PROMOTING CARDIAC REHABILITATION USE ACROSS THE PHASES:
FOCUS ON WOMEN

FIORELLA ANDANI HEALD

A THESIS SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

GRADUATE PROGRAM IN KINESIOLOGY AND HEALTH SCIENCE
YORK UNIVERSITY
TORONTO, ONTARIO

August 2021

ABSTRACT

Cardiac rehabilitation (CR) utilization is sub-optimal, especially in women, despite the abundant evidence of its benefits. This thesis aimed to understand CR utilization across the acute, outpatient, and maintenance phases, with a focus on women. First, an observational study evaluated an evidence-based online course for inpatient cardiac healthcare providers on promoting patient participation in CR. The course was effective in increasing CR knowledge, self-efficacy, and encouragement practices among providers. Second, a retrospective cohort study compared patient characteristics, utilization, and outcomes in women in mixed-sex, women-only, and home-based CR models. While caution is warranted, the benefit of women-only CR was not evident; therefore, whether full gender-tailored programs are advantageous requires further investigation. Finally, the effects of maintenance phase CR were reviewed in women and men using subgroup meta-analyses. Limited data suggested maintenance CR improves cardiorespiratory fitness and lipids in women and men, but anthropometrics only in men.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisors, Dr. Sherry Grace and Dr. Susan Marzolini, whose tremendous and continuous support, guidance, expertise, and encouragement have allowed me to grow and learn greatly throughout the course of my studies. I would also like to thank the co-investigators and everyone who has been involved in my thesis studies, as well as my thesis committee members and my colleagues, for their invaluable support and contribution.

Finally, I would like to thank my family for their kind and endless support and encouragement throughout these years.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of morbidity (13.5% of total disability-adjusted life years) and mortality (33% of total deaths) for women globally.[1] Furthermore, women with CVD experience worse outcomes than men, with higher mortality and morbidity rates.[2,3]

Cardiac rehabilitation (CR) is a comprehensive model of care for secondary prevention, generally offered in clinical settings, across 3 phases (i.e., acute/inpatient, outpatient, and maintenance). Outpatient CR has been shown to improve outcomes, including quality of life,[4–7] as well as morbidity[4,8] and mortality rates.[5,9] Moreover, observational data suggests women may have better mortality gains compared to men when they fully participate.[10]

However, CR utilization overall is sub-optimal,[11] and even lower in women.[12–14] The indicators of CR utilization are referral, enrollment, adherence, completion, and maintenance. Ideally, following a cardiac event or procedure, patients receive inpatient CR and from there are referred by provider to outpatient CR. Patients need to be informed about and encouraged to enroll in the program. They will then need to attend their first visit, adhere to the prescribed sessions, and then complete the program and transition to a maintenance program in order to maintain the gains for life. Unfortunately, these steps often do not happen.

A review found only an average of 34% of eligible patients were referred to CR,[15] and one meta-analysis reported an enrollment rate of 42.3 ± 18.7% (median = 39.3%)[16] while another found adherence rate of 66.5 ± 18.2% (median = 72.5%) of prescribed sessions.[17] Completion rate of 26.9% was reported among Medicare beneficiaries in the United States,[18] and 77% based on the United Kingdom's CR registry.[19] Women are 32% less likely to be referred to a CR program than men,[14] and when compared to men have lower rates in terms of enrollment (38.5% vs 45.0%),[16] adherence (64.2% vs 68.6%),[17] and completion (65% vs 71%)[20].

Strategies to augment utilization are needed. Barriers to referral and enrollment encouragement by healthcare providers include lack of knowledge and time.[14] Indeed, women perceive significantly lower healthcare provider endorsement of CR compared to men.[21] Some barriers to utilization at the patient level include distance, transportation issues (cost and time), experiencing exercise as tiring or painful / unsuitable exercise modalities, and time constraints due to family responsibilities, with many of these being greater hindrances for women.[22–24] Women's-only classes have been developed in an attempt to overcome these barriers,[25] and other alternative approaches such as home-based models are preferred by some women.[26,27]

Maintenance of health behavior changes, particularly exercise, is required for optimal secondary prevention, which is supported through maintenance CR programs when available. By maintaining exercise and risk factor control, physiological benefits will accrue, and hence patient health outcomes will be optimized.[28] However, to the author's knowledge there is little known about the impact of maintenance CR, and no meta-analysis of its effects have been undertaken, including in women.

Therefore, the purpose of this thesis was to understand CR utilization across the 3 phases (i.e., acute, outpatient, and maintenance), with a focus on women. First, the thesis describes a test of an intervention to encourage healthcare providers to promote their inpatient enrollment in CR. Then, it compares mixed-sex, women-only, and home-based cardiac rehabilitation models in terms of patient characteristics, utilization, and outcomes in women, as well as between women and men. Finally, the effects of maintenance phase CR are compared between women and men.

II. LITERATURE REVIEW

CVDs are a group of diseases that affect the structure and function of the heart and blood vessels. Coronary artery disease (CAD), the most common type of CVD, is characterized by the narrowing of the heart blood vessels, resulting in reduced oxygenated blood flow to the heart.[29,30] CVD is the number one cause of mortality globally, accounting for 31.8% of deaths,[1,31] and the leading cause of disability-adjusted life years (DALYs) lost due to ill-death, disability or early death worldwide.[32] In Canada, in 2015, the rate of all-cause mortality in individuals with CAD was 2.84 times higher than those without CAD.[33] As a result of the direct and indirect costs associated with morbidity and mortality, the economic burden of CVD in Canada in 2010 was estimated at CA$ 7.7 billion for men and CA$ 5.4 billion for women.[34]

Manifestations and outcomes of CVD are known to differ between men and women, due to sex-specific pathophysiology and gender-related factors.[24,35–38] Indeed, women with CVD have a unique and hazardous constellation of risk factors (notably older age and higher prevalence of comorbidities such as hypertension and diabetes),[20] in addition to the traditional CVD risk factors (i.e., extreme obesity, physical inactivity, and depression), many of which are more common in women.[24] Compared to men, women are more likely to present with a heterogeneous distribution of symptoms, creating challenges for healthcare providers and women themselves to interpret symptoms as cardiac in origin, contributing to the sex differences in cardiac care access and timeliness.[3,24] Related, women with CVD experience worse outcomes than men.[2,3] Despite the high burden of CVD among women, women are grossly under-represented in studies on the treatment of CVD; where they are represented, most studies fail to conduct gender-based analyses.[20]

2.1 Cardiac Rehabilitation

Cardiac rehabilitation (CR) is a comprehensive model of care for secondary prevention, to mitigate this burden.[30] CR is designed to optimize cardiovascular risk reduction, enhance heart-health behaviors, thereby reducing cardiovascular morbidity and mortality. The core components of CR are patient assessment, exercise training, dietary counseling, risk factor management (e.g., smoking, lipids, blood pressure, weight, and diabetes mellitus), and psychosocial intervention.[39]

Phases of CR: Acute, Outpatient, Maintenance

CR throughout the world recognize the same progression from hospitalization after an acute CVD event through to recovery and on-going maintenance,[40] which is divided into acute/inpatient CR (phase I), early outpatient CR (phase II), and long-term/maintenance outpatient CR (phase III/IV) (see Figure 1).[41] Acute CR starts in the inpatient setting generally within 24-48 hours following an index cardiovascular event or intervention until discharge. It consists of early progressive mobilization and implementation of strategies for secondary prevention, including clinical assessment to guide optimization of medical therapy, individualized behavioural education for risk factor modification, and referral and encouragement to outpatient CR.[11,42,43] However, acute CR is often not available and most patients do not receive acute CR due to shorter length of stay in hospitals.[42]

Outpatient CR offers rehabilitative services to patients early after a CVD event, generally within the first 3 to 6 months after a cardiac event or procedure, and continuing for as much as 1 year after the event/procedure.[41] In a recent global study, it was established that patients are offered a median of 22 hours of CR per program, or 3 sessions per week over 8 weeks (duration ranging from 2 to 32 weeks).[44]

Outpatient CR is generally offered in a clinical setting; however, alternative settings (e.g., home-based and community-based) and models (e.g., women-only) are offered to engage as many patients as possible. In home-based programs, patients are given an exercise prescription and encouraged to perform and log unsupervised exercise. Follow-up and education sessions with exercise specialists are usually conducted via telephone calls. Patients may need to come to the center for assessments and orientation. The women-only model is similar to regular (i.e., mixed-sex) supervised outpatient CR, except that the classes are exclusively for women, and some components may be tailored to women's needs.[45]

Maintenance of health behavior changes is essential in order to sustain the benefits of CR and achieve optimal secondary prevention; however, these changes decay substantively post-program.[21,46,47] Maintenance CR programs were developed accordingly, to promote maintenance of the healthy lifestyle changes achieved in the previous phases, particularly exercise.[21,28] Maintenance CR provides longer-term delivery of preventive and rehabilitative services for CVD patients,[41] and is often offered in a community setting with a minimal fee.

CR Benefits

There are some data to demonstrate the benefits of Phase I CR.[48] For example, a community cohort study with 2,419 participants reported a significant 20% reduction in all-cause mortality in those who participated compared to non-participants after a median follow-up of 6 years.[49]

With regard to the outpatient phase, there is abundant and unequivocal evidence on the benefits, which establish 20% reductions in mortality and morbidity,[50–55] as well as improvements in health-related quality of life.[56] For this reason, clinical guidelines promote CR for CVD,[30,48] including patients with CAD,[57,58] acute coronary syndrome (ACS) including ST-elevation myocardial infarction (STEMI)[59,60] and NSTEMI,[60,61] post revascularization (i.e., CABG[62] and PCI[63]), and heart failure,[64,65] as well as for women with CVD.[66]

To the author's knowledge, there are no meta-analyses on the benefits of maintenance CR. One systematic review suggests that physical activity and exercise interventions post-CR lasting ≥ 12 weeks can help individuals with CVD maintain physical activity in the long-term, compared with usual care.[67] An observational study suggests that community-based maintenance CR programs are successful at attracting elderly, male participants.[68]

Given that women with CVD are more in need of CR due to the reasons outlined above, it is important to understand if women benefit from CR. Currently, there is insufficient randomized data for mortality and morbidity to determine the benefits of outpatient CR in women.[69] However, there are many narrative reviews demonstrating its benefits in reducing CVD risk factors, improving health behaviours, quality of life, and psychosocial well-being.[70–72] Whether women benefit from maintenance CR has not been investigated to the author's knowledge.

2.2 Underutilization of CR

CR Utilization Across All Phases

CR utilization refers to referral (by healthcare provider), enrollment, adherence, completion, and maintenance (all requiring patient action, but can be impacted by program factors) (Figure 1). A referral is an official communication amongst healthcare provider, CR program, and the patient, which recommends participation in a CR program. Enrollment is defined as patient attendance at a first CR program visit. Adherence refers to the proportion of sessions (i.e., on-site exercise sessions with education, home-based calls) completed of those prescribed. Completion is attendance at some of the CR intervention components and a formal re-assessment at the conclusion of the CR intervention.[11] Maintenance refers to sustaining healthy lifestyle changes, such as accruing ≥150 minutes of at least moderate-intensity activity each week.

The ideal continuum of care involving CVD patients should be as such: following a cardiac event or intervention, patients receive acute CR in inpatient setting (including being informed and encouraged to enroll in an outpatient CR program by healthcare providers), and from there are referred to outpatient CR by healthcare providers. Patients then need to enroll and attend their first visit in CR. They then adhere to the prescribed sessions and complete the post-CR assessment to graduate from the program. The outpatient programs should support patients to transition to a maintenance programs, in order to sustain gains for life. Unfortunately, this continuum of care often does not happen.

CR utilization rates vary by jurisdiction due to multi-level factors.[73] A review reported only an average of 34% of eligible patients are referred to CR.[15] A meta-analysis of CR enrollment reported an overall rate of 42.3 ± 18.7% (median = 39.3%),[16] and of adherence of 66.5 ± 18.2% (median = 72.5%) of prescribed sessions;[17] however, caution should be warranted in over-interpreting these results as inclusion criteria was not limited to population-based studies. An enrollment rate of 24.4% and completion rate of 26.9% were reported among Medicare beneficiaries in the United States.[18] A report based on United Kingdom's CR registry showed the proportion of patients completing CR was 77%;[19] however, caution is also warranted in overinterpretation as sites may not enter data for patients who only attend an initial session. Utilization rates are even lower in lower-income countries where the burden of CVD is higher.[74]

A population-based study in the United States found that CR enrollment ranged from 32% to 39% between 2005 and 2015. This study also revealed that patients who were female, aged between 18 and 54 years (compared to ≥ 65 years), black, uninsured, current smokers, employed for wages/unemployed (compared with self-employed/student/retired participants), and have less education were significantly less likely to participate in CR.[75] To the author's knowledge, globally, the only other population-level data available were from Europe, which revealed that 51% patients were advised to attend CR and 41% of all patients self-reported attending half of prescribed sessions.[76]

CR Utilization in Women

It is well-established that women use CR less than men. Meta-analyses have been performed comparing sex differences in CR referral, enrollment and adherence. A meta-analysis revealed that women were 32% less likely to be referred to a CR program (49% of men vs 39% women).[14] Meta-analysis revealed that enrollment was significantly lower in women than men (38.5% vs 45.0%) and women were 36% less likely to enroll in CR,[16] and adherence was significantly lower in women compared to men (64.2% vs 68.6% of prescribed sessions attended).[17]

2.3 Overcoming CR Underutilization

CR under-use is shown to be caused by factors at multiple levels.

Provider-Level Factors Impacting Patient Referral and Enrollment

Eligible CVD patients are insufficiently referred to CR,[77] and providers play a critical role in CR referral as well as enrollment.[78] Referral paperwork from providers needs to get to the CR program, and patients must be informed of the importance and benefits of CR and encouraged to attend. Physician factors affecting CR referral include geographic accessibility, patient characteristics and motivation, awareness of CR sites and referral processes, beliefs about CR benefits, and medical indications for CR (such as risk factors); other reasons include lack of a centralized method for referral and inadequate communication among treatment teams, patients, and CR facilities.[21,79] Physician factors affecting patient enrollment in CR include physicians recommendations, which was the most consistently identified factor affecting patient CR enrollment, medical specialty (cardiologists or cardiac surgeons), referral, and physician attitudes toward CR.[21]

Referral and encouragement to enroll in CR do not happen as often or as positively for women patients as they do for men.[20,80] The reason remain unclear; however, some explanations could include unconscious bias, and/or women reporting barriers directly to providers, which might affect provider's decision to refer.

A Cochrane review investigated interventions that aim to increase patient utilization of CR, specifically CR enrollment, adherence, and completion.[78] The International Council of Cardiovascular Prevention and Rehabilitation's (ICCPR) created a position statement to translate evidence from the identified interventions into implementable recommendations for healthcare providers. The recommendations were that to increase enrollment, healthcare providers (level of evidence: strong) should promote CR to patients face-to-face (strong), and that to increase adherence part of CR could be delivered remotely (weak).[11]

Correspondingly, an online course has been developed as a tool to implement the recommendation around encouragement at the bedside. It conveys why it is needed, how acute cardiac providers can provide strong, positive CR endorsement to patients at the bedside, as well as discussion points (http://learnonthego.ca/Courses/promoting_patient_participation_in_CR_2020/promoting_patient_participation_in_CR_2020EN/story_html5.html).[11] In the course, sex/gender is listed as one of the factors that should <u>not</u> impact referral to CR, and states that women are among those who are less often represented in CR but need it most. It is hoped that completion of the course may reduce sex bias in CR referral and enrollment.

The course was developed following a needs assessment, and underwent an initial multi-method, single-center evaluation.[11] It includes a point-of-care tool with the key points suggested for providers to convey to patients to promote CR enrollment.

This course is marketed globally by ICCPR, and has been approved for continuing professional education credits from the Continuing Professional Development United Kingdom (CPD UK, https://cpduk.co.uk/directory/profile/international-council-of-cardiovascular-prevention-and-rehabilitation-iccpr) and the Canadian Cardiovascular Society (CCS, https://www.ccs.ca/en/professional-development/programs-and-events).

Patient Level Factors Impacting Patient Adherence and Completion in Outpatient CR

Extensive research has established patient-related barriers to CR use.[81–83] These can be grouped into five broad categories: intrapersonal barriers (self-reported health, health beliefs, lack of time, motivation, and religious reasons), interpersonal barriers (lack of family/social support and work conflicts), logistical barriers (transport, distance, and availability of personal/community resources), CR program barriers (services offered, group format, exercise component, and CR sessions), and health system barriers (lack of referral, cost, negative experiences with the health system, and language).[84]

Research has suggested that men and women have barriers, but the nature of women's barriers differ.[85] Women cite lack of referral and awareness more than men, while men cite that they are already exercising so do not perceive they need it. A systematic review suggests women's main barriers to CR include lower education level, multiple comorbid conditions, non-English native language, lack of social support, and high burden of responsibilities.[22]

To overcome some of these barriers, alternative models have been developed. Home-based CR refers to systematic, comprehensive, and personalized services that involve medical evaluation, prescribed exercise, cardiovascular risk factor modification, patient education, and behavioral activation/counseling that are delivered mostly or entirely outside of the traditional CR setting.[86] It was developed to overcome distance, transportation, and time-related barriers, among others.[86,87] Various studies revealed home-based CR is as cost effective and beneficial as center-based CR in terms of all-cause mortality rates, revascularization and recurrent myocardial infarction (MI) events, exercise capacity, health-related quality of life, and risk factor management (e.g., weight, blood pressure, and lipids).[88]

The review[78] identified a 2 trials where attempts to increase women's use were made by offering women-only programs.[87,89] Women-only CR is tailored to address women's preferences, such as desire to exercise in single-sex settings, self-consciousness regarding body image, desire for more emotional support / peer support, and preference for non-modality based forms of exercise such as dance and yoga[90,91]; outcomes have been reported to be equivalent to mixed-sex model.[87]

Little is known about whether and which women would prefer home-based or women-only models if given the option.[26,27,92] Some data on adherence suggests women may adhere more to women's only models.[70] The only 2 trials with outcome data (one trial comparing only mixed-sex to women-only models,[70] and the other one comparing mixed-sex vs women-only vs home-based models)[87] suggest outcomes are equivalent regardless of model. Clearly, more research is needed to determine if women do adhere more to women-only, and if they do, given more CR is associated with better outcomes,[93] whether better outcomes could be achieved.

2.4 Maintaining CR Effects

Maintenance of health behavior changes, particularly exercise, is required for optimal secondary prevention, which is promoted in maintenance CR programs. By maintaining exercise and risk factor control, physiological benefits will accrue, and hence patient health outcomes will be optimized.[28] Two reviews have been conducted (a narrative[94] and a systematic[67] review) on approaches to promote exercise maintenance and physical activity post-CR, but none on maintenance CR effects specifically, and women were consistently under-represented in these studies (mean proportion of women was 19.8%). Women are known to be less active than men as of adolescence[95]; therefore, it is important to understand whether women in maintenance programs adhere as much as men do, and whether they derive benefits from these programs.

In conclusion, there is a need for more research on sex and gender in CVD.[24,37,38] This is particularly true in relation to women and CR utilization, as it is known that the more CR the better,[93] including over time. Therefore, a series of 3 studies will be undertaken in this thesis, in order to understand CR promotion across the phases, with a focus on women.

III. OBJECTIVES OF THESIS

3.1 Study 1

The objective of the first thesis study ("Promoting Patient Participation in Cardiac Rehabilitation with an Inpatient Cardiac Healthcare Provider Course") was to describe the change in attitudes, knowledge, self-efficacy and encouragement practices of inpatient cardiac healthcare providers before and after completing the online professional development course, and to understand their satisfaction with and perceptions of the course's utility. It was hypothesized that the course on promoting CR participation would significantly increase/improve healthcare providers' attitudes, knowledge, self-efficacy, and practice in encouraging their inpatients to enroll in CR, and that providers would be satisfied with the course and apply it in their clinical practice.

3.2 Study 2

The objectives of the second study ("Comparing Mixed-Sex, Women-Only, and Home-Based Cardiac Rehabilitation Models: Patient's Characteristics, Utilization, and Outcomes") were to: (1) compare the sociodemographic and clinical characteristics of women who elected to participate in mixed-sex, women-only, and home-based models; (2) compare program utilization in terms of (i) session adherence (mixed-sex vs women-only only) and (ii) program completion between women in the three CR models, (iii) as well as women compared to men in the mixed-sex model; and (3) compare outcomes, namely in (i) cardiorespiratory fitness, (ii) risk factors, i.e., resting systolic (SBP) and diastolic blood pressure (DBP), lipid profile (total cholesterol [TC], triglycerides [TG], high-density lipoprotein cholesterol [HDL-C], and low-density lipoprotein cholesterol [LDL-C]), tobacco use, and anthropometrics (body mass index [BMI] and waist circumference), and (iii) psychosocial well-being (depressive symptoms and quality of life), in women between the three CR models, and women compared to men in the mixed-sex model (see

Figure 2). It was hypothesized that: (1) program utilization is greater in women-only CR compared to the other models; (2) there are significant improvements in outcomes from pre- to post-program in each CR model in women and in men; and (3) outcomes do not differ regardless of model attended in men and women, except women attending women-only will have better outcomes than women in mixed-sex due to greater participation.

3.3 Study 3

The objective of the third study ("A Systematic Review and Meta-Analysis on the Effects of Maintenance Phase of Cardiac Rehabilitation, with a Focus on Sex") was to review and compare the effects of maintenance phase CR on any outcomes, including but not limited to: (i) cardiorespiratory fitness, (ii) risk factors (SBP and DBP, lipid profile [TC, HDL-C, LDL-C, triglycerides], and anthropometrics [BMI and waist circumference]), as well as (iii) psychosocial well-being (e.g., quality of life), in women compared to men. It was hypothesized that the effects of maintenance CR are equivalent in women and men, such that health profile, is sustained over time.

IV. METHODS

4.1 Study 1: Promoting Patient Participation in Cardiac Rehabilitation with an Inpatient Cardiac Healthcare Provider Course

Evaluative Framework

The course evaluation is based on Kirkpatrick's 4-level model for evaluating training programs, comprising reaction, learning, behavior, and results. Level 1 (reaction) evaluates participants' impressions of the learning experience, as well as their interest, motivation and satisfaction in the program. Level 2 (learning) is a measure of the knowledge acquired, skills improved, or attitudes changed as a consequence of the training. Level 3 (behavior) measures the extent to which participants apply the learning and change their behavior because of training. Level 4 (results) evaluates the final results that occur due to training, such as the effects on the participants' work or environment resulting from improved performance after training.[96]

Level 1 (reaction) is assessed in the evaluation items (Appendix C, items number 2 to 7). The pre- and post-tests evaluate Level 2 (learning; Appendix A and B, entire section A and section B number 1, 3, 5, 6, and 7). Level 3 (behavior) is assessed in the pre- and post-tests (Appendix A and B, section B number 2 and 4) and the evaluation items (Appendix C, item number 10).

Materials

The source of data is a free, open source online course developed by the Grace lab[97] with the University Health Network (UHN) learning office (http://learnonthego.ca/Courses/promoting_patient_participation_in_CR_2020/promoting_patient_participation_in_CR_2020EN/story_html5.html).

The multi-step, evidence-based development process and validation of the English online course is described elsewhere.[97] This English online course, including the embedded point-of-care tool with discussion points for download, was first translated to Portuguese, French, Spanish and traditional Chinese character via Google Translate; these were then checked by a bilingual CR expert. Images were revised as needed, and each version has an embedded handout for patients regarding CR from a reliable source in the corresponding language. The courses were created in Articulate and are posted on http://learnonthego.ca with the support of educational developers at University Health Network. All are freely available online at: https://globalcardiacrehab.com/CR-Utilization. The translations are disseminated by the International Council of Cardiovascular Prevention and Rehabilitation (ICCPR; https://globalcardiacrehab.com/).

Design and Procedure

This study was observational, specifically one group pretest-posttest in design. An ethics waiver was approved by the Office of Research Ethics (ORE) of York University.

Learners are first directed to an embedded pre-test survey created in Google forms. After viewing the course, they are again directed to Google forms to take a post-test, and then to complete an evaluation as well as provide feedback. Learners provide 3 initials to enable linkage of pre and post-test surveys only. Participants are required to complete the pre- and post-tests as well as evaluation in order to attain a completion certificate for continuing professional education credits (https://ccs.ca/en/professional-development/programs-and-events). This study utilized the available test scores as well as evaluation items from inception (i.e., September 2019) to November 2020.

Participants

The course is directed towards any cardiac healthcare providers in any country working with inpatients or outpatients indicated for CR or those wanting to. Participants to date consist of physicians, nurses and nurse-practitioners, allied healthcare providers, CR coordinators, and graduate students; from 16 different countries. This study included all participants who had completed any of the pre-test and/or post-test and evaluation.

Measures

Sociodemographic characteristics were described, including profession, years in practice, sex, and country of practice; all of which were obtained in the pre-test (Appendix A). Participants' initials were used to match the pre- and post-tests only.

The pre- and post-test survey as well as evaluation items were developed to assess participants' learning and satisfaction with the course, based on Kirkpatrick's model.[96] The pre- and post-tests consist the same 6 multiple-choice questions and 4 true or false questions assessing knowledge pertaining to CR (Appendix A and B, section A), as well as 7 Likert scale questions related to CR knowledge, attitudes, self-efficacy, and practice (Appendix A and B, section B; see note which specifies which specific items correspond to each). Additionally, there is an open-ended question in the post-test regarding ways participants might change how they discuss CR with women after taking the course (Appendix B, section A, item number 11). Note some items were revised in May 2020 to avert ceiling effects and include items focused on women in line with this thesis.

The number of correct knowledge answers in the pre and post-test was computed for the 10 questions in section A (0 as the lowest and 10 as the highest score), as per scoring key in Appendix B.

The evaluation and feedback survey is comprised of 5-point Likert scale and open-ended items related to participants' perception and comments on the course (Appendix C).

Statistical Analyses

Statistical analyses were performed using IBM SPSS Statistics version 26 for Macintosh.[98] Descriptive analysis was first used to describe reach (i.e., number of learners who initiated the course and their country of origin) and learner characteristics. The number of learners who fully completed the post-test survey was computed; differences between completers and non-completers were tested using chi-square and Mann-Whitney U test as applicable.

To assess effects, total knowledge scores were computed, and mean and standard deviation were calculated for total knowledge from the pre- and post-test (section A). The total scores of the old version of pre- and post-tests were calculated. McNemar's test for individual items and Wilcoxon signed-rank test for the total score were utilized as data were not normally distributed.

For section B, mean and standard deviation or frequencies and percentages were computed. For items 2 and 4 related to discussion practices which are scored on a 3-point Likert scale, a separate overall mean score was computed. To assess change in pre- and post-test scores for continuous items for learners who fully completed both, Wilcoxon signed-rank test was used as data were not normally distributed.

For the evaluation portion, mean and standard deviations were computed for the Likert-type items, and an overall mean computed. Open-ended responses were coded using content analysis.[99]

4.2 Study 2: Comparing Mixed-Sex, Women-Only, and Home-Based Cardiac Rehabilitation Models: Patient's Characteristics, Utilization, and Outcomes

Design and Procedure

This study used a retrospective cohort design with 4 comparison groups. Data used in this study were extracted from an electronic patient management record utilized across the UHN

Cardiovascular Prevention and Rehabilitation sites, from January 2017 to February 2020 (only to March 2019 for Toronto Western as the program was shortened to 4 months at that time); data were extracted from pre- and post-program.

Ethics approval was obtained from UHN Research Ethics Board. A waiver of consent was obtained in accordance with retrospective use of anonymous data collected for routine clinical purposes.

Setting

CR centers

UHN is an academic health sciences center, with a comprehensive cardiac program. It has 2 CR centers; one located in the city center (Toronto Western Hospital, TWH) and one located approximately 10 kilometers North from the city center (Toronto Rehabilitation Institute, TRI). Patients are referred to the program closest to their residence.

The programs are led by physicians and staffed by a multi-disciplinary team, with exercise specialists, registered kinesiologists, physiotherapists, and nurses case-managing patients. Psychologists, dietitians, and social workers are also available when needed. The cost of the CR program is covered by provincial health insurance; however, patients pay for parking.

Assessment and Model Allocation

Patients are systematically referred from the inpatient cardiology units of the institution, as well as another proximate hospital; outpatient referrals are also accepted from primary care and outpatient cardiology clinics (see Figure 3 for program flow). Before starting the program, every patient completes an intake assessment, including: intake questionnaires (Appendix D) consisting of sociodemographic characteristics and assessment of medical history, health behaviors (including tobacco use), psychosocial well-being (i.e., depressive symptoms and quality of life), and nutrition; a risk factor assessment (i.e., resting blood pressure and anthropometric measurements); recording medications; as well as a consultation with a program physician. The intake assessments are similar at TRI and TWH, except that all items in the questionnaires are asked verbally by CR staff, and physician consultation is scheduled after starting the program at TWH.

Following this, patients come on a separate visit for their functional capacity assessment: at TRI, a cardiopulmonary exercise testing (CPET) involving a graded exercise test (GXT) with breath-by-breath gas exchange analysis; and at TWH, a GXT only. This assessment is most commonly conducted on a treadmill using a Bruce protocol; however, other modalities (i.e., stationary cycle ergometer, arm ergometer, recumbent leg and arm ergometer) and protocols (i.e., modified Bruce, low-level treadmill, modified low-level treadmill) are also available. The choice of modality and protocol is determined by the testing physician based on balance, presence/absence of musculoskeletal issues, clinical presentations, etc. All data are entered into the electronic patient record.

After completion of their intake CPET, patients are given the option to choose between the hybrid program at the centers or the home-based program, and women have the additional option of the women-only program (Figure 3). Patients are encouraged to enroll in a model that best suits their medical condition (e.g., heart failure program, stroke program, etc). However, some patients may choose a different model based on schedule convenience; ultimately, model selection is based on patient preference (CR models are described below). There are 13 and 6 session times offered each week at TRI and TWH respectively for mixed-sex, and 1 weekly session option for women-only model at both sites. Home-based sessions are based on patients' availability during business hours.

Patients at both centers are reassessed at the end of their program (after 6 months), and those at TRI are also assessed at the midpoint of their program (after 3 months), inclusive of short questionnaires (Appendix E) to assess psychosocial well-being, employment and support structure (i.e., transportation to the center and living situation), a risk factor assessment (i.e., resting blood pressure and anthropometric measurements), as well as a functional capacity assessment (i.e., CPET or GXT).

Mixed-Sex and Women-Only Models

The mixed-sex and women-only CR programs at UHN are based on a hybrid model (Figure 3), which is a combination of home-based exercise independent of CR staff and regular supervised facility-based exercise; both aspects occurring concomitantly. Both the mixed-sex and women-only models offer a comprehensive program that consists of structured exercise, patient education, risk factor management, dietary and psychosocial counselling, as well as other components as needed.

After the intake assessments, there are weekly classes over 6 months (a total of 25 sessions); each class lasts approximately 90 minutes. The exercise program is individualized according to each patient's functional capacity and clinical conditions, which is described in detail under *Exercise Prescription and Progression* in this thesis.

The patient education program is evidence-based,[100] and all of the material is available online for patients (https://www.healtheuniversity.ca/en/cardiaccollege/Pages/default.aspx). In the mixed-sex and women-only models, the education program is delivered in a group setting in conjunction with each visit. Patients are encouraged to read the corresponding booklet in advance and bring it to each session, where the patients are engaged in the education through adult learning principles.

Participants are screened for depressive symptoms, with those screening positive being referred to the program social worker or psychologist. All participants are offered a group stress management program separate from the regular visits, and one-on-one sessions with the registered dietitian.

Aspects of each component of the CR program in the women-only model are consistent with those offered in the mixed-sex model; however, examples during patient education are tailored to the audience.

Home-Based Model

The home-based program is an unsupervised model (Figure 3), where structured exercise is predominantly conducted independent of CR staff, with periodic one-on-one supervised sessions with CR staff. Supervised visits include: a one-on-one orientation that includes introduction to the CR program and their CR supervisor, education on exercise safety and exercise prescription, orientation to the online learning management system, information about allied health services, as well as an aerobic exercise trial with initial exercise prescription; a one-on-one resistance training instruction; and telemetry and/or one-on-one supervised exercise sessions as required (rarely). Additionally, patients may choose to participate in workshops and/or, if required, receive allied health consultation (i.e., with a dietitian, psychologist, or social worker) at the center.

The aerobic exercise trial is conducted based on results of the exercise stress test using the same exercise prescription method as in the mixed-sex and women-only models. Resistance training exercises and weight / resistance loads are prescribed also using the same method as in the mixed-sex and women-only models; patients are advised to purchase resistance bands / dumbbells. Patients receive written instructions for exercise.

Patients in the home-based program have weekly telephone consultation for the first 3 months, and less frequent telephone consultation thereafter through months 4 (TWH; a total of 12 calls) to 6 (TRI; a total of 15 calls), each lasting for 15 minutes on average. Each telephone consultation consists of reviewing goals from the previous week, reviewing the exercise diary submitted by patients electronically, the exercise prescription and potential progression, clinical items (e.g., risk factor control), education modules, addressing patient's questions, and finally, setting goals for the next consultation.

The education modules are delivered online through the Cardiac College Learning Management System; education content in the home-based model is the same as in the mixed-sex and women-only models. There are 22 learning modules which are grouped into 4 courses (i.e., program introduction, exercise and heart disease, risk factor management and healthy eating, and preparing for life after program). Patients must complete all of the learning modules in one course before moving on to the next one, and CR supervisors have access to the system to check patients' progress, their goals and action plans, as well as their exercise diaries.

Patients have the same assessments at the center as those in the mixed-sex and women-only models.

Exercise Prescription and Progression

Aerobic exercise is individualized and prescribed 5 days per week. Initial training intensity is based on patients' cardiopulmonary assessment and in accordance with the American College of Sports Medicine's (ACSM) guidelines for exercise testing and prescription. At TWH, target heart rate is calculated using the heart rate reserve (HRR) method (i.e., target heart rate (HR) = $[(HR_{peak} - HR_{rest}) \times \%\ \text{intensity desired}] + HR_{rest}$),[101] with a desired exercise intensity range of 40% to 60%, pertaining to moderate to vigorous intensity. At TRI, where breath-by-breath gas exchange analysis is available in CPET, ventilatory anaerobic threshold is used to determine the target training HR which is the gold standard intensity for prescribing exercise. Furthermore, the intensity of exercise may be adjusted to achieve an 11-15 rating of perceived exertion.[101]

Participants are prescribed walking and/or jogging on the track or on stationary equipment if musculoskeletal issues preclude ambulation (TRI) or treadmills and/or stationary cycles only (TWH) for 30 to 60 minutes per session. Prescription progression is considered approximately every 2 weeks as exercise specialists deem fit, with the goal of increasing to 30-60 minutes per session. As most patients are on a beta-blocker, exercise intensity is monitored using perceived exertion (heart rate used as a guideline). Exercise diary information, heart rates measured at the center, as well as communication with the patient assist the CR supervisor in deciding when to progress the exercise prescription.[102] Exercise intensity is monitored using the final heart rate (via 10-second pulse rate taken at the radial artery or heart rate monitor) and the rating of perceived exertion taken at the end of each training session.

Patients are prescribed resistance training unless contraindicated or limited by comorbidities, such as having a resting SBP >160 mmHg and/or DBP >110 mmHg, symptomatic inguinal hernia, glaucoma, severe proliferative diabetic retinopathy, or musculoskeletal limitations that would be aggravated by resistance training. Resistance training is prescribed 2-3 sessions per week for 7-10 upper, and lower body and trunk stabilizing exercises. Initial weight loads of 60% of 1-repetition maximum are used; one set of 10 repetitions is prescribed initially and patients progress to 2 sets and increase to 15 repetitions before weights increase. Resistance is provided through handheld dumbbells, resistance bands, and body weight. All patients are encouraged to exercise at home 4 days/week for aerobic and 1-2 days/week for resistance training and document their exercise in an exercise diary that is reviewed by the exercise specialists weekly.

Participants

UHN CR program inclusion criteria include aged 18 years or older with at least one of the following indications: CAD, ACS, spontaneous coronary artery dissection, atrial fibrillation, adult congenital heart disease, cardiomyopathy, following cardiac interventions (i.e., PCI, CABG, valve intervention/surgery, implantable rhythm device, aneurysm repair, and ablation), and those at risk for developing CAD or CVD (minimum of 3 modifiable cardiac risk factors [i.e., diabetes/pre-diabetes, hypertension, dyslipidemia, current/recent tobacco smoker, depression, physical inactivity, sleep apnea]) or 2 modifiable cardiac risk factors and a strong family history.

The program has separate classes for patients with stroke with mobility deficits (otherwise integrated into the regular CR program), heart failure, diabetes, and breast cancer, which were not considered in this study. Those are at significant risk of a fall, with significant cognitive and/or uncontrolled serious mental health (i.e., not anxiety, etc), and with issues presenting as a barrier to participate safely are excluded from the program.

Study-specific inclusion criteria include patients who attended at least 1 on-site exercise session for mixed-sex and women-only models and at least 1 telephone consultation for the home-based model.

Measures

Sociodemographic and Clinical Characteristics

Sociodemographic characteristics (i.e., age at enrollment, marital status, highest educational attainment, language spoken, occupational status, travel time to CR center, and living situation) are obtained from the intake questionnaires (Appendix D) that patients completed prior to initial assessments. Clinical characteristics (i.e., referral event/procedure, cardiovascular risk factors, and comorbidities) are obtained from intake assessments. The above data were used to compare the characteristics of patients in each group, as well as women choosing each model.

CR Utilization: Session Adherence and Program Completion

Program model attended is recorded in the electronic record (i.e., “regular” for mixed-sex, “women-only” or “home-based”). Session adherence was operationalized as the number of on-site sessions attended in the mixed-sex and women-only models (of 25 sessions) and completed telephone consultations in the home-based model (of 12 sessions for TWH and 15 for TRI); given that these are somewhat different indicators, adherence to home-based was considered separately. In order to compare all three models, proportion of attended out of prescribed sessions was calculated and reported in percentage.

For the purpose of this thesis, participants were considered to have completed CR program if they had attended the discharge assessment and had at least one outcome data available. Completion status and reasons for non-completion are recorded and categorized by the case manager into medical (e.g., comorbidities, need for revascularization) or non-medical reasons (e.g., work responsibilities, transportation issues), which were utilized to describe program completion.

Outcomes

Outcomes were measured at intake and discharge assessments. Cardiorespiratory fitness is measured as peak oxygen consumption ($VO2_{peak}$; only at TRI) and metabolic equivalent of tasks (METs; both at TRI and TWH), obtained during exercise test.

Resting systolic (SBP) and diastolic blood pressure (DBP) are assessed by automatic digital blood pressure device (BpTRU™) at intake assessments, but not at the discharge assessments; five serial BP measurements are ascertained at 10 second intervals while the patient is sitting. Prior to exercise test at both intake and discharge assessments, SBP and DBP are also measured using a digital blood pressure monitor for the upper arm with automatic inflation and microphone-assisted Korotkoff auscultation by a cardiopulmonary technologist or attending physician; position depending on the exercise test modality. Resting blood pressure was compared with blood pressure from exercise test to check for accuracy; however, only blood pressure from exercise test was compared between intake and discharge assessments, and between models and sex. Blood pressure in adults is defined as normal when SBP is <120 mmHg and DBP <80 mmHg, elevated when SBP is 120-129 mmHg and DBP <80 mmHg, stage 1 hypertension when SBP is 130-139 mmHg or DBP 80-89 mmHg, and stage 2 hypertension when SBP is ≥140 mmHg or DBP ≥90 mmHg.[103]

Lipid profile is recorded from bloodwork results from standard medical laboratories where available (not all patients go for the test despite provision of requisition pre- and post-program); including TC, HDL-C, LDL-C, and TG (in mmol/L).

Waist circumference measurements (in centimeters) are taken horizontally around the abdomen at the narrowest part of the torso between the iliac crest and the xiphoid process (or at the level of the iliac crest if narrowest part is not available) at end expiration in standing position using a tape measure. Body mass index is defined as body mass, measured using the InBody 520 body composition analyzer (Biospace Co., Ltd., Seoul, South Korea), divided by the square of body height (kg/m^2; stadiometer). Tobacco use is self-reported in the intake questionnaires (Appendix D, page 3 of questionnaire) and assessed again during discharge assessments, and was categorized as current smoker and former smoker/never smoked in this study.

In terms of psychosocial well-being, depressive symptoms at TRI are self-reported using the 20-item validated Centre for Epidemiologic Studies-Depression (CES-D) scale (Appendix D, page 7 of the questionnaire) with scores ranging from 0 to 60; higher scores indicate greater depressive symptomatology, and scores ≥16 indicate suspected depression;[104] The CES-D scale has been widely used in CAD population,[105–107] and a 5-unit increase in the CES-D score is associated with a 25% increased risk of mortality and 18% increased risk of stroke or MI.[108] This scale is not utilized at TWH.

Quality of life is measured with the validated Cantril's ladder of life,[109] which has been widely used in CVD population.[110,111] Patients are presented with a picture of a ladder with steps numbered from 0 at the bottom, representing the worst possible life, to 10 at the top, representing the best possible life for them.[109] Patients are asked on which rung of the ladder they feel they personally stand at the present time (Appendix D and E, page 3 of the questionnaires).

<u>*Statistical Analyses*</u>

Statistical analyses were performed using IBM SPSS Statistics version 26 for Macintosh,[98] with statistical significance defined as $P<.05$. Missing values were not cross-checked with hard charts due to hospital restrictions related to circumstances around Coronavirus Disease 2019 (COVID-19), therefore were excluded from analysis when applicable. Descriptive statistics were reported as numbers and percentages (%) for categorical variables and mean ± standard deviation (SD) or median and interquartile range when data were not normally distributed for continuous variables.

Baseline Characteristics Associated with Program Model

First, univariate analyses were performed to describe the characteristics of participants at entry to CR. Baseline sociodemographic and clinical characteristics (dependent variables) were compared in women between mixed-sex, women-only and home-based models (independent variables) using analysis of variance (ANOVA) for continuous variables (or non-parametric test when assumptions for ANOVA were not met) and chi-squared statistics for categorical variables.

These characteristics were compared between women and men in mixed-sex (independent variables) using independent samples t-test for continuous variables and chi-squared statistics for categorical variables. Post-hoc analyses were conducted using Bonferroni correction when applicable.

Retention and Matching

The baseline sociodemographic and clinical characteristics of those retained versus lost to follow-up were also compared using independent samples t-test or chi-squared statistics as applicable.

As mentioned in the literature review, women generally present with CVD at an older age than men.[112–114] Furthermore, CABG is associated with more severe CAD, higher short-term adverse events, and longer recovery compared to PCI; patients undergoing CABG were found to have a higher burden of comorbidities compared to those undergoing PCI, and they were more likely to be men, and older.[115–117] These could potentially introduce bias in the outcomes of this study.[118] Therefore, women in mixed-sex were matched to men by age (1-2 years interval) and cardiac intervention (CABG and non-CABG) using the Case-Control Matching procedure without replacement in IBM SPSS Statistics version 26 for Macintosh.[98]

Program Utilization

For program utilization, independent samples t-tests were used to compare the number of sessions attended (dependent variable) in women between mixed-sex and women-only models (independent variable), and separately in women vs men for mixed-sex and home-based models (independent variable). Proportion of attended out of prescribed sessions was compared in women across the 3 models using ANOVA (or non-parametric test when assumptions for ANOVA were not met). Chi-squared statistics were used to compare program completion and dropout reason (dependent variables), in women between the 3 models (independent variable), and between women and men in mixed-sex (independent variable).

Clinical Outcomes

Continuous dependent variables included VO_{2peak}, METs, SBP and DBP, TC, TG, HDL-C, LDL-C, BMI, waist circumference, depressive symptoms, and quality of life. Categorical dependent variables included tobacco use.

To assess the change of outcomes from pre- to post-program within each group, paired t-tests were used when data were normally distributed, or Wilcoxon signed-rank test when data were not normally distributed; tobacco use was assessed using McNemar's test. To assess differences between models in women, for continuous variables, general linear mixed models were performed with the clinical outcome as the dependent variable, CR model and timepoint as fixed effects parameters, and intercept as random effects parameter to account for baseline differences. In the women and men comparisons, a similar model was used, only sex was used instead of CR model, and women were compared to their matched counterpart (men). The women-only model and men were used as reference categories. Tobacco use (categorical variable, dichotomous) was compared using McNemar's test if data allow.

4.3 Study 3: A Systematic Review and Meta-Analysis on the Effects of Maintenance Phase of Cardiac Rehabilitation, with a Focus on Sex

<u>Design</u>

The third study was a systematic review and meta-analysis, with a secondary analysis focusing on impacts in women and sex differences. This study was undertaken in accordance with the Cochrane Handbook for Systematic Reviews of Interventions[119] and assessed with A MeaSurement Tool to Assess systematic Reviews (AMSTAR) checklist;[120] it was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[121] The review protocol was registered on PROSPERO (CRD42020167959; note focus on sex initiated after registration), an international database of prospectively registered systematic reviews in health and social care.

Inclusion/Exclusion Criteria

Only published randomized controlled trials, with usual care and/or active comparison arms, were included. Population inclusion criteria included adults (ages 18 years or over) with myocardial infarction (MI), angina, following coronary artery bypass graft (CABG) surgery, or percutaneous coronary intervention (PCI); if other patient types are included in the sample, they must comprise less than 40%. Additionally, patients must have completed an outpatient (phase II) CR program of at least 6 weeks duration (supervised or unsupervised).

Intervention must include maintenance CR program (i.e., Phase III or IV, depending on the term in the region) of at least 6 months duration, structured aerobic exercise (supervised or unsupervised; with or without other forms of exercise), at least monthly contacts with patients, and some in-person contact at least at the beginning.

Outcomes assessed included functional capacity (e.g., stress test, walk test, strength), psychosocial well-being (e.g., quality of life, return to work, depression, anxiety, support, stress), medical risk factors (e.g., anthropometrics, blood pressure, lipids), lifestyle risk factors (e.g., exercise behavior [self-report or objectively-measured], tobacco use, diet, medication adherence), costs, harms (e.g., adverse events), mortality (all-cause or cardiovascular-related) and morbidity (re-hospitalization [all-cause and cardiovascular-related], revascularization, non-fatal MI, stroke).

Information Sources and Search Strategy

Studies published since the inception of selected databases (i.e., Medline, Pubmed, Embase, Lilacs, PsycINFO, CINAHL, and EMCARES) to January 2020 in any language were searched; the search was developed and performed by an information specialist. A sample search strategy for Medline is shown in Appendix F. Two clinical trial registers were also searched, namely the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP) and ClinicalTrials.gov.

Study Selection and Data Extraction

Citation screening was managed using Covidence (https://www.covidence.org/), a Cochrane-recommended tool for systematic review management.[122] Two researchers independently considered the abstracts of potentially eligible articles, then consider the full-text articles of potential citations to ascertain whether they meet the eligibility criteria. For the former, any discrepancies were resolved by the raters; for the latter, discrepancies were resolved by a third rater.

Subsequently, the methodological quality of included articles was assessed using the Cochrane Risk of Bias Tool version 1.[123] Information regarding the sample, nature of the CR intervention, and outcome results were extracted from the selected articles in tabular format in a data extraction form based on a Cochrane template. The longest follow-up data were extracted, as well as results based on intention-to-treat and adjusted analyses where available. This was undertaken by the first reviewer, then checked and revised by the second reviewer (candidate) independently; any discrepancies were resolved through discussion with a third party.

The corresponding authors of all included trials were contacted by email to obtain sex dis-aggregated data if not publicly available, which were utilized in the sub-group analyses; as well as if there was missing information. This was also extracted (by candidate only).

Finally, the level of evidence for each outcome was assessed with the Cochrane Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach,[124] using the online software GRADEpro Guideline Development Tool (https://gradepro.org); assessed by the first reviewer and checked by the candidate.

Data Analyses

Synthesis and analysis of the results were qualitative and quantitative. Authors created an excel file with all outcomes (including units of measurement and assessment tools), to determine whether there were at least 3 trials for any given outcome measured consistently, where the same type of comparison arm existed (i.e., trials with usual care arms and/or active comparison arms were grouped separately); where this was met, meta-analysis was undertaken, including for dis-aggregated sex data. Meta-regression was contemplated with plans to test for effects by quality, setting, and sex; however, sufficient trials were not identified. For all other outcomes, synthesis of results was tabular and narrative only.

Lipid values were converted to mmol/L for consistency. Continuous outcomes were expressed as mean differences; dichotomous outcomes were expressed as relative risks (RR). Standard errors were converted to standard deviation where available.

Where possible, meta-analyses were performed using the Cochrane Review Manager (RevMan) software version 5.4,[125] where mean differences and 95% confidence intervals (CIs) were compared between intervention and control/comparison groups; data were entered by the first reviewer and checked by the second reviewer (candidate) independently. For trials with more than

2 arms, both comparisons were included in the appropriate meta-analysis, and the intervention group sample size was divided to include half in each meta-analysis as per the Cochrane handbook.[119]

A random-effects meta-analysis with DerSimonian-Laird method was utilized for the overall analyses, and fixed-effects meta-analysis for the sex subgroup analyses, which provided an overall summary measure of effect for each outcome. Heterogeneity among included studies was explored qualitatively and quantitatively; the latter using the chi-squared test of heterogeneity and I^2 statistic. In case of substantial heterogeneity, investigation of sources of heterogeneity such as clinical and methodological variability was contemplated using meta-regression; however, this was not done as there were no more than 10 trials.[119] Funnel plot was not examined for asymmetry to assess for reporting bias since there were no more than 10 comparable trials for an outcome.

V. RESULTS

5.1 Study 1

Learner Characteristics and Reach

Overall, 522 learners from 33 (16.3% of all globally) countries initiated the course; 198 (43.3%) were from lower-middle- and upper-middle-income countries (n=15; 45.5% of countries). Their characteristics are shown in Table 1. There were 52 (10.0%) students, primarily in kinesiology. Allied health care professions specified were most commonly: physiotherapists (n=33), kinesiologists (n=8), and exercise physiologists (n=7).

Four hundred and fourteen (79.3%) completed the post-test; years in practice was significantly greater among learners who did not finish the post-test, and the Chinese version had a significantly higher proportion of completers compared to any of the other language versions (Table 1). Learners from lower-middle-income countries (42.9%) were significantly less likely to complete the post-test survey (*P*=.032). Finally, 302 (57.9%) completed the evaluation survey.

Course Effects

CR knowledge scores (multiple choice) are presented in Table 2. As shown, there were significant improvements in knowledge scores on 5/10 items, as well as in the overall score upon completing the online course.

The mean scores from the Likert items in section B (i.e., knowledge, attitudes, self-efficacy, and practice for Kirkpatrick's levels 2 and 3) of Appendix A and Appendix B are presented in Table 3. As also shown, there were significant increases from pre to post-course on 6 of the 7 items, with significant increases in the overall scores as well.

Course Evaluation

Learner responses to course evaluation Likert items are shown in Figure 4; satisfaction was very high. With regard to the open-ended items, the most significant thing participants learned from this course were: CR components, evidence of CR benefits, identifying good and poor candidates for CR, the importance of HCP promoting CR to patients, how to conduct CR discussions with patients, availability of alternative CR delivery models (e.g., women-focused and home-based CR), and factors that should / should not impact referral to CR. Participants reported benefits as a result of taking this course included: starting to discuss the importance of CR with their patients and encouraging them to participate, sharing this new knowledge of CR / this course with their colleagues, and referring more eligible patients to CR.

Participants anticipated the following barriers as they applied what they learned in this course: patient perception / acceptance of the importance of CR, limited resources or access to CR (such as availability of CR programs locally and alternative delivery models), and that implementing this new knowledge would require a team effort and they have limited health human resources where they work. Anticipated opportunities included: patients would feel motivated if they are encouraged and informed of CR benefits, and availability of alternative CR delivery models. Finally, additional comments or feedback participants shared included positive feedback such as the usefulness and good quality of, as well as satisfaction with the course; learners also offered some minor suggestions for improvements, changes, and additional content.

5.2 Study 2

Cohort Characteristics

The female cohort during the period of study comprised 543 participants in the supervised mixed-sex, 160 in supervised women-only, and 24 in the home-based model, whereas the matched cohort comprised 454 women and 454 men in supervised mixed-sex; thus, there were 1181 participants in total. Their sociodemographic and clinical characteristics are shown in Table 4; other referral indications were primarily aneurysm, congenital heart disease, and heart transplant. Ninety-nine (14.2%) women had elevated SBP, 39 (5.6%) elevated DBP, 264 (48.4%) LDL-C above target, 390 (55.9%) waist circumference above target, and 152 (36.9%) elevated depressive symptoms at baseline.

The median wait time from referral to intake assessment (first visit) was 70.0 (Q1, Q3: 50.0, 104.0) days in mixed-sex, 73.0 (Q1, Q3: 52.0, 115.8) days in women-only, and 55.5 (Q1, Q3: 33.8, 102.5) days in home-based; wait times did not differ significantly among women between models (P=.281). There was no difference between women and men in the mixed-sex program either (P=.540); median wait time in men was 72.0 (Q1, Q3: 48.0, 107.5) days.

Characteristics of Women Choosing Each CR Model

As shown in Table 4, 22.0% chose women-only and 3.3% of women chose home-based. By program model, for sociodemographic characteristics, there was a significantly higher proportion of participants who were retired or had no formal employment in the women-only compared to the mixed-sex model (P=.009). In terms of clinical characteristics, there were significantly more women with family history of CVD in mixed-sex than in women-only (P=.024). No other differences were observed in other characteristics among women.

With regard to differences in outcomes at baseline in women in the supervised programs (Table 7), cardiorespiratory fitness was significantly higher in women in mixed-sex compared to those in women-only (P=.007 and P=.006 for VO_{2peak} and METs, respectively). No other differences were observed.

Compared to the matched sample of men (Table 4), significantly less women in the supervised mixed-sex model were married or in a common-law relationship (*P*<.001), and lived with a spouse or partner (*P*<.001). In terms of clinical characteristics, PCI was a more common referral procedure in men (*P*<.001), while valvular heart disease (*P*=.015), primary prevention (*P*<.001), and myocardial infarction (*P*=.004) were more common in women (*P*<.001); family history was a more common CVD risk factor in women than men (*P*<.001). As for comorbidities, the proportion of sleep apnea in men was significantly higher than in women (*P*=.022), while the proportions of osteoarthritis and cancer were higher in women compared to men (*P*<.001 and *P*=.003, respectively). No other differences were observed (as per matching, there were no differences in age or CABG).

Compared to matched men at baseline, cardiorespiratory fitness (*P*<.001 for both VO_{2peak} and METs) were significantly lower in women, while total cholesterol (*P*=.005), triglycerides (*P*=.007), HDL-C (*P*<.001), and depressive symptoms (*P*<.001) were significantly higher in women (Table 8).

Program Utilization

Table 5 displays program utilization by model and sex. Women in the mixed-sex model adhered to a higher proportion (*P*=.046) of sessions compared to those in the women-only model; no significant difference between matched men and women in mixed-sex were observed. Overall, where reason was available, 62 (45.3%) women missed sessions for clinical reasons (in descending order these were: musculoskeletal issues, cardiac event, psychological issue, or other medical conditions); there were no significant differences by model in the proportion missing sessions for clinical vs non-clinical reasons. Of those missing sessions for non-clinical reasons, in descending order these were: personal choice, work responsibilities, family/caregiver responsibilities, relocation, transportation issues, travel distance, and other reasons. Twenty-five (32.5%) men missed sessions for clinical reasons (musculoskeletal issues, cardiac event, or other medical conditions); there was no significant sex difference in the proportion of the matched sample missing sessions for clinical vs non-clinical reasons. Of those missing sessions for non-clinical reasons, these were similar, namely: personal choice, work responsibilities, relocation, family/caregiver responsibilities, transportation issues, travel distance, and other reasons; family/caregiver responsibilities were a less common reason in men, although this was not inferentially tested.

Program completion is also shown in Table 5. Women completers in the mixed-sex program attended a mean of 18.2±5.3 sessions/25 prescribed, in the women-only program 16.6±4.6 sessions/25 *(P*<.001 when compared to mixed-sex), and in the home-based 12.4±6.5 sessions/15; male completers attended a mean of 17.5±6.0 mixed-sex sessions/25 *(P*=.504 compared to women in same model).

With regard to model differences in program completion (Table 5), women in the home-based model had a lower completion rate compared to mixed-sex (*P*=.031) and women-only models (*P*=.042). In the matched sample of men and women, there was no significant difference in completion.

<u>*Outcomes*</u>

Differences in sociodemographic and clinical characteristics of those women who completed outcome assessments versus those who did not are shown in Table 6. As shown, with regard to sociodemographic characteristics, the proportion of retained female participants who spoke English as their first language was significantly greater than among those who dropped out. With regard to clinical characteristics, the proportion of retained female participants who had dyslipidemia was significantly greater than among those who dropped out. No other differences were observed. In matched men, compared to those lost to follow-up, there was a higher proportion of men with CABG among those who completed CR (n=32, 11.3% vs. n=9, 5.3%; *P*=.031), while the proportion of men with arrhythmia/rhythm device (n=14, 8.3% vs n=7, 2.5%; *P*=.005) was higher among those who dropped out than those who completed. No other differences were observed (data not shown).

Table 7 displays outcome scores by model at each assessment point. Tobacco use was negligible. Post-program, among completers, 311 (90.4%) and 339 (98.5%) women had SBP and DBP under the guideline-recommended target of 140/90 mmHg, respectively; 160 (52.3%) women reached the guideline-recommended target for LDL-C of 1.8 mmol/L, and 195 (54.9%) women had a waist circumference of ≤88 cm. In terms of depressive symptoms, 207 (77.8%) women did not have elevated CES-D scores. These proportions did not differ significantly by model among women.

Among women, cardiorespiratory fitness significantly improved with mixed-sex and women-only CR (supervised models). With regard to cardiovascular risk factors, HDL-C and waist circumference significantly improved in mixed-sex. With regard to psychosocial outcomes, depressive symptoms and quality of life significantly improved in mixed-sex. No other changes were observed; there was low power for home-based, but what would be considered a clinically-significant reduction in SBP was observed.

As also shown in Table 7, after adjusting for intake values, cardiorespiratory fitness was significantly greater with mixed-sex than women-only CR (for VO_{2peak}: estimate=1.67, standard error [SE]=0.63, 95% Confidence Interval [CI] 0.43 to 2.91; for METS: estimate=0.51, SE=0.18, 95% CI 0.15 to 0.86). There were no significant differences in other clinical outcomes post-CR by supervised model; there was a trend favouring mixed-sex for SBP. Visual inspection of the home-based data suggests cardiorespiratory fitness, blood pressure, and HDL-C may be lower at discharge, while cholesterol, waist circumference and BMI higher than in the supervised models.

When examining sex differences in outcomes in the supervised mixed-sex program (Tables 4 and 5), general linear mixed models adjusting for baseline values revealed cardiorespiratory fitness (P<.001 for both VO_{2peak} and METs), and quality of life (P=.002) were significantly lower in women, while total cholesterol (P<.001), triglycerides (P=.014), HDL-C (P<.001), LDL-C (P<.001), and depressive symptoms (P<.001) were significantly higher in women compared to men.

5.3 Study 3

Overall, 819 citations were identified, of which 10 trials (21 publications) [126–146] that met the eligibility criteria were included (Figure 5). No trials were identified in any other language. Of the "other" sources searched, only the Reid et al. trial was included.[127] Upon contacting authors, data from 3 trials were available by sex[127,128,130]; for one trial, a sex-specific paper is forthcoming.[140]

Characteristics of Included Trials

Risk of bias for each included trial is shown in Figure 6 and overall in Figure 7. In no trials were the participants or providers blinded, as this would not be methodologically possible given the nature of CR.

With regard to trial design (Table 9), seven trials (70%) had usual care comparison arms, one (10%) had an active comparison arm, and two (20.0%) had both (3-armed trials). In the Brubaker 2000 trial, the active comparison arm (i.e., centre-based group) was excluded because it was not randomized.[134] Longest follow-up duration ranged from 6 months – 4 years. All were parallel group RCTs, and none were cluster randomized.

Trials were performed in North America, Europe and Asia, between 2000 and the present year. Trial sample sizes ranged between 24 and 3241 patients (median=91; Table 9). The average age of the participants in the trials analyzed ranged between 55 and 65 years (median=62), and 859 (16.4%) trial participants were female (one trial did not report sex[134]). Two trials enrolled some (<11%) patients with heart failure, valvular heart disease/surgery and cardiomyopathy.[130,134] For 1 (10.0%) trial, intention-to-treat analyses was performed for outcomes of interest[138,140,141]; note that for the Reid et al. trial,[127] overall results are reported using this principle, but the sex differences are reported per protocol.

With regard to the CR maintenance program setting (Table 9), four (40.0%) trials were hospital-based, one (10.0%) was home-based, two (20.0%) were hospital and home-based, one (10.0%) was in a medical setting outside a hospital, one (10.0%) was home-based and in a medical setting outside a hospital, and one (10.0%) was multi-center either in hospital or medical setting outside a hospital. One (10.0%) trial included virtual reality. The median duration of the CR maintenance programs was 11 months. Six (60.0%) were comprehensive.

Outcomes

Outcomes assessed were mortality, morbidity (e.g., major adverse cardiac events, CVD admissions and interventions), CVD risk score, adverse events, functional capacity (i.e., stress test, walk test) and strength (i.e., knee extension), medical risk factors (e.g., anthropometrics, blood pressure, lipids, glucose, c-reactive protein), lifestyle risk factors (e.g., exercise behavior [self-report and objectively-measured], tobacco use, diet, medication use), psychosocial well-being (e.g., quality of life, depression, anxiety, support, stress) and cognition. No trials reported on costs, although a cost analysis was planned for Reid et al. trial, but was not performed due to need for further research on the intervention (personal communication from authors).[126] Level of evidence for each is shown in Table 10 and 11 (by comparison).

Table 9 also qualitatively summarizes the findings of all trials for all outcomes. Some significant effects were observed for outcomes that could not be pooled in meta-analysis. Knee extension strength was significantly greater with maintenance CR than active comparison.[129] Cardiac medication use increased significantly with maintenance CR, but did not with usual care.[128] Depressive symptoms were lower and social support higher with maintenance CR than usual care.[132] Cognition was greater and depressive symptoms lower with maintenance CR than both usual care or active control.[143] Left ventricular ejection fraction was greater with maintenance CR than usual care.[146] Significant differences were also found for physical activity, stress management and dietary habit in comparison to usual care.[144] No other effects were observed.

The results of the meta-analysis is published elsewhere,[147] where beneficial effects of maintenance CR were observed for QoL and lipids, but were not seen for mortality and morbidity (where there were only 2 trials), nor functional capacity, blood pressure or body composition.

Among the 3 trials for which data were available by sex (Table 12), qualitatively (subgroup meta-analysis results summarized below), for women at post-test, waist circumference[130] and perceived stress[128] were worse in women after maintenance CR compared to usual care; one trial found BMI was better with maintenance CR compared to usual care in women, however there was lack of equivalence at baseline which likely explains this effect.[127] No other group differences in outcomes in women were observed. As for changes with maintenance CR in women, all changes were not favourable for women, were in men or were with usual care.

As for sex differences (Table 12), with usual care, functional capacity was significantly lower in women,[127] but there was no difference with maintenance CR.[127,128,130] With regard to blood pressure, it was lower for women than men in usual care and with maintenance CR.[130] With regard to lipids, total cholesterol was lower in men than women with maintenance CR,[128] while HDL-C was higher in women than men with maintenance CR.[128] Anthropometrics were more favourable in women than men in usual care.[127] There were no sex differences at post-test for blood glucose or tobacco use.[128,130] Finally, perceived stress was higher in women than men with maintenance CR.[128]

Meta-Analysis: Sex Subgroup Analyses

The summary of subgroup analyses by sex is shown in Table 13. With regard to exercise capacity, measured as both VO_{2peak} and metabolic equivalent of tasks (METs; participants=377), results suggested that sex significantly modified the effect of maintenance CR compared to usual care; in women, the treatment effect favoured intervention, and in men it favoured usual care. There was an overall effect of maintenance CR on VO_{2peak} in men and in women, but not for METs.

With regard to risk factors, there were no sex effects for tobacco use, blood glucose, or blood pressure (Table 13). For anthropometrics, maintenance CR had an effect for men, but not women. With regard to lipids, maintenance CR had an effect for men on total cholesterol, LDL-C, and HDL-C. There was a sex difference for total cholesterol (in women, the treatment effect favoured usual care and in men it favoured intervention) and HDL-C (such that in women, the treatment effect favoured intervention and in men it favoured usual care).

VI. DISCUSSION

6.1 Study 1

Based on evidence, HCP should promote CR to patients face-to-face in order to increase CR enrollment. This study aimed to evaluate a generic version of an online professional development course available in 5 languages to promote CR encouragement practices of inpatient HCP. While reach is modest to date, knowledge, self-efficacy and encouragement intentions of HCP significantly increased after completing this online course; participating HCP reported high satisfaction with the course, such that it is warranted to promote this more broadly.

Learners have taken the course from all World Health Organization regions. Learners from these diverse countries had significant improvements in CR knowledge, self-efficacy and practice, as well as evaluated this course positively, supporting international applicability. Indeed, great efforts were taken to get input on the course to ensure broadest relevance, but it must be conceded that in some countries some of the content would not apply, such as having available translators for example. Nevertheless, while ICCPR's global audit ascertained CR is available in 111/203 (54.7%) countries of the world,[148] we have only reached HCP in one-third of those (Table 1). But if one considers there is only sufficient density such that CR encouragement is not futile (i.e, at least 1 spot for every 15 incident ischemic heart disease patients per year) in approximately 45 countries,[148] then reach on a country basis is a bit more favourable. Interestingly however, respondents from all but 4 countries are from countries where CR density is very low (and pre-test knowledge scores were significantly lower among these respondents, especially those in China, where CR is growing at the fastest rate of any country globally, suggesting need for the course and that we are reaching our intended audience; data not shown). These HCP likely work in institutions with CR programs, and we hope they may now champion broader availability with their new knowledge.[149] While each HCP will treat many patients for many years so impact on CR encouragement could be great, considering CR utilization is suboptimal in almost every country (with the potential exception of the United Kingdom), we must endeavour to reach more HCP in countries where CR density is greatest such that they have the capacity to treat referred patients,[148] such as the United States, Canada, Argentina, Barbados, Uruguay, Colombia, France, Australia, Grenada, Guam, Trinidad and Tobago, and Taiwan, where the first language spoken matches the course translations available. We are doing a good job in Canada, but clearly, we must reach more physicians and males.

This study provides some insights regarding areas where CR knowledge is still limited, even after course completion. It was insufficiently evident to learners that a HCP (not volunteer) should be encouraging patients to attend as there is more impact,[151] that all patients should be encouraged to attend, including women and whether one has a perception a patient may or may not be willing to attend, and that few patient factors should discourage referral.[11]

Limitations

Caution is warranted in interpreting these findings. First, in relation to design, there was no control group as a comparison, so effects of history and practice effects from the first knowledge test cannot be ruled out as alternative explanations for the increases observed. Moreover, there was no randomization, so no causal conclusions can be drawn; further testing through a randomized design is warranted based on the promising results herein. Second, the translations were not undertaken by professional translators, which may have limited conveyance of key concepts and impacted the comprehensibility of the survey items; there were a few differences when comparing the survey results from the various language versions (data not shown) which have been due to measurement error. Third, generalizability is limited as the sample is one of convenience. Moreover, there may be selection bias, such that people who were interested in taking the course may value the importance of CR (e.g., at pre-test, learners rated the importance of providing CR information to patients and intention to do so as 5/5). This may have resulted in higher scores on the pre-test, minimizing capacity for change at post-test; this appeared to be the case for CR attitudes, where an increase was not observed but it could not be due to a ceiling effect. Fourth, while attrition for the post-test was minimal, there was some retention bias in terms of years in practice and much lower retention for those completing the Chinese version; retention for the post-course evaluation was moderate.

Finally, there are measurement issues. The measures were investigator-generated, and there were some issues with the knowledge items identified. Moreover, the outcomes assessed were limited. Retention of knowledge and attitude change was not measured (i.e., no follow-up post-course); most crucially, clinical practice impacts (i.e., whether more HCP are having CR discussions with patients routinely after completing the course, and the quality of the discussions; Level 4 of Kirkpatrick's model[96]) and self-efficacy after having some discussions with patients at the bedside were not assessed. It would also be useful to know if HCP are using the point-of-care tool (Figure 8) to ensure comprehensive discussions with patients, and whether they are providing the patient handout recommended in the course. Future research should assess whether more patients treated by HCP who have completed the course are actually enrolling in CR more often compared to patients treated by HCP who have not taken the course.

6.2 Study 2

This novel study has examined women's characteristics, utilization, and outcomes in all available CR models. While caution is warranted due to generalizability limits and because the women-only program was not gender-tailored per se, contrary to hypotheses, the benefit of women-only

CR was not evident. The main factor explaining difference in model choice appeared to be work status, such that women with more time flexibility could elect to attend supervised women-only CR, which is necessarily offered less frequently due to participant exclusivity. Contrary to conjecture in the literature based on mostly uncontrolled studies, women attending mixed-sex attended more sessions than those in women-only. Moreover, women in home-based were less likely to come on-site for post-program assessment, to be considered program completers. Outcome data suggested supervised CR resulted in greater cardiorespiratory fitness, with significant improvements from pre to post-program in risk factors and psychosocial well-being in mixed-sex participants only.

Model Selection

In this study, there were very few women patients who selected home-based; this has been shown in some other research,[152] but whether this is due to limits on the number of spaces in home-based at the centre under study cannot be known; some patients seem to prefer home-based, but others preferring in-person monitoring and encouragement gravitate toward supervised models.[92] Indeed, in this study we did not have information on why participants elected the model they did, but the lack of differences in clinical characteristics suggests it was not often the clinicians encouraging patients for medical reasons. In line with previous literature, more working women elected this model, suggesting working likely impedes on-site participation.[153]

Indeed, the only difference between women who elected supervised women-only over mixed-sex was that they were less often in paid employment. As shown in previous research,[152] because women-only cannot be offered as often as mixed-sex classes, many women cannot accommodate attending women-only classes due to time constraints, despite potentially wanting to. In addition, at the program under study, the mixed-sex class was available outside of business hours, but women-only was not (in home-based patients could exercise at a time that suited them, but calls with staff were held during business hours as well). This greatly limits the potential impact of women-only CR, and raises accessibility biased for this already-underserved group.

Utilization

The greater adherence in mixed-sex than women-only was inconsistent with the previous research; the 2 randomized trials comparing adherence in women-only vs mixed-sex showed either the opposite effect of greater adherence with women-only (note: it included motivational interviewing),[89] or equivalent adherence between these supervised models.[87] The magnitude of difference was not great, and may relate to the fact that the content in the women-only program at the centres (the same 2 of 3 centres included in the latter trial summarized above) is very similar to the mixed-sex; there are currently efforts under way to tailor programming to women. The benefit of women-only would likely be greater if this tailoring did better engage women in the programming and risk reduction behaviours. The program has recently undertaken some evaluation, and will work to improve the program to better meet women's needs.

While there was a small sample size, it did appear adherence to home-based was somewhat greater than in supervised models, but completion was lower. More research is needed on patient engagement in supervised versus unsupervised given the sudden move to remote delivery in the midst of the COVID-19 pandemic,[154] and that exploiting technology-enhanced home-based may enable significant increases in capacity so a larger proportion of indicated patients can receive CR services. It is likely that adherence appears higher than in supervised because it is much easier to answer a call than travel to a site. The lower completion could be explained in that home-based patients have to travel on-site for that assessment, and they likely chose the home-based model because they have constraints to going on-site, be they time and/or travel-related.

Outcomes

An improvement of 1 ml/kg/min in VO_{2peak} is associated with 9-15% risk reduction in cardiac and overall mortality, both in men and women, and a 0.5 MET increase is associated with significantly lower mortality.[155–158] In this study, the improvement in cardiorespiratory fitness was clinically-meaningful in women in mixed-sex and women-only CR (i.e., the supervised models), but not in home-based.

The somewhat greater utilization rates in the mixed-sex likely translated to the significantly greater functional capacity in women attending that model, although the higher fitness at intake likely also played a role; there was also a trend towards lower SBP with mixed-sex compared to women-only. Moreover, the greater utilization may have resulted in the significant increase in HDL-C and quality of life as well as reduction in depressive symptoms with mixed-sex, which were not observed with women-only. It was unexpected that the women-only model did not result in improved psychosocial well-being as has been observed with the 2 women-only CR RCTs.[159–161] Overall, clearly women-only did not result in better outcomes in this study as hypothesized.

Sex Differences

Consistent with literature,[162–164] women did come to CR with a poorer clinical profile than men. Women presented with poorer functional capacity, and had a poorer risk factor profile, but then they do have more to gain. Also consistent with literature, they were older, had less spousal support, different cardiac indications (i.e., women treated less aggressively), and more comorbidities.[165] Both women and men in supervised CR achieved significant improvements in cardiorespiratory fitness, again an indicator closely associated with mortality,[158] but this was greater in men as shown in the literature. Quality of life was also better in men, with also lower lipids and depressive symptoms, even with adjustment for intake values. It is disheartening that we still have not closed this chasm in men's and women's outcomes, and based on this paper, women-only CR does not appear to be the answer we hoped it to be.

Implications and Research Directions

The results of this study suggest there might not be enough benefit of a women-only model that is not gender-tailored to warrant the resources needed; indeed there is limited controlled research in this area and hence not a large body of high-quality evidence to inform policy and CR care provision decisions at the program-level.[166] Given the limited sample and generalizability, it is premature to draw conclusions regarding whether women-only CR can address gender bias in CVD secondary prevention. Further research should consider whether offering some tailored women-only sessions might be engaging and cost-efficient.[167] Perhaps we should also be better at standardizing what gender-tailoring is desired by women in practice as well as what can lead to increased program engagement, and subsequently then better outcomes. Results of this study also suggest we need to question and investigate whether women adhere and push themselves to achieve outcome improvements in unsupervised settings to the same degree; women have so many constraints to coming on-site, but without post-program data this is difficult to establish.

Limitations

Caution is warranted when interpreting these findings due to several study limitations. Chiefly, generalizability is limited due to the fact that the study was conducted at one academic health science centre, so the women-only offerings may be different than at other centres. Moreover, as CR programs in this study are available at no cost to patients; utilization data would likely be different in CR with different payment models. Moreover, the CR programs in this study offer a fairly high dose of CR compared to other jurisdictions,[167] which may impact utilization rates. Finally, most women-only programs are offered in the Eastern Mediterranean region[167]; it is likely these results are not generalizable to that setting.

Second, there was some retention bias for the third objective, approximately 40% of participants did not attend their discharge assessment. Third, the sample size in home-based was small, and this is compounded by the low retention mentioned above, rendering analyses likely under-powered. Hence, some outcome changes in the third objective could not be assessed due to the lack of available data; there may be differences not identified by this study so more research is warranted. Fourth, multiple comparisons were performed, which can increase error rates. Fifth, there are challenges associated with using administrative data; missing and implausible values were checked against hard charts at the beginning, but due to COVID-19 we could not check all values. With regard to measurement, best practices in blood pressure assessment were not followed, and thus there is likely some error. Finally, the study design was not randomized, therefore causal conclusions cannot be drawn.

6.3 Study 3

Phase II CR is key to ensuring patients achieve risk factor targets and adopt a healthy lifestyle, but this must be maintained for patient outcomes to be optimized. Results of this systematic review demonstrate there are few trials on maintenance CR (i.e., 10), and the interventions are quite heterogeneous in terms of setting, exercise prescription and comprehensiveness; data on women’s outcomes are scant, and the mixed findings render it difficult to understand the effects of maintenance CR in women. Based on limited data, the beneficial effects of maintenance CR favoured women over men for blood pressure and HDL-C, whereas the opposite is true for total cholesterol and perceived stress. Furthermore, there was no difference in functional capacity between women and men with maintenance CR.

Limitations

Caution is warranted in interpreting these results. First, the search strategy was not peer-reviewed. Second, with regard to the methodological quality of included trials, all had major bias due to the fact that in CR trials it is not possible to mask the patients or providers to randomization/intervention. Moreover, level of certainty was low for most outcomes. Third, for some meta-analyses, heterogeneity was very high, but there were insufficient trials to perform subgroup analyses or meta-regression to understand the drivers of the heterogeneity. Fourth, for many outcomes, meta-analysis could not be performed due to insufficient data for pooling; thus, results for these outcomes were solely narratively synthesized. This introduces bias, particularly considering it was difficult to draw conclusions where sample sizes were small, as lack of significant effects may have been due to insufficient power. Fifth, given only a small proportion of eligible patients access maintenance CR, results would not be generalizable to all CVD patients, particularly those who are not adherent to healthy lifestyle recommendations.

Sixth, it is difficult to situate our findings in relation to previous literature, given our inclusion/exclusion criteria were more narrow than the only other review in this area; [168] it included 26 trials of long-term CR, of which only 3 true maintenance trials were included in our 10 herein.[128,130,146] Nevertheless, our conclusions were primarily consistent. Finally, presence and degree of publication bias is unknown.

VII. CONCLUSIONS

7.1 Study 1

Considering as well the previous positive evaluation of this course,[97] results of this study suggest this open access, evidence-based online course to promote patient participation in CR available in 5 languages is effective in increasing CR knowledge, self-efficacy, and encouragement practices among inpatient cardiac HCP. HCP were very satisfied with the course, and while testing impact on actual CR use is needed, concerted promotion is warranted. Each HCP who takes the course will treat many patients over many years, therefore impact on CR encouragement could be great. This should result in more patients enrolling in CR, ultimately reducing morbidity and mortality at a population level. Furthermore, CR trainings for HCP such as this course should be focused in areas where CR knowledge is still limited as shown in this study, particularly the importance of encouraging all patients, including women, to attend CR.

7.2 Study 2

We need to better engage women in CR and ensure they achieve optimal outcomes. Approximately 10% of CR programs globally offer some form of women-centred programming, although the nature of this programming is not well-characterized.[167] The CR community must consider how to deliver high-quality, women-engaging CR consistently in practice, in a feasible way such that it could be available at most programs, and not be limited in availability such that women have barriers to engaging with it. This could include online women-only sessions or peer support for example. Whether full gender-tailored programs are advantageous requires more controlled, large-scale investigation.

7.3 Study 3

Participation in maintenance CR results in increased QoL and better lipids when compared to usual care, and limited data suggests that its benefits favour women and men differently for different outcomes. There are not many trials in this area, but given the null effects for many outcomes and that the number of beneficial effects between women and men is comparable, results raise questions about whether we should be augmenting maintenance CR capacity and encouraging patients to attend when often they must pay out-of-pocket. It is known phase II CR is highly effective, so efforts should certainly be made to ensure all patients (including women) at least access those services, with a sufficient dose to reduce mortality and morbidity. By ensuring all indicated patients receive the minimum needed amount of CR, at no cost, the CR community will have a major impact on society.

VIII. THESIS IMPLICATIONS

In an attempt to overcome provider-level factors of CR under-utilization, evidence-based trainings on promoting patient participation in CR for cardiac providers such as this online course should be promoted among cardiac providers. It is hoped that cardiac providers will encourage all eligible patients to attend CR in order to increase CR utilization overall. As there is insufficient evidence of the benefits of non-gender-tailored women-only CR, further research should be directed to understand how to deliver gender-tailored women-only program in a feasible and inclusive way, as well as what gender-tailoring is desired by women in practice and what can lead to increased program engagement. Furthermore, considering the lack of evident benefits of maintenance CR for many outcomes, the comparable number of beneficial effects between women and men, and the inaccessibility of maintenance CR program in general, efforts should be focused on ensuring all patients, including women, utilize phase II CR with a sufficient dose to reduce mortality and morbidity. Ultimately, it is hoped that all indicated patients can access and achieve the optimal benefits of CR and gender bias in CVD secondary prevention can be eliminated.

IX. CANDIDATE’S ROLE

8.1 Study 1

The candidate was responsible for managing learners as of April 2020 (e.g., providing completion certificates and answering questions), data analyses and coding, as well as write-up.

8.2 Study 2

The candidate was responsible for supporting principal investigator’s communication with research ethics board for amendment, maintaining study binder, supporting first extraction of data from the CR electronic patient record, data cleaning and analyses, as well as manuscript write-up.

8.3 Study 3

The candidate undertook the role of second reviewer (citation screening, data extraction, risk of bias assessments, checking summary of findings tables / level of evidence), contacting authors for data by sex, sub-analyses by sex (qualitative and quantitative), as well as write-up of the data by sex.

REFERENCES

1. Institute for Health Metrics and Evaluation (IHME). *GBD Results Tool*. Seattle, WA: IHME, University of Washington; 2021.
2. Wenger NK. You've come a long way, baby. *Circulation*. 2004;109(5):558-560.
3. Mehta LS, Beckie TM, DeVon HA, et al. Acute myocardial infarction in women: a scientific statement from the American Heart Association. *Circulation*. 2016;133(9):916-947.
4. Belardinelli R, Paolini I, Cianci G, Piva R, Georgiou D, Purcaro A. Exercise training intervention after coronary angioplasty: the ETICA trial. *J Am Coll Cardiol*. 2001;37(7):1891-1900.
5. Heran BS, Chen JM, Ebrahim S, et al. Exercise-based cardiac rehabilitation for coronary heart disease. Taylor RS, ed. *Cochrane Database Syst Rev*. 2011;(172):40.
6. Shepherd CW, While AE. Cardiac rehabilitation and quality of life: a systematic review. *Int J Nurs Stud*. 2012;49(6):755-771.
7. Yohannes AM, Doherty P, Bundy C, Yalfani A. The long-term benefits of cardiac rehabilitation on depression, anxiety, physical activity and quality of life. *J Clin Nurs*. 2010;19(19-20):2806-2813.
8. Giannuzzi P. Global secondary prevention strategies to limit event recurrence after myocardial infarction. *Arch Intern Med*. 2008;168(20):2194.
9. Taylor RS, Brown A, Ebrahim S, et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. *Am J Med*. 2004;116(10):682-692.
10. Colbert JD, Martin BJ, Haykowsky MJ, et al. Cardiac rehabilitation referral, attendance and mortality in women. *Eur J Prev Cardiol*. 2015;22(8):979-986.
11. Santiago de Araújo Pio C, Beckie TM, Varnfield M, et al. Promoting patient utilization of outpatient cardiac rehabilitation: A joint International Council and Canadian Association of Cardiovascular Prevention and Rehabilitation position statement. *Int J Cardiol*. 2020;298:1-7.
12. Oosenbrug E, Marinho RP, Zhang J, et al. Sex differences in cardiac rehabilitation adherence: a meta-analysis. *Can J Cardiol*. 2016;32(11):1316-1324.
13. Samayoa L, Grace SL, Gravely S, Scott LB, Marzolini S, Colella TJF. Sex differences in

cardiac rehabilitation enrollment: a meta-analysis. *Can J Cardiol*. 2014;30(7):793-800.
14. Colella TJ, Gravely S, Marzolini S, et al. Sex bias in referral of women to outpatient cardiac rehabilitation? A meta-analysis. *Eur J Prev Cardiol*. 2015;22(4):423-441.
15. Cortés O, Arthur HM. Determinants of referral to cardiac rehabilitation programs in patients with coronary artery disease: A systematic review. *Am Heart J*. 2006;151(2):249-256.
16. Samayoa L, Grace SL, Gravely S, et al. Sex differences in cardiac rehabilitation enrollment: a meta-analysis. *Can J Cardiol*. 2014;30(7):793-800.
17. Oosenbrug E, Marinho RP, Zhang J, et al. Sex differences in cardiac rehabilitation adherence: a meta-analysis. *Can J Cardiol*. 2016;32(11):1316-1324.
18. Ritchey MD, Maresh S, McNeely J, et al. Tracking cardiac rehabilitation participation and completion among Medicare beneficiaries to inform the efforts of a national initiative. *Circ Cardiovasc Qual Outcomes*. 2020;13(1):e005902.
19. National Audit of Cardiac Rehabilitation. *The National Audit of Cardiac Rehabilitation: Quality and Outcomes Report 2019*.; 2019.
20. Grace SL, Racco C, Chessex C, Rivera T, Oh P. A narrative review on women and cardiac rehabilitation: program adherence and preferences for alternative models of care. *Maturitas*. 2010;67(3):203-208.
21. Ghisi GL, Polyzotis P, Oh P, Pakosh M, Grace SL. Physician factors affecting cardiac rehabilitation referral and patient enrollment: a systematic review. *Clin Cardiol*. 2013;36(6):323-335.
22. Supervía M, Medina-Inojosa JR, Yeung C, et al. Cardiac rehabilitation for women: a systematic review of barriers and solutions. *Mayo Clin Proc*. 2017;92(4):565-577.
23. Grace SL, Gravely-Witte S, Kayaniyil S, Brual J, Suskin N, Stewart DE. A multisite examination of sex differences in cardiac rehabilitation barriers by participation status. *J Women's Heal*. 2009;18(2):209-216.
24. Norris CM, Yip CYY, Nerenberg KA, et al. State of the Science in Women's Cardiovascular Disease: A Canadian Perspective on the Influence of Sex and Gender. *J Am Heart Assoc*. 2020;9:e015634.
25. Price J, Landry M, Rolfe D, Delos-Reyes F, Groff L, Sternberg L. Women's cardiac rehabilitation: improving access using principles of women's health. *Can J Cardiovasc*

Nurs. 2005;15(3):32-41.

26. Andraos C, Arthur HM, Oh P, Chessex C, Brister S, Grace SL. Women's preferences for cardiac rehabilitation program model: A randomized controlled trial. *Eur J Prev Cardiol*. 2015;22(12):1513-1522.
27. Grace SL, Racco C, Chessex C, Rivera T, Oh P. A narrative review on women and cardiac rehabilitation: program adherence and preferences for alternative models of care. *Maturitas*. 2010;67(3):203-208.
28. Izawa KP, Yamada S, Oka K, et al. Long-term exercise maintenance, physical activity, and health-related quality of life after cardiac rehabilitation. *Am J Phys Med Rehabil*. 2004;83(12):884-892.
29. Kumar V, Abbas A, Aster J, Perkins J, Robbins S. *Robbins and Cotran Pathologic Basis of Disease*. 8th ed. Philadelphia, PA: Elsevier/Saunders; 2010.
30. Stone JA, Arthur HM, Suskin NG. *Canadian Guidelines for Cardiac Rehabilitation and Cardiovascular Disease Prevention*. 3rd ed. (Stone JA, Arthur HM, Suskin NG, eds.). Winnipeg: Canadian Association of Cardiac Rehabilitation; 2009.
31. World Health Organization. Cardiovascular Diseases (CVDs). Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).
32. Kassebaum NJ, Arora M, Barber RM, et al. Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(10053):1603-1658.
33. Public Health Agency of Canada. Canadian Chronic Disease Surveillance System (CCDSS). Available at: https://health-infobase.canada.ca/ccdss/data-tool/.
34. Public Health Agency of Canada. Economic Burden of Illness in Canada. Available at: https://cost-illness.canada.ca/custom-personnalise/results-national-resultats.php.
35. Garcia M, Miller VM, Gulati M, et al. Focused Cardiovascular Care for Women: The Need and Role in Clinical Practice. *Mayo Clin Proc*. 2016;91(2):226-240.
36. Sutantri S, Cuthill F, Holloway A. 'A bridge to normal': a qualitative study of Indonesian women's attendance in a phase two cardiac rehabilitation programme. *Eur J Cardiovasc Nurs*. 2019;18(8):744-752.
37. Spence JD, Pilote L. Importance of sex and gender in atherosclerosis and cardiovascular

disease. *Atherosclerosis*. 2015;241:208-210.

38. Regitz-Zagrosek V, Oertelt-Prigione S, Prescott E, et al. Gender in cardiovascular diseases: impact on clinical manifestations, management, and outcomes. *Eur Heart J*. 2016;37(1):24-34.

39. Balady GJ, Williams MA, Ades PA, et al. Core Components of Cardiac Rehabilitation/Secondary Prevention Programs: 2007 Update. *Circulation*. 2007;115(20):2675-2682.

40. Price KJ, Gordon BA, Bird SR, Benson AC. A review of guidelines for cardiac rehabilitation exercise programmes: Is there an international consensus? *Eur J Prev Cardiol*. 2016;23(16):1715-1733.

41. Thomas RJ, King M, Lui K, et al. AACVPR/ACC/AHA 2007 Performance Measures on Cardiac Rehabilitation for Referral to and Delivery of Cardiac Rehabilitation/Secondary Prevention Services. Endorsed by the American College of Chest Physicians, American College of Sports Medicine, American Ph. *J Am Coll Cardiol*. 2007;50(14):1400-1433.

42. Mampuya WM. Cardiac rehabilitation past, present and future: an overview. *Cardiovasc Diagn Ther*. 2012;2(1):38-49.

43. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. *Eur Heart J*. 2016;37(29):2315-2381.

44. Chaves G, Turk-Adawi K, Supervia M, et al. Cardiac Rehabilitation Dose Around the World: Variation and Correlates. *Circ Cardiovasc Qual Outcomes*. 2020;13(1):e005453.

45. Beckie TM, Beckstead JW. The effects of a cardiac rehabilitation program tailored for women on global quality of life: a randomized clinical trial. *J Women's Heal*. 2010;19(11):1977-1985.

46. Scane K, Alter D, Oh P, Brooks D. Adherence to a cardiac rehabilitation home program model of care: a comparison to a well-established traditional on-site supervised program. *Appl Physiol Nutr Metab*. 2012;37(2):206-213.

47. Reid RD, Morrin LI, Pipe AL, et al. Determinants of physical activity after hospitalization for coronary artery disease: the Tracking Exercise After Cardiac Hospitalization (TEACH) Study. *Eur J Cardiovasc Prev Rehabil*. 2006;13(4):529-537.

48. Piepoli MF, Hoes AW, Agewall S, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. *Eur Heart J*. 2016;37(29):2315-2381.

49. Lee JY, Han S, Ahn JM, et al. Impact of participation in phase i and phase II cardiac rehabilitation on long-term survival after coronary artery bypass graft surgery. *Int J Cardiol*. 2014;176(3):1429-1432.
50. Anderson L, Oldridge N, Thompson DR, et al. Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease. *J Am Coll Cardiol*. 2016;67(1):1-12.
51. Kabboul N, Tomlinson G, Troy FA, et al. Comparative Effectiveness of the Core Components of Cardiac Rehabilitation on Mortality and Morbidity: A Systematic Review and Network Meta-Analysis. *J Clin Med*. 2018;7(12):514.
52. Lawler PR, Filion KB, Eisenberg MJ. Efficacy of exercise-based cardiac rehabilitation post–myocardial infarction: A systematic review and meta-analysis of randomized controlled trials. *Am Heart J*. 2011;162(4):571-584.e2.
53. Dunlay SM, Pack QR, Thomas RJ, Killian JM, Roger VL. Participation in cardiac rehabilitation, readmissions, and death after acute myocardial infarction. *Am J Med*. 2014;127(6):538-546.
54. Doll JA, Hellkamp A, Thomas L, et al. Effectiveness of cardiac rehabilitation among older patients after acute myocardial infarction. *Am Heart J*. 2015;170(5):855-864.
55. Martin B-J, Hauer T, Arena R, et al. Cardiac rehabilitation attendance and outcomes in coronary artery disease patients. *Circulation*. 2012;126(6):677-687.
56. Francis T, Kabboul N, Rac V, et al. The Effect of Cardiac Rehabilitation on Health-Related Quality of Life in Patients With Coronary Artery Disease: A Meta-analysis. *Can J Cardiol*. 2019;35(3):352-364.
57. Smith SC, Benjamin EJ, Bonow RO, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update. *Circulation*. 2011;124(22):2458-2473.
58. Fihn SD, Gardin JM, Abrams J, et al. 2012 ACCF/AHA Guideline for the diagnosis and management of patients with stable ischemic heart disease. *J Am Coll Cardiol*. 2012;60(24):e44-e164.
59. Antman EM, Anbe DT, Armstrong PW, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1999 Guidelines for the Managem. *Circulation*. 2004;110(9):e82-292.

60. National Clinical Guideline Centre. *MI - Secondary Prevention: Secondary Prevention in Primary and Secondary Care for Patients Following a Myocardial Infarction: Partial Update of NICE CG48*. Vol November. London: Royal College of Physicians (UK); 2013.

61. Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non–ST-elevation acute coronary syndromes. *J Am Coll Cardiol*. 2014;64(24):e139-e228.

62. Hillis LD, Smith PK, Anderson JL, et al. 2011 ACCF/AHA guideline for coronary artery bypass graft surgery. *J Am Coll Cardiol*. 2011;58(24):e123-e210.

63. Levine GN, Bates ER, Blankenship JC, et al. 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention. *J Am Coll Cardiol*. 2012;58(24):1-79.

64. Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: A report of the American college of cardiology foundation/american heart association task force on practice guidelines. *J Am Coll Cardiol*. 2013;62(16):e147-e239.

65. Arnold JM, Howlett JG, Dorian P, et al. Canadian Cardiovascular Society Consensus Conference recommendations on heart failure update 2007: Prevention, management during intercurrent illness or acute decompensation, and use of biomarkers. *Can J Cardiol*. 2007;23(1):21-45.

66. Mosca L, Benjamin EJ, Berra K, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women--2011 update: a guideline from the American Heart Association. *Circulation*. 2011;123(11):1243-1262.

67. Martinello N, Saunders S, Reid R. The Effectiveness of Interventions to Maintain Exercise and Physical Activity in Post-Cardiac Rehabilitation Populations. *J Cardiopulm Rehabil Prev*. 2019;39(3):161-167.

68. Mandic S, Body D, Barclay L, et al. Community-based cardiac rehabilitation maintenance programs: Use and effects. *Hear Lung Circ*. 2015;24(7):710-718.

69. Ghisi GL, Chaves GS, Bennett A, Lavie CJ, Grace SL. The effects of cardiac rehabilitation on mortality and morbidity in women: a meta-analysis attempt. *J Cardiopulm Rehabil Prev*. 2019;39(1):39-42.

70. Beckie TM, Beckstead JW. Predicting cardiac rehabilitation attendance in a gender-tailored randomized clinical trial. *J Cardiopulm Rehabil Prev*. 2010;30(3):147-156.

71. Midence L, Arthur HM, Oh P, Stewart DE, Grace SL. Women's Health Behaviours and

Psychosocial Well-Being by Cardiac Rehabilitation Program Model: A Randomized Controlled Trial. *Can J Cardiol*. 2016:1-7.

72. Beckie TM, Beckstead JW. The effects of a cardiac rehabilitation program tailored for women on global quality of life: a randomized clinical trial. *J Women's Heal*. 2010;19(11):1977-1985.
73. Clark AM, King-Shier KM, Spaling MA, et al. Factors influencing participation in cardiac rehabilitation programmes after referral and initial attendance: Qualitative systematic review and meta-synthesis. *Clin Rehabil*. 2013;27(10):948-959.
74. Turk-Adawi KI, Grace SL. Narrative review comparing the benefits of and participation in cardiac rehabilitation in high-, middle- and low-income countries. *Heart Lung Circ*. 2015;24(5):510-520.
75. Peters AE, Keeley EC. Trends and predictors of participation in cardiac rehabilitation following acute myocardial infarction: Data from the behavioral risk factor surveillance system. *J Am Heart Assoc*. 2018;7(1):1-6.
76. Kotseva K, Wood D, De Bacquer D, et al. EUROASPIRE IV: A European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries. *Eur J Prev Cardiol*. 2016;23(6):636-648.
77. Harrison RW, Simon D, Miller AL, De Lemos JA, Peterson ED, Wang TY. Association of hospital myocardial infarction volume with adherence to American College of Cardiology/American Heart Association performance measures: Insights from the National Cardiovascular Data Registry. *Am Heart J*. 2016;178:95-101.
78. Pio CS de A, Chaves G, Davies P, Taylor R, Grace S. Interventions to Promote Patient Utilization of Cardiac Rehabilitation: Cochrane Systematic Review and Meta-Analysis. *J Clin Med*. 2019;8(2):189.
79. Sandesara PB, Lambert CT, Gordon NF, et al. Cardiac Rehabilitation and Risk Reduction: Time to "rebrand and Reinvigorate." *J Am Coll Cardiol*. 2015;65(4):389-395.
80. Tsui CK-Y, Shanmugasegaram S, Jamnik V, Wu G, Grace SL. Variation in Patient Perceptions of Healthcare Provider Endorsement of Cardiac Rehabilitation. *J Cardiopulm Rehabil Prev*. 2012;32(4):192-197.
81. Ragupathi L, Stribling J, Yakunina Y, Fuster V, McLaughlin MA, Vedanthan R. Availability, use, and barriers to cardiac rehabilitation in LMIC. *Glob Heart*.

2017;12(4):323-334.

82. Supervia M, Medina-Inojosa JR, Yeung C, et al. Cardiac Rehabilitation for Women: A Systematic Review of Barriers and Solutions. *Mayo Clin Proc*. 2017;92(4):565-577.

83. Daly J, Sindone AP, Thompson DR, Hancock K, Chang E, Davidson P. Barriers to participation in and adherence to cardiac rehabilitation programs: a critical literature review. *Prog Cardