post-CR. Inclusion criteria for this study were all consecutive cases with an indication for CR and fully completed psychological questionnaires at baseline and post-CR. From a total number of 499 screened patients, 441 patients fulfilled the inclusion criteria and were analyzed.

Cardiac rehabilitation program

Patients attended a standard outpatient CR program three times a week for a period of 12 weeks. Exercise training was composed mainly of aerobic endurance training but also included resistance exercises and relaxation sessions. Each training comprised two 45-minute sessions, designed to achieve twice the training heart rate at the predetermined exercise intensity for about 30 minutes (60%-85% of peak heart rate during a maximal exercise stress test). During 12 educational sessions, patients learned about heart disease-related issues (e.g., medication, risk factors, and etiology of the disease), role change, and coping strategies. Special emphasis was given to dietary counseling and stress management. After screening for psychological distress, if necessary, patients were offered psychosocial support by a psychologist. The psychological interventions were done in a single setting and based on cognitive-behavioral therapy strategies. The number of sessions varied among patients depending on the amount of psychological distress and personal needs. If necessary, smoking cessation intervention was offered by a specialist health professional.

Assessment of exercise capacity and ejection fraction

Exercise capacity. Exercise capacity was determined during a symptom-limited exercise stress test, which was performed using an upright computer-controlled, rotational speed-independent stationary bicycle (Ergometrics 800S, Ergoline GmbH, Bitz, Germany). A 3-minute warmup phase, during which patients cycled without workload, was followed by an increase of the workload with either 10, 15, or 20 W/minute, using a ramp protocol. The protocol was chosen in order to reach the maximal exercise capacity at a test duration between 8 and 12 minutes. A 12-lead ECG was always recorded, and blood pressure was measured every 2 minutes.

Ejection fraction. Ejection fraction was determined by ventriculography during a diagnostic coronary angiography or by echocardiography.

Psychological measures

The psychological measures were selected according to their prognostic relevance in cardiac patients. Type D personality (a combination of NA and SI), depression, and vital exhaustion were found to be predictive for morbidity and mortality in CHD patients. Whereas anxiety, depression, and vital exhaustion vary over time, type D was conceptualized more as a trait.

Negative affect and social inhibition. To assess NA and SI, the German version of the Standard Assessment of negative affectivity, social inhibition, and type D personality, the DS 14, a standardized self-report instrument, was applied. For 14 items, subjects rated their personality on a 5-point Likert scale ranging from 0, totally disagree, to 4, totally agree. The 7-item subscales for NA and SI yielded a score of 0-28 points each. Patients who scored >10 on both scales were classified as type D personality. The DS 14 is a reliable and valid measure for assessing NA and SI in cardiac patients (Cronbach's alpha = 0.86-0.87) with moderate stability over time.
Anxiety and depression. Symptoms of depression and anxiety were assessed by the German version\(^\text{26}\) of the 14-item self-report Hospital Anxiety and Depression Scale (HADS).\(^\text{29}\) Each item is rated on a 4-point Likert scale (range from 0, mostly, to 3, not at all). The 7-item subscales for anxiety and depression yield a score of 0–21 points each. The level of anxiety and depressive symptoms is interpreted as normal (0–7 points), mild (8–10 points), moderate (11–14 points), or severe (15–21 points). The HADS has been used extensively in various cardiac populations\(^\text{30}\) and is a valid screening tool to detect anxiety and depressive disorders in cardiac patients.

