Sex Differences in Cardiac Rehabilitation Adherence: A Meta-analysis

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Brief summary for the electronic table of contents:

The objectives of this meta-analysis were to review studies that describe cardiac rehabilitation (CR) adherence, and then quantitatively assess whether a significant sex difference exists. Results showed CR enrollees adhered to a median of three-quarters of prescribed sessions. Men adhered on average to almost 70% of CR sessions, while women adhered significantly less (64%). Interventions such as action planning, self-monitoring and tailored advice which successfully increase CR adherence should be tested in women.

ABSTRACT

Background: Cardiac rehabilitation (CR) participation is associated with significantly lower mortality, and this benefit has been established as dose-dependent. Given it has been suggested that women adhere less than men, the objective of this study was to review cardiac rehabilitation adherence among women and men, and to determine whether a sex difference exists.

Methods: MEDLINE, CINAHL, EMBASE, PsycINFO, and the Cochrane databases were systematically searched. Titles and abstracts were screened, and selected full-text articles were independently considered based on predefined inclusion/exclusion criteria. Data from included articles were extracted by 2 authors independently and assessed for quality. The meta-analysis was undertaken with pre-defined subgroup analyses.

Results: The search identified 5148 articles, of which 149 were fully examined for inclusion consideration. Fourteen studies reporting data on 8176 participants (2,234 [27.3%] women) were included. Overall, CR adherence ranged from 36.7-84.6% of sessions, with a mean of 66.5 ± 18.2% (median = 72.5%). Men and women enrolled in CR adhered to 68.6% and 64.2% of prescribed sessions, respectively (mean difference = -3.6; 95% confidence interval = -6.9 to -0.3). The sex difference persisted in studies of high quality, that were undertaken in Canada, published since 2010, and where programs were longer than 12 weeks duration and offered less than 3 sessions per week.

Conclusions: This was the first meta-analysis to systematically report CR adherence rates, suggesting patients adhere to over 2/3rds of prescribed sessions. CR adherence is significantly lower among women than men. Identified strategies to promote adherence need to be tested among women.

Cardiovascular disease continues to be the leading cause of morbidity and mortality among men and women globally.[1] However, women who suffer an acute coronary event might be more likely than men to incur morbidity and mortality in the short-term.[2] In addition, they often have lower physical function, are less physically active, of lower socioeconomic status, and are at greater risk in the context of smoking and diabetes than men.[3] For these reasons, secondary prevention is of paramount importance, particularly among women.

Cardiac rehabilitation (CR) programs offer structured exercise, education, counseling, and risk reduction strategies to promote secondary prevention. CR participation is associated with a reduction in recurrent cardiac events, as well as improved survival, functional status, and psychosocial well-being.[4,5] Considering the abundance of empirical evidence, Class I, Level A clinical practice guideline recommendations[6,7] promote CR use.

A risk-treatment paradox is observed however, such that although women might be in greater need of the secondary prevention offered through CR, they are significantly less likely to access it than men.[8,9] This sex difference has been recognized for well over a decade,[10] despite the women-specific guideline recommendations promoting their access to CR.[3]

Moreover, a dose-response association between CR adherence and mortality reductions has been established,[11] including among women.[12] It is often cited in the literature that approximately 50% of patients drop-out of CR,[13–15] however we would argue that there is no definitive empirical review to support this general claim. To our knowledge, a meta-analysis of studies reporting rates of CR adherence has not been undertaken. Therefore, the objectives of this study were first to review studies that describe CR adherence among women and men, and second to quantitatively assess whether a significant sex difference exists.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-**A**nalyses (PRISMA) statement and recommendations were followed for this meta-analysis[16] (http://www.prisma-statement.org/).

Search strategy and data sources

Comprehensive literature searches of the Cochrane Library (CCTR-CENTRAL), CINAHL, EMBASE, PsycINFO, and Medline/PubMed databases were conducted for peer-reviewed articles from database inception to January 2015, with support from a staff librarian (M.P.). Reference lists of key studies and reviews were also searched. Examples of subject heading search terms used were “Heart Disease,” “Coronary Disease,” “Rehabilitation Centre,” “Cardiovascular Disease,” and “Patient Participation.” Some keywords used in the search included “Cardiac Rehabilitation,” “Adherence,” and “Compliance.” The search strategy for Medline is shown in Supplemental Table S1.

Inclusion criteria

Articles were included in the review if the following criteria were met: 1) study design consisted of a primary observational study (i.e., cross-sectional, prospective, retrospective) or an interventional study (randomized controlled trials or non-randomized studies); 2) the outcome was CR adherence, defined as ratio of completed CR sessions to those prescribed, expressed as a percentage. Numerators and denominators for the rates had to be reported in the publication, be calculable from the data presented, or provided by the corresponding author; 3) Participants who were eligible for CR and had at least enrolled in a program, namely adults with acute coronary syndrome, chronic stable angina, stable heart failure, and those who underwent one of the following procedures: percutaneous coronary intervention, coronary artery bypass graft surgery,

cardiac valve surgery, or cardiac transplantation; 4) The article was a full-length report, published in a peer-reviewed journal, and written in the English language; 5) Rates of CR adherence were reported for men versus women; and 6) Outpatient CR program had to be comprehensive (i.e., include exercise and education), supervised, and of a minimum 8 weeks duration.

Exclusion criteria

Meta-analyses, systematic reviews, qualitative studies, published letters, comments, editorials, case-series and case reports, non-empirical, and dissertations were excluded. Additionally, published articles were excluded if they stemmed from the same cohort, in which case the publication presenting the most relevant and higher-quality evidence in relation to the objectives herein was included. Studies that focused exclusively on patients with heart failure, transplantation or a cardiac valve disorder were also excluded, as patients may have lower adherence due to recurrent clinical events. A flow chart based on the PRISMA guidelines[16] describing study selection is presented in Figure 1.

Study selection

Citations from all databases (N = 2925) were independently evaluated by 2 authors (E.O. and J.Z.) and discrepancies were resolved by a third reviewer (T.C.). Citations were rejected if the reviewer determined that the study did not examine outpatient CR adherence according to the title or abstract.

Original articles of 149 relevant abstracts were then obtained. When adherence numerators or denominators were missing according to sex, authors were contacted to ascertain this information. Two reviewers (R.P.M. and J.Z.) then independently assessed the articles for

inclusion using a standardized, piloted form based on the criteria outlined. Discrepancies were resolved by discussion and consensus with a third reviewer (S.L.G.).

Data extraction process and quality assessment

A standardized, piloted data extraction form created by the authors was used when extracting data from studies meeting inclusion/exclusion criteria. Two reviewers then independently collected data from each article (R.M. and E.O.). SPSS (IBM SPSS Statistics 22) was used to record the data elements. Any discrepancies were resolved through independent verification of the data by a third reviewer (S.M.).

The quality of the studies was evaluated using the standardized form developed by Downs and Black[17] for intervention and observational studies alike. Scores ranged from 12-24, with higher score denoting greater quality. Two reviewers independently assessed the quality of the included articles (R.M. and E.O.). Any discrepancies were resolved through independent verification by a third reviewer (S.M.). After all studies were rated, the median rating was computed, and used to differentiate studies rated as either “high” or “poor” quality.

Data synthesis and analysis

Meta-analysis was performed using Review Manager Analysis software (version 5.3).[18] The combined results were examined using a random effects model, because heterogeneity in the methodology of the studies was perceived as inevitable. To determine the effects of heterogeneity on the meta-analysis, I^2 statistics were used.I^2 scores of $\leq 40\%$ were interpreted as unimportant heterogeneity.

Publication bias was tested through the use of a funnel plot. In addition, the Egger's test of the intercept was conducted to detect possible bias in the funnel plot[19] Duval and Tweedle's trim and fill procedure[20] was also performed to estimate the number of missing studies required to make the funnel plot more symmetric and to estimate the impact on the original effect size of including the imputed studies. The latter two analyses were conducted using the Comprehensive Meta-Analysis (CMA; version 2.0) software package.[21]

Potential causes of heterogeneity were explored by performing subgroup analyses. We chose to use subgroup analyses because our meta-analyses included 14 studies, and it is recommended that only a single covariate be included for every 10 studies in meta-regression analysis. Nevertheless, we also conducted a meta-regression analysis to quantify the amount of variance accounted for by each covariate and to ascertain if there was evidence that the effect size was related to the covariate, using CMA. The influence of high versus poor quality studies on the pooled estimates was tested. Other subgroup analyses defined *a priori* were as follows: country where the study was conducted (Canada vs. United States of America); the source for adherence ascertainment (patient-report vs. CR chart vs. administrative data); the duration of the program and session frequency (less than 12 weeks vs. 12 weeks or more; and less than 3 sessions vs. 3 sessions per week or more), as well as year of publication (up to 2009 vs. 2010 to present).

Results

In Figure 1, the results of the search and application of inclusion/exclusion criteria are shown. Of the 2925 articles identified as potentially eligible for inclusion, 149 full-text articles were considered for eligibility after screening. Adherence rates were secured directly from the authors for 10 (71.4%) studies. Ultimately, 14 papers were included in the meta-analysis.[22–35]

The funnel plot is shown in Supplemental Figure 1. The symmetrical shape of the funnel plot and results of Egger's regression test (p = 0.4) did not suggest significant publication bias. On the other hand, the trim and fill procedure indicated that 4 additional studies would be required to make the plot more symmetric (Figure 4). Addition of the imputed studies yielded an adjusted effect size of -0.84 (-4.33, 2.65), which markedly changes the original effect size.

Characteristics of included studies

Each study is described in Table 1. With regard to quality assessment, the median rating was 15. Thus, 6 (42.9%) studies were rated as higher quality.[23,25,26,28,31,36]

The included studies reported on data collected between 1980[26] and 2014 (median year = 2009).[22] Most studies were conducted in Canada (n = 7; 50.0%), or the United States (n = 6; 42.9%). Almost all studies were observational in design (n = 13; 92.9%); only one study was interventional (7.2%).[25] Six (42.9%) were multi-site studies.

As also shown in Table 1, the greatest proportion of studies relied on patient-report alone to ascertain CR adherence (n = 5; 35.7%). In 4 (28.6%) studies, adherence was ascertained by administrative data. In another 4 studies (28.6%), adherence was ascertained from CR charts. Finally, in one study (7.1%) CR adherence was ascertained through a combination of CR charts and patient-report.

On average the duration of CR programs was 15.20 ± 6.88 (standard deviation) weeks, with a range from 8 - 32 weeks. The frequency of sessions ranged from 1 to 3 per week, with a mean frequency of 2.55 ± 0.72sessions per week.

In terms of participants, a total of 8,176 were included in this review (see Table 1), with 2 large studies accounting for 3,065 (37.5%) of the total participants.[27,34] Mean ages, where reported, ranged from 55.0-67.7 years, with a mean of 61.5 ± 2.6 years. Women accounted for less than a third of study participants (n = 2,234; 27.3%).

CR adherence

The overall mean percent CR adherence ranged from 36.7%[23] to 84.6%.[27] The overall mean CR adherence was 66.49 ± 18.15% of prescribed sessions (median = 72.5%; interquartile range = 38.1).

When examining the CR adherence by sex among all studies, as shown in Table 1, rates for men ranged from 38.6%[23] to 89.0%,[30] and rates for women ranged from 34.7%[23] to 85.0%. [30] Overall mean adherence for men was 68.59 ± 29.2% (median = 75.6%), and for women was 64.19 ± 30.7% (median = 71.9%). As shown in Figure 2, the mean difference in adherence by sex ranged from -23.05,[22] to 9.46 in the study in Iran.[32]

Sex differences in CR adherence

Inferential tests for sex differences in CR adherence were undertaken by the primary authors in 12 (85.7%) of the included studies. In Table 1, available results are presented. Overall, 9 (64.3%) studies reported no significant sex differences. Four (28.6%) studies reported sex differences, with men significantly more likely to adhere than women. One (7.1%) study, which was conducted in Iran, found that women were significantly more likely to adhere than men.[29] No studies undertook adjusted analyses.

Meta-analysis

Figure 2 displays CR adherence by sex for each included study, and the associated mean differences and 95% confidence intervals (CI). In the pooled analysis, CR adherence was significantly greater in men compared with women. Heterogeneity was considered high (I^2 = 78%).

Subgroup analyses were performed, as outlined in the Methods section. Forest plots for each of these analyses are shown in Figure 2 and Supplemental Figures 2-6.With regard to study quality (Figure 2), results revealed that sex differences in CR adherence were observed in studies above the median quality score, however in the meta-regression analysis there was no evidence that the effect size was significantly related to study quality (p = 0.4).With regard to country (Figure S2), CR adherence did not significantly differ by sex in the United States, however in Canada there was a significant difference, with again men adhering to more sessions than women. The subgroup analysis regarding program duration (Figure S3) revealed that there were no significant sex differences in CR adherence in programs of less than 12 weeks; however in programs of 12 weeks or more, men were significantly more adherent than women. The subgroup analysis comparing the year when the studies were published (Figure S4) revealed no significant sex differences for articles published in 2009 or before, while the studies published in 2010 or after revealed significance favoring men. Finally, the subgroup analysis comparing frequency of the CR sessions (Figure S5) revealed significant sex differences in programs where less than 3 CR sessions are offered per week.

Finally, with regard to the subgroup analysis assessing the source for adherence ascertainment (Figure S6) no significant sex differences were observed when the outcome was patient-reported, or ascertained in CR chart or administrative data. Overall, none of the subgroup analyses demonstrated a significant difference (p > 0.05).

Discussion

This is the first study to our knowledge to have systematically and quantitatively reviewed CR adherence in studies operationalizing adherence consistently using a continuous measure, namely percentage of prescribed sessions attended. Overall, men adhered to CR sessions at an average of about 69% with a median of 75.6%, while women adhered to an average of about 64% with a median of 71.9%, over the average 15 weeks of prescribed CR. This sex difference persisted in studies where quality was higher, in studies published since 2010, particularly in the Canada, and where programs were longer than 12 weeks duration and had fewer than 3 sessions per week. Given the dose-response association between CR adherence and reduced mortality, it is cause for concern that this sex difference exists in the current era.

Although it has been established that women are less likely to be referred to CR than men,[9] even among women who are referred and subsequently enroll, lower participation is nevertheless observed. The multiple factors hindering patient adherence to CR are well established in the literature.[36] For women specifically, they report perceiving exercise as tiring or painful, transportation, family responsibilities, and comorbidities (e.g., musculoskeletal issues) as barriers to a significantly greater degree than men.[27]

The results of the subgroup analyses suggest that the sex differences in CR adherence start to diverge over time, with significant sex differences observed in CR programs of longer than 12 weeks duration. While the "minimum dose" of CR required to achieve mortality benefit is not established, given the dose-response association between CR adherence and mortality,[11] clearly women need to be encouraged to adhere to the full course of CR. With regard to session frequency, sex differences were observed where programs offered less than 3 sessions per week. Programs in the United States quite consistently offer 3 sessions per week due to reimbursement

models, and accordingly sex differences were not observed in studies based in the United States. Finally, it was surprising that a sex difference was not observed in studies prior to 2009, but was over the last 5 years. This could potentially be explained by the lower proportion of women referred in the past, and perhaps only the more motivated women were referred. This finding should however be interpreted with caution due to the degree of heterogeneity observed.

Quality and availability of evidence

Overall, the quality of studies reviewed in this meta-analysis was low, however it was encouraging that the sex differences were still observed in the higher-quality studies. Many studies did not report adherence as a continuous measure or by sex, and hence for a large proportion of studies the outcome of interest was only ascertained through direct contact with corresponding authors. Given the dose-response association between CR adherence and mortality,[11,12] future studies should utilize and report this continuous and standard definition for CR adherence, as per for example the recent Canadian initiative to standardize cardiovascular data definitions nationally.[37,38] Moreover, the preponderance of the data stemmed from North America, and hence whether a sex difference in CR adherence also exists in Europe and other regions of the world should also be established, and where observed, alleviated.

Clinical practice and policy implications

Interventions to improve CR adherence have been recently reviewed, although without particular attention to sex.[39] Of the 8 trials identified, only 3 demonstrated a significant effect in increasing adherence. These interventions included self-monitoring of activity, action planning and tailored counselling by CR staff. Although the root causes of low CR adherence are multifactorial and complex, these interventions should be revisited with regard to their potential

to address lower adherence among women specifically. Moreover, women-only CR programs are becoming more available, and preliminary evidence suggests participating in these programs may result in increased adherence.[40]

Limitations

Caution is warranted when interpreting these results. First, the literature search was limited to studies reported in English, which might limit the generalizability of the findings. Second, with an I^2 value of 86%, the degree of heterogeneity among the 14 studies available in the literature was high. Again, subgroup analyses were undertaken to reduce the heterogeneity, but it is hoped this initial work will spur further attempts to quantify CR adherence.

In conclusion, CR enrollees adhere to a median of three-quarters of prescribed sessions. Men adhered to on average 5% more CR sessions when compared with women (69% vs 64%). This sex difference was most prominent where programs were of longer duration and lower session frequency, the study was set in Canada, as well as in higher quality studies, published since 2010. Interventions such as action planning, self-monitoring and tailored advice, which successfully increase CR adherence, should be tested in women.

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Table 1. Included Studies Evaluating CR adherence differences between men and women, N=14

Study Author, Year, Country	Participants: Sample size and Cardiac diagnosis, Proportion women (%), Proportion men (%), Mean age overall	Study design,Source of outcome measure	CR Program (duration [wks], frequency [times / wk])	CR Adherence Among Men (mean±SD %)	CR Adherence Among Women (mean±SD %)	CR Adherence Sex Difference: MD (95% CI), or t-test and/or p-value	QA Score ; QA grade
Banerjee, 2007, Canada	220, ACS, CABG, 15.45% (w), 84.45% (m), 56.20 (mean age)	Observational – Retrospective, CR Charts	24 weeks, 1 or 2 times/week	44.44 ± 26.11%	38.88 ± 28.89%	-5.56 (-15.48, 4.35)	15; poor
Cannistra, 1992, USA	225, ACS, CABG, 22.67% (w), 77.33% (m), 55.00 (mean age)	Observational – Prospective, Administrative data	12 weeks, 3 times/week	89.00 ± 34.52%	85.00 ± 21.31%	-4.00 (-11.78, 3.78)	12; poor
Casey, 2008, USA	600, ACS, PCI, CABG, HF, 30.33% (w),	Observational – Prospective, CR Charts	12 weeks, 3 times/week	78.98 ± 28.43%	78.64 ± 28.31%	-0.34 (-5.73, 5.05)	16; high

	69.67% (m), 66.00 (mean age)						
Dunlay, 2009, USA	132, ACS, 28.79% (w), 71.21% (m), 62.00 (mean age)	Observational – Prospective, Administrative data	12 weeks, 3 times/week	38.61 ± 22.50%	34.72 ± 24.44%	-3.89 [-8.63, 0.85]	17; high
Dunlay, 2014, USA	1569, ACS, PCI, CABG, 29.38% (w), 70.62%(m),62.00(mean age)	Observational – Retrospective, Administrative data	12 weeks, 3 times/week	43.33 ± 26.67%	43.05 ± 29.16%	-0.28 (-10.80, 10.24)	15; poor
Grace, 2004, Canada	501, ACS, PCI, CABG, 26.75% (w), 73.25% (m)	Observational - Cross-Sectional, Patient-Report	varied	79.22 ± 32.56%	75.70 ± 36.60%	-3.52 (-9.87; 2.83)	13; poor
Grace, 2007, Canada	661, ACS, PCI, CABG, 23.75% (w), 76.25% (m), 61.21 (mean age)	Observational – Prospective, Patient-Report	varied	78.73 ± 27.50%	84.01 ± 22.72%	-5.28 (0.55, 10.01)	15; poor
Grace, 2009, Canada	1496, ACS, PCI, CABG, HF, 28.74% (w), 71.26% (m), 67.67	Observational – Prospective, Patient-Report		86.24 ± 24.38%	80.68 ± 27.20%	-5.56 (-10.15, -0.97)	15; poor

	(mean age)						
Kowal, 2015, Canada	282, ACS, PCI, CABG, HF, 32.62% (w), 67.38% (m), 65.44 (mean age)	Observational – Prospective, Patient-Report	16 weeks, 2 times/week	73.16 ± 37.21%	50.41 ± 41.60%	-22.75 (-27.27, -18.23)	15; poor
Oldridge, 1992, USA	492, ACS, PCI, CABG, 31.51% (w), 68.49% (m), 58.30 (mean age)	Observational - Cross-Sectional, Administrative data	12 weeks, 3 times/week	78.00 ± 41.60%	68.00 ± 47.22%	- 10.00 (-26.19, 6.19)	18; high
Pack, 2013, USA	148, ACS, PCI, 41.11% (w), 50.28% (m), 61.00 (mean age)	Interventional – Randomized Control Trial, CR Charts	12 weeks, 3 times/week	50.28 ± 32.22%	41.11 ± 30.56%	-9.17 (-13.46, -4.88)	24; high
Sarrafzadegan, 2007, Iran	499, ACS, PCI, CABG, 27.86% (w), 72.14% (m), 56.20 (mean age)	Observational Cohort– Prospective, CR Charts	8 weeks, 3.0 times/week	69.58 ± 19.58%	79.04 ± 35.42%	9.46 (-0.08, 19.00)	14; poor
Swardfager, 2011,	195, ACS, PCI, CABG, 61.88%	Observational – Prospective, CR	32 weeks, 1 time/week	66.57 ± 29.68%	61.88 ± 22.81%	-4.69 (-7.41, -1.97)	18; high

Canada	(w), 66.57% (m), 64.30 (mean age)	Charts andPatient-Report					
Tsui, 2012, Canada	1156, ACS, PCI, CABG, HF, 22.15% (w), 77.85% (m), 64.40 (mean age)	Observational - Cross-Sectional, Patient-Report	varied	84.15 ± 25.39%	77.56 ± 33.35%	-6.59 (-14.30,1.12)	16; high

ACS, Acute Coronary Syndrome;CABG, Coronary Artery Bypass Graft;CI, Confidence Interval;CR, Cardiac Rehabilitation; MD, Mean Difference; N/A, Not Analyzed;N/R, Not Reported; PCI, Percutaneous Coronary Intervention; QA, Quality Assessment; SD, Standard Deviation; USA, United States of America

*Reported if data were available.

Figure 1. Flow diagram of study selection process through the phases of the review

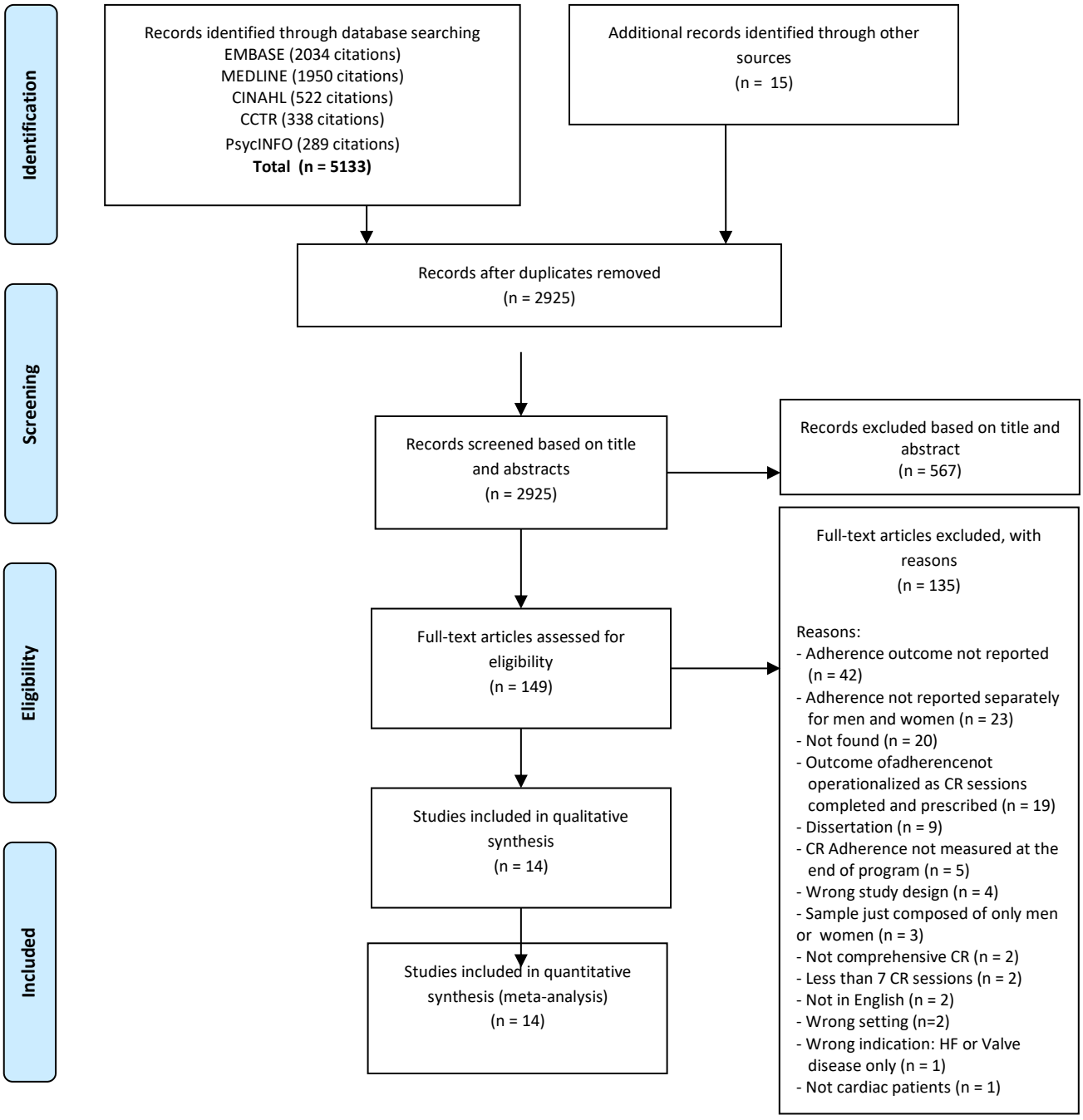
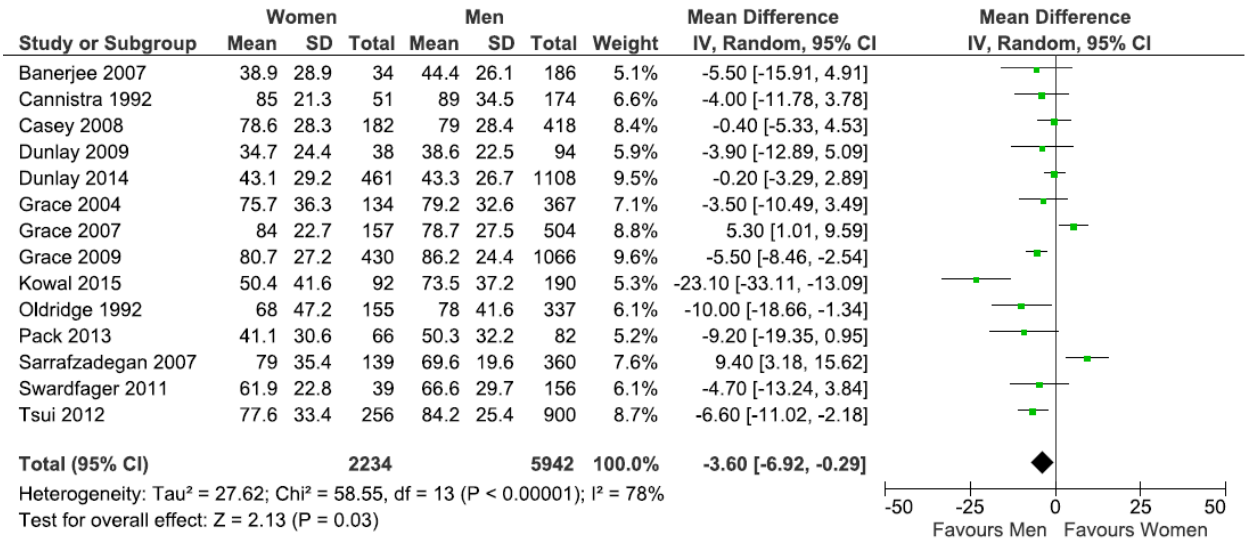
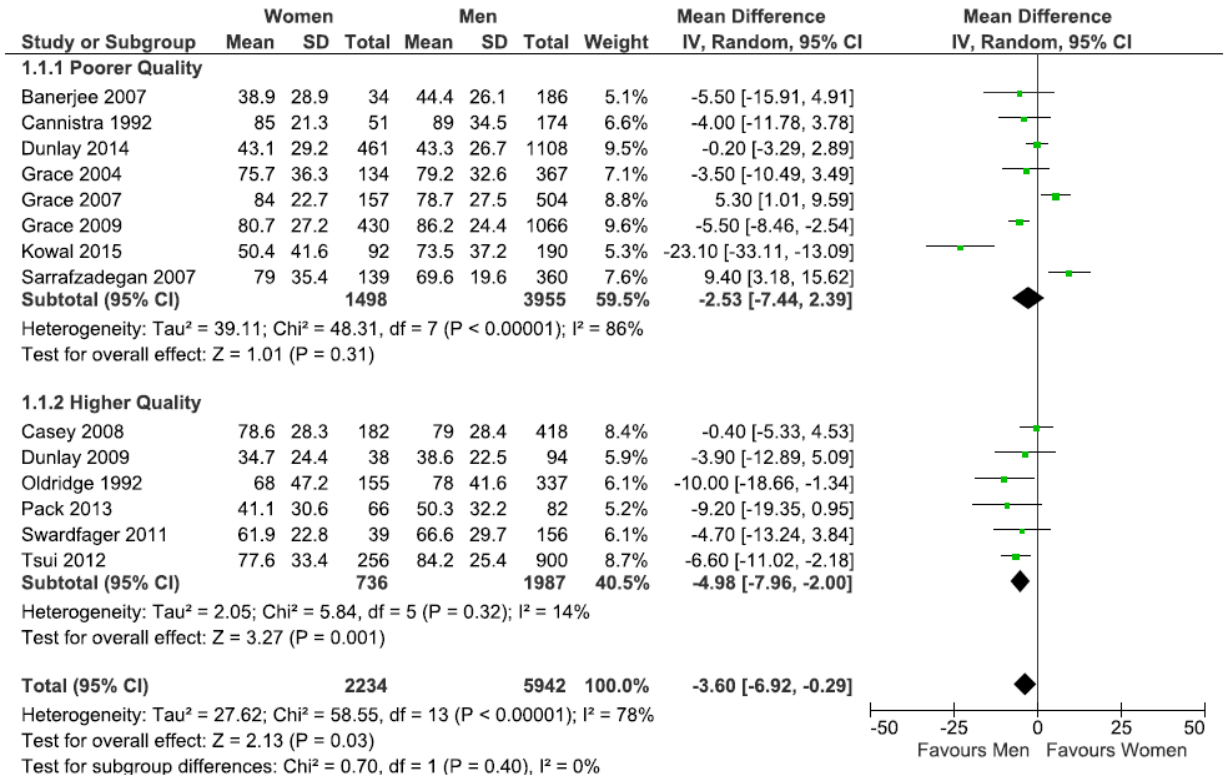


Figure 2. Forest plot presenting mean differences in CR adherence by sex in all included studies.



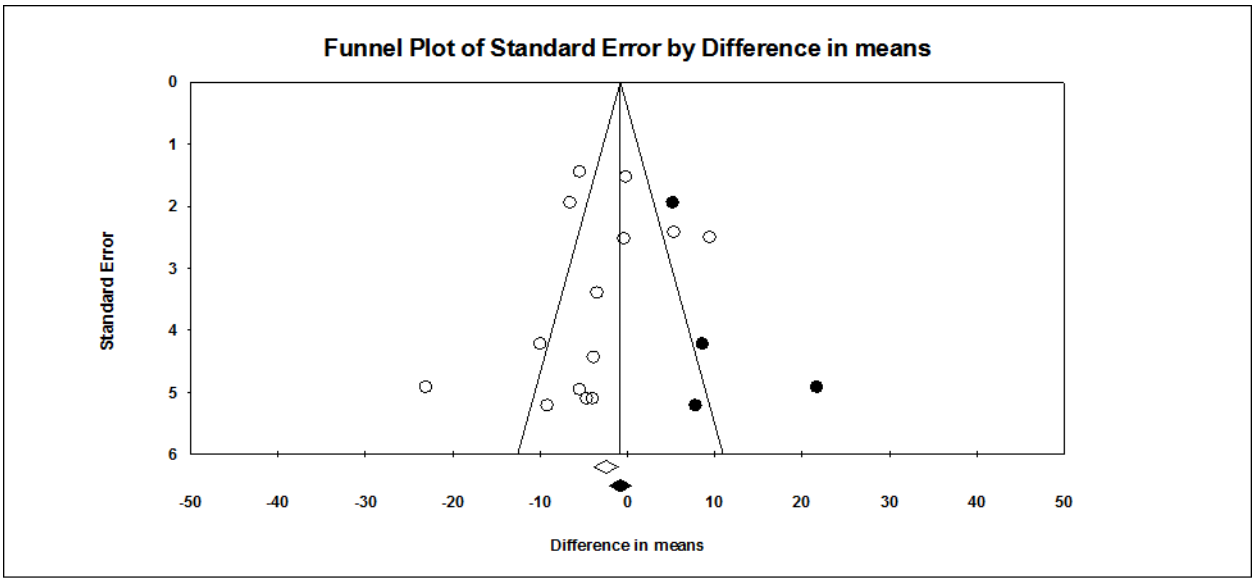
Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Figure 3. Forest plot presenting mean differences in CR adherence by sex based on study quality.



Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Figure 4. Funnel plot of standard error by difference in means

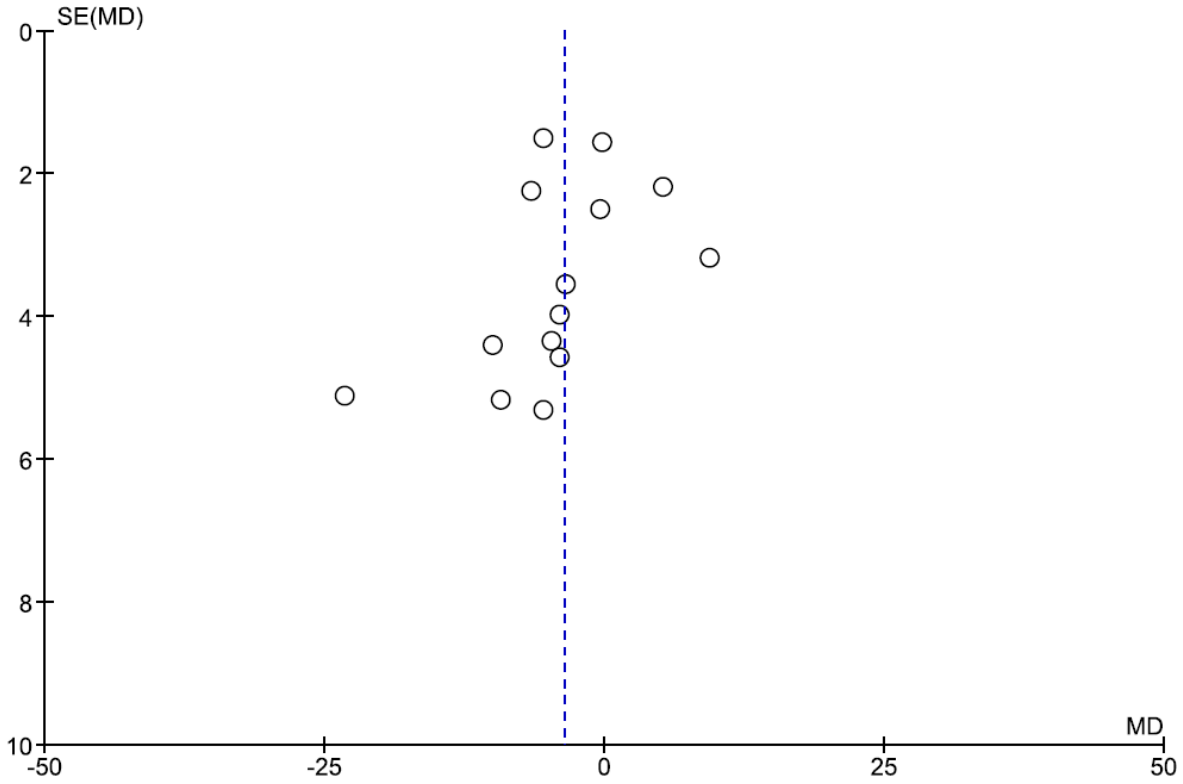


*Note solid circles are original data; open circles are imputed filled values.

Supplemental Table S1. Sample search strategy for MedLine.

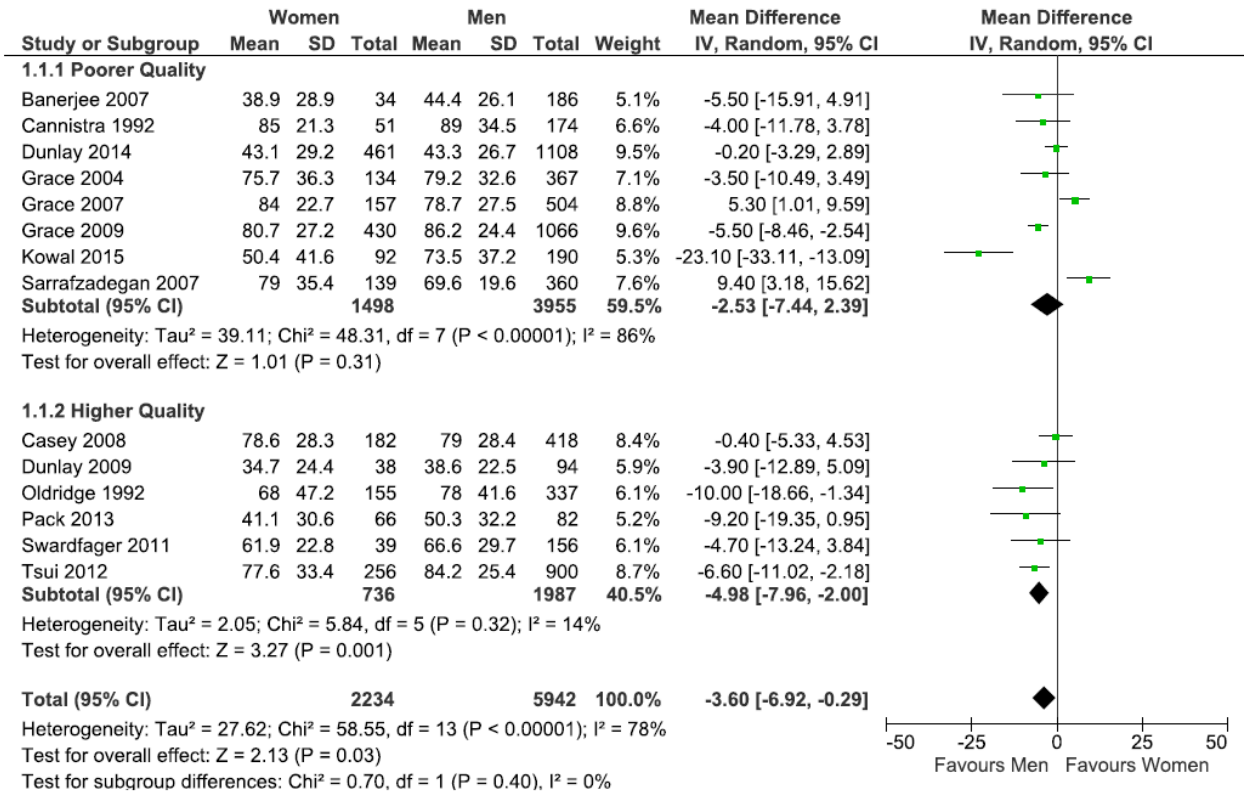
1	*Population: Adult Patients with Cardiac Condition*
2	Cardiovascular Disease/
3	expHeart Disease/
4	expArteritis/
5	expThrombosis/
6	Hypertension/
7	expMyocardial Ischemia/
8	(angina or myocardial infarction or coronary artery bypass or valve replacement or cardiac event or chronic heart failure or ischemic heart disease or percutaneous coronary intervention or coronary artery disease or coronary angioplasty or revascularization or coronary heart disease or heart transplant*).tw, kw, hw.
9	or/2-8
10	*Intervention: Cardiac Exercise / Rehab Programme*
11	rehab*fs
12	exp Exercise/
13	exp Exercise Therapy/
14	Weight Lifting/
15	exp Walking/
16	exp Running
17	((cardiac or heart or CR or exercise) adj2 rehab*).tw, kw, hw.
18	(aerobicconditioning or exercise-based or strength training or weight lifting or resistance training or exercise prescription) .tw, kw, hw.
19	or/11-18
20	*Comparison:Sex Differences*
21	Program Evaluation/
22	expReferral and Consultation/
23	Sex Factors/
24	Women's Health/
25	Men's Health/
26	Treatment Outcome/
27	((gender or sex) adj3 (differen* or rate*)).tw, hw, kw.
28	((factor* or barrier* or predict*) and (default* or compliant* or noncompliant* or participation or nonparticipation or adhere* or non-adhere* or complet* or non-complet* or attend* or non-attend* or drop-out* or withdraw)).tw, hw, kw.
29	or/27-34
30	9 and 19 and 25 and 35
31	*Outcomes: Programme Adherence*
32	Patient Compliance/
33	Treatment Refusal/
34	Patient Dropouts/
35	((complian* or non-complian* or participation or non-participation or adhere* or non-adhere* or complet* or non-complet* or attend* or non-attend* or drop-out* or withdraw or default*) and (program* or rehab*)).tw, hw, kw.
36	or/21-24

Supplemental Figure 1. Funnel plot



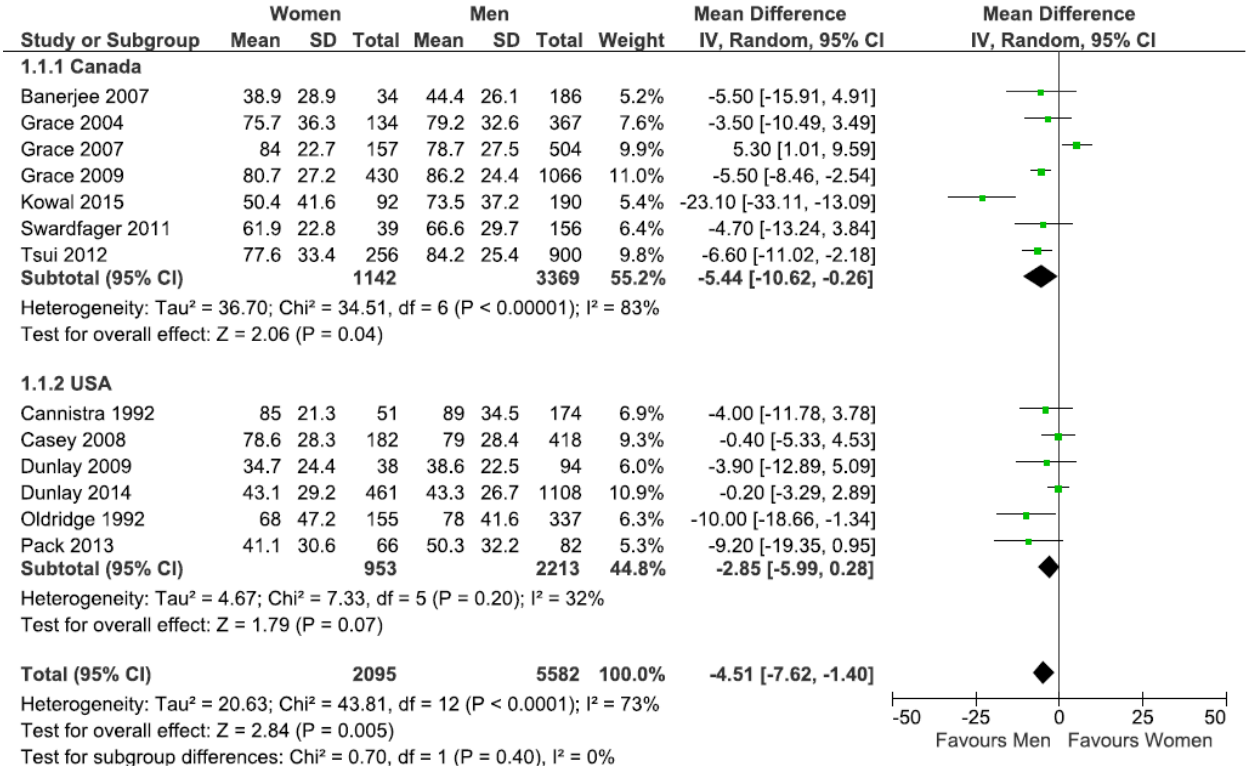
SE, Standard Error; MD, Mean Differences.

Supplemental Figure 2. Forest plot presenting mean differences in CR adherence by sex based on study quality.



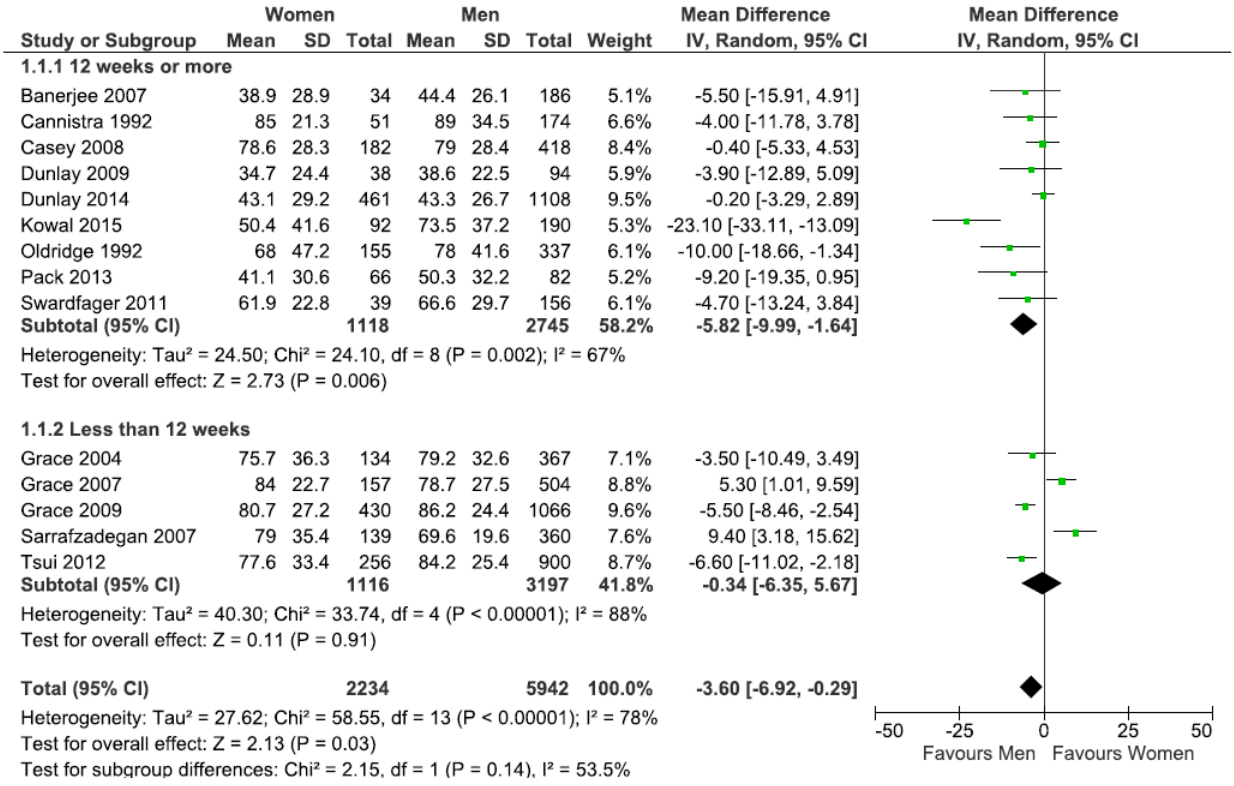
Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Supplemental Figure 3. Forest plot presenting mean differences in CR adherence by sex in programs in the Canada versus United States.



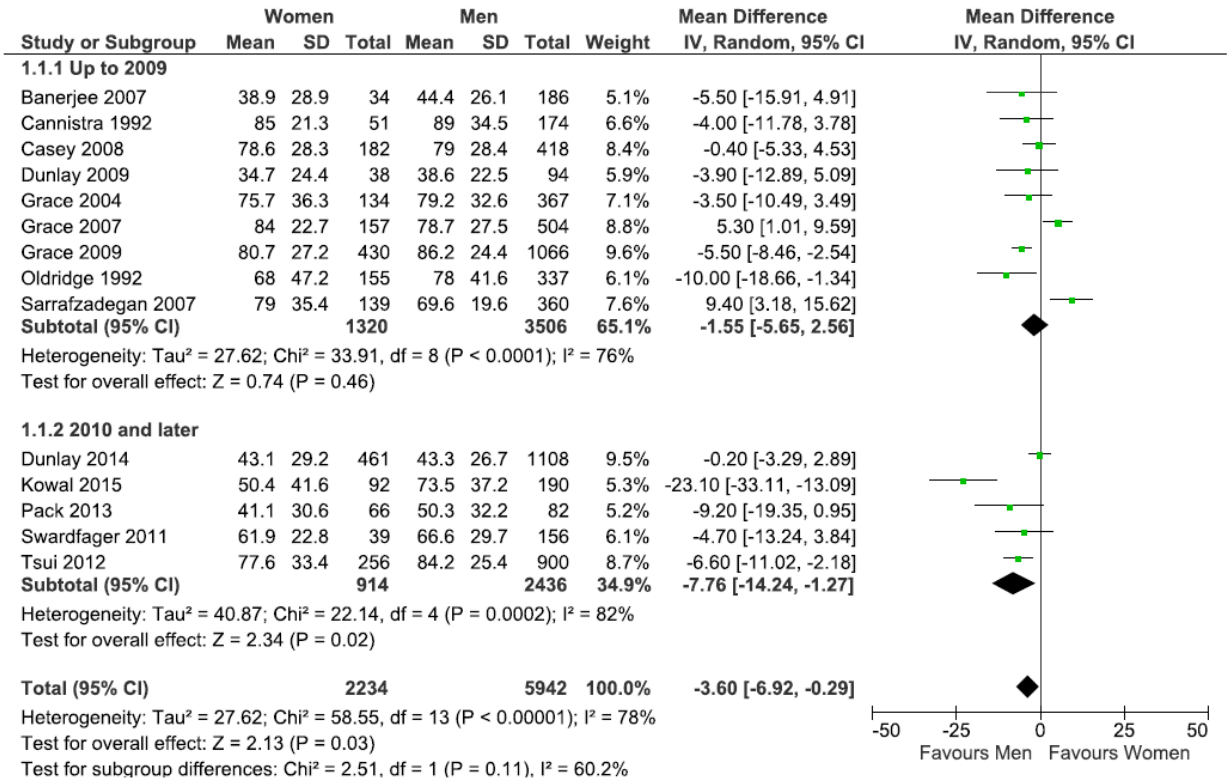
Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Supplemental Figure 4. Forest plot presenting mean differences in CR adherence by sex in programs with 12 weeks in duration versus programs with less than 12 weeks in duration.



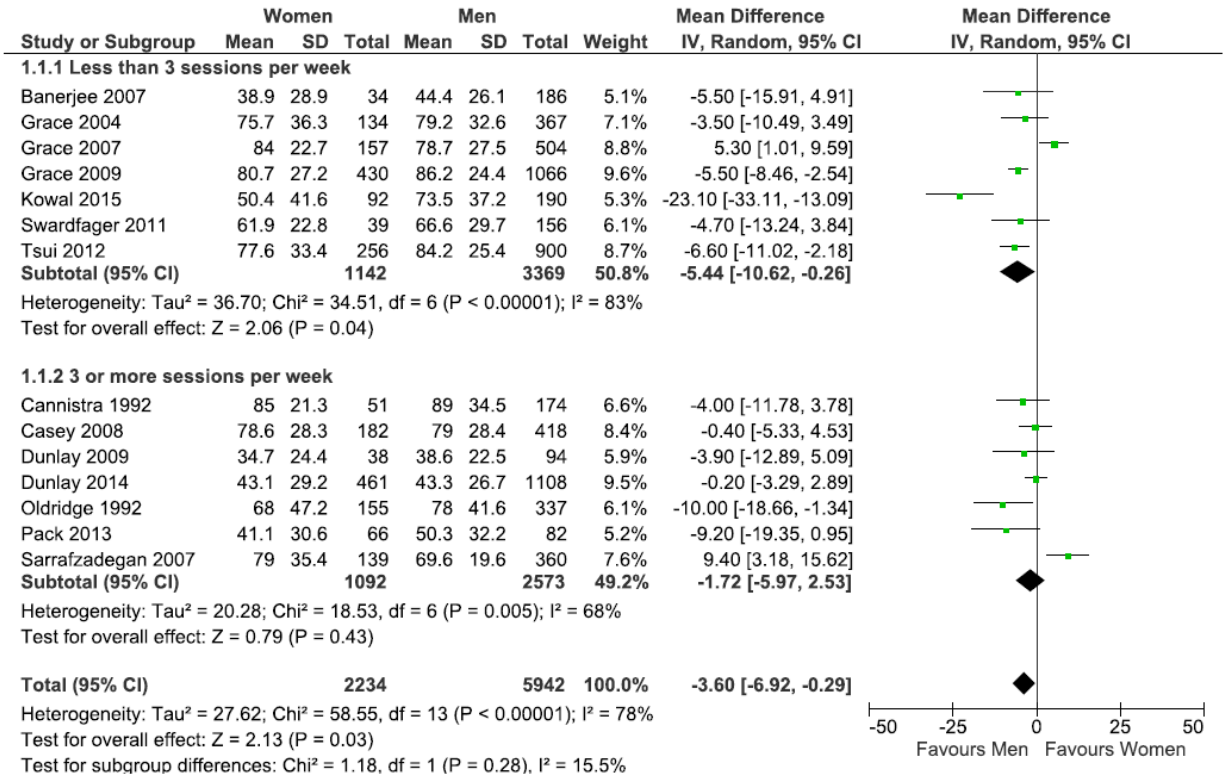
Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Supplemental Figure 5. Forest plot presenting mean differences in CR adherence by sex based on year of publication



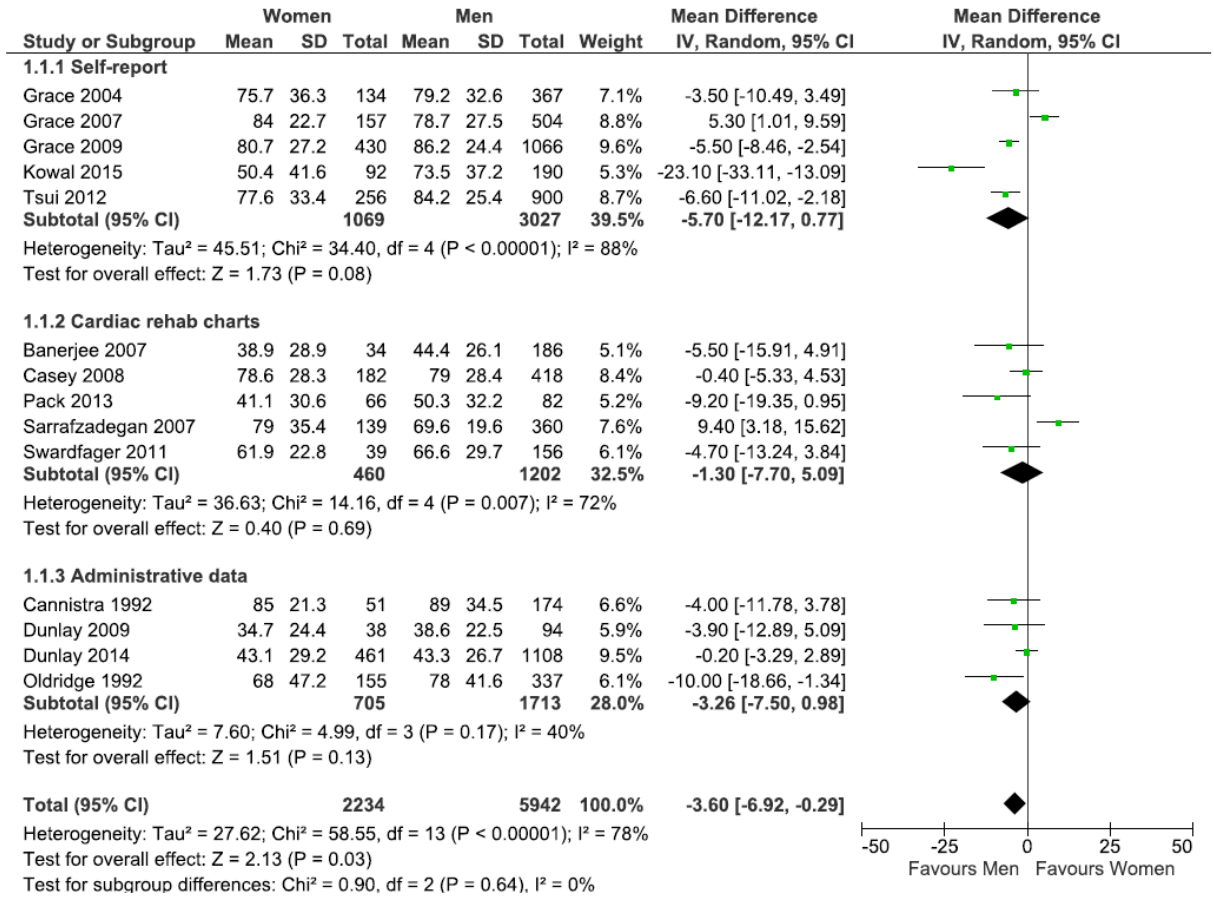
Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Figure 6. Forest plot presenting mean differences in CR adherence by sex in programs with a frequency of 3 or more sessions per week versus programs with less than 3 sessions per week.



Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.

Supplemental Figure 7. Forest plot presenting mean differences in CR adherence by sex based on method of adherence ascertainment



Error bars indicate 95% CIs for each study. CI, confidence interval; CR, cardiac rehabilitation.