Exhaustion. In order to assess feelings of psychological (not physical) exhaustion, the German version\(^\text{31}\) of the 9-item short form of the Maastricht Vital Exhaustion Questionnaire (MVEQ)\(^\text{32}\) was applied. Undue fatigue, trouble falling asleep, waking up at night, general malaise, apathy, irritability, loss of energy, demoralization, and waking up exhausted are symptoms covered by this questionnaire. Each item is rated with 0 (no), 1 (don’t know), or 2 (yes) points, giving rise to a total exhaustion score between 0 and 18. Over the last 20 years, the construct of vital exhaustion has been proved to be a reliable precursor of different manifestations of CHD.\(^\text{3}\) The German version of the MVEQ was validated and demonstrated strong reliability (Cronbach’s alpha = 0.78) in assessing feelings of vital exhaustion.\(^\text{27,33}\)

Data analyses

Data were analyzed using SPSS (version 15.0) statistical software package (Chicago, IL). Differences in psychological measures at baseline were analyzed by multivariate analysis of variance (MANOVA), with gender as the independent variable, controlled for age, ejection fraction, and observed exercise capacity as percentage of the expected exercise capacity, standardized for gender and age.\(^\text{34}\) To analyze the general efficacy of the CR, effect sizes (Cohen’s \(d\)) were calculated.\(^\text{35}\)

To analyze the impact of gender on the change of the assessed psychological variables from entry to discharge of CR, a univariate analysis of variance (ANCOVA) was applied. Homogeneity of the variances was tested by Levene tests demonstrating nonsignificant results for all psychological measures. This indicates that homogeneity of variances was given. Normal distribution could not be approved for any of the psychometric scales, but because of the large sample size, this statistical prerequisite is not unconditionally necessary to use the ANCOVA procedure.\(^\text{36}\) The ANCOVA was controlled for age, ejection fraction, and observed exercise capacity as percentage of the expected exercise capacity. In addition, the baseline value of each measure was added as a covariate. Results

Women comprised 20.2\% (89 of 441) of the sample. Women and men did not differ in age, ejection fraction, or BMI and were equally likely to be smokers (Table 1). Significantly higher mean values were measured for male exercise capacity compared with female exercise capacity (\(t(438) = 9.89, p < 0.001\)). In addition, differences were observed for the percentage of the predicted gender-specific and age-specific exercise capacity between men and women (\(t(439) = 2.06,\))

Table 2. Psychological Measures at Baseline Grouped by Gender\(^a\)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Women ((n = 89))</th>
<th>Men ((n = 352))</th>
<th>(F) Value</th>
<th>(p) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative affect DS 14 NA(^b)</td>
<td>9.5 (5.7)</td>
<td>9.0 (5.0)</td>
<td>0–28</td>
<td>0.45</td>
</tr>
<tr>
<td>Social inhibition DS 14 SI</td>
<td>9.2 (5.9)</td>
<td>9.5 (5.5)</td>
<td>0–28</td>
<td>0.35</td>
</tr>
<tr>
<td>HADS depression</td>
<td>3.6 (3.0)</td>
<td>3.9 (3.5)</td>
<td>0–21</td>
<td>1.12</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>5.2 (3.8)</td>
<td>5.0 (3.8)</td>
<td>0–21</td>
<td>0.146</td>
</tr>
<tr>
<td>Vital exhaustion MVEQ</td>
<td>7.8 (5.0)</td>
<td>6.6 (4.9)</td>
<td>0–18</td>
<td>2.83</td>
</tr>
</tbody>
</table>

\(^a\)Analyses controlled for age, ejection fraction, and exercise capacity \((n = 441)\).
\(^b\)DS 14 NA, negative affect; DS 14 SI, social inhibition; HADS, Hospital Anxiety and Depression scale, depression subscale; HADS, anxiety subscale; MVEQ, Maastricht Vital Exhaustion Questionnaire.
Table 3. Pre-CR and Post-CR Effect Sizes (d) for Five Psychometric Tests, Grouped by Gender (n = 441)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Women (n = 89)</th>
<th>Men (n = 352)</th>
<th>Total (n = 441)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative affect DS 14 NA</td>
<td>0.22</td>
<td>0.11</td>
<td>0.13</td>
</tr>
<tr>
<td>Social inhibition DS 14 SI</td>
<td>0.19</td>
<td>0.07</td>
<td>0.09</td>
</tr>
<tr>
<td>HADS depression</td>
<td>0.14</td>
<td>0.21</td>
<td>0.20</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>0.17</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Vital exhaustion MVEQ</td>
<td>0.32</td>
<td>0.41</td>
<td>0.39</td>
</tr>
</tbody>
</table>

aDS 14 NA, negative affect; DS14 SI, social inhibition; HADS, Hospital Anxiety and Depression scale, depression subscale; HADS anxiety subscale; MVEQ, Maastricht Vital Exhaustion Questionnaire.

Table 4. Psychological Measures at Discharge Grouped by Gender

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Women (n = 89)</th>
<th>Men (n = 352)</th>
<th>F Value</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative affect DS 14 NA</td>
<td>8.2</td>
<td>8.5</td>
<td>2.31</td>
<td>0.129</td>
</tr>
<tr>
<td>Social inhibition DS 14 SI</td>
<td>8.0</td>
<td>9.1</td>
<td>5.74</td>
<td>0.017</td>
</tr>
<tr>
<td>HADS depression</td>
<td>3.1</td>
<td>3.1</td>
<td>0.23</td>
<td>0.626</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>4.5</td>
<td>4.2</td>
<td>0.09</td>
<td>0.761</td>
</tr>
<tr>
<td>Vital exhaustion MVEQ</td>
<td>6.1</td>
<td>4.5</td>
<td>5.04</td>
<td>0.025</td>
</tr>
</tbody>
</table>

aAnalyses controlled for, age, ejection fraction, and exercise capacity (n = 441). Baseline values of each psychological measure were added as covariate for each ANCOVA separately.

bDS 14 NA, negative affect; DS14 SI, social inhibition; HADS, Hospital Anxiety and Depression scale, depression subscale; HADS anxiety subscale; MVEQ, Maastricht Vital Exhaustion Questionnaire.

Discussion

Our study investigated differences in psychological distress among men and women before CR and gender-specific benefits of CR in improving psychological health. In contrast to other studies, our sample showed no gender differences on psychological measures at baseline. The absence of missing gender differences at baseline is unexpected and might be explained by specific sample characteristics. Besides the low levels of psychological distress for both genders, the female patients in our sample are considerably younger than was expected, and there was no age difference between men and women in our sample. This is also unanticipated, as women normally develop CHD between 4 and 8 years later than men.

A second unexpected result was the low level of psychological distress in the total sample compared with the level in CHD patients in general. This lower level of psychological distress could also account for the overall small to moderate efficacy of the CR with regard to the reduction of psychological distress. The treatment effects range from d = 0.08 (SI) to d = 0.39 (vital exhaustion) and are, therefore, smaller than, for example, the results of Linden et al.’s meta-analysis, which showed a general efficacy of CR to reduce psychological distress from d = 0.19 for SI and d = 0.70–0.80 for vital exhaustion.

Overall, our study demonstrated similar effects of CR between genders. For the psychological variables depression, anxiety, and NA, no differences in the improvement from study entry to discharge were found between men and women. These equal effects are in contrast especially with earlier research from randomized controlled trials in patients with psychological distress at the beginning of CR. These studies showed no or even negative intervention effects for women if hard end points, such as mortality, were analyzed. As a consequence, CR intervention programs specifically for female patients were developed and proved to be...
efficacious in reduction of psychological distress and mortality. However, these studies included only women; therefore, no gender-specific conclusions on the efficacy of such programs can be drawn. Further research is warranted to prove the superiority of gender-specific intervention programs in CR. Our study, therefore, replicates the results of studies with unselected regular patients in CR that showed comparable results for both men and women.

Our results might be biased because of referral procedures and self-selection biases before CR. It is well known that older women have a smaller chance of being referred to an outpatient CR program. This might be due to lower degrees of functional capacities, which are necessary for exercise-based therapeutic approaches. On the other hand, women mention problems with transportation, family responsibilities, and experiencing exercise in the CR as tiring or painful. These factors lower motivation for women to participate in CR and are important barriers to participation. Another self-selection bias might be a result of exclusion of highly psychologically distressed patients. Either they decided not to participate or did not complete the program and were, therefore, not included in our study. Participation and adherence in CR programs are known to decline with age and increasing psychological distress. This effect is even stronger for CR programs with the focus on physical exercise.

We found differential effects of CR for vital exhaustion and SI that require explanation and further exploration in other studies. Women profit less from CR with regard to the reduction of vital exhaustion and more with regard to the reduction of SI. The smaller effects in vital exhaustion for women might be explained by higher levels of vital exhaustion for women in the general population. Furthermore, women in outpatient CR often still take care of the household while attending CR, which leads to a higher workload. Therefore, women still might feel fairly exhausted compared with men, who normally do not continue with their work while recovering from cardiac events. A practical suggestion could be to increase cooperation with the families of women with CHD to reduce the household workload while the patient attends an outpatient CR program. To improve the effects of CR with regard to vital exhaustion, it is important to keep adherence to CR programs, leading to even poorer outcomes of CR in general.

Results on SI stemming from the general population showed slightly higher values of SI for men than for women. The differential effect of CR can also be explained by adjusting psychologically to the normal level and, therefore, differential level of the general population. In addition, the tend-and-befriend hypothesis supports the idea that women seek more social support during perceived stress, which can also be the case during CR (e.g., therapeutic group activities in CR).

**Limitations**

Compared with other studies concerned with gender differences in CHD and CR, the patients in this study showed very low psychological distress. Therefore, gender-specific differences in the efficacy of CR and at baseline of CR might be underestimated, as there might be a floor effect with low effect sizes. Possible preselection procedures prior to CR might exist. This can lead to an exclusion of more depressed patients or to a gender-specific recommendation of CR treatment, as shown in other studies. As a control group without treatment is not included, it remains unclear whether the reduction of psychological distress can be accounted for by the treatment or as a normal decrease (i.e., natural course) after a cardiac event. Lastly, our study has two major limitations. First, there was an unbalanced number of male and female patients in the sample, which might, however, reflect the lower prevalence of CHD in female patients. Second, the dataset lacks important somatic parameters, such as exercise capacity or blood lipid parameter at the end of treatment, which were not collected routinely.

**Conclusions**

The assumption that women are generally more impaired in psychological health at baseline of CR and benefit less from outpatient CR was not confirmed. Gender differences with regard to the reduction of psychological distress show both disadvantages (vital exhaustion) and advantages (SI) for women. In the light of these results, standard outpatient CR programs seem to be an equally promising treatment option for both men and women in terms of improving psychological health. Although the results are promising, older women and patients with higher psychological distress seem to be missing from our study, where not only the burden but also the potential gain is greater. Reasons for this might be problems with barriers to participation or low adherence. Encouragement especially of older female patients by physicians to attend a CR program as often as men do is, therefore, urgently needed, as women may improve health status after a cardiac event as much as men do. Future research on the efficacy and effectiveness of CR needs to improve in referral and participation of older women, patients with severe functional impairment, and those with high psychological distress in order to reach conclusions of high external validity.

**Acknowledgments**

We thank all patients who participated in this study. Many thanks also go to Karen Aebersold and Gesine Grande for valuable comments on earlier versions of the report.

**Disclosure Statement**

The authors have no conflicts of interest to report.

**References**


Address correspondence to:
Jürgen Barth, Ph.D.
Institute of Social and Preventive Medicine (ISPM)
Division of Social and Behavioral Health Research
University of Bern
Bern
Switzerland

E-mail: jbarth@ispm.unibe.ch
AUTHOR QUERY FOR JWH-2008-1058-BARTH_1P

AU1: Closing page? ref 39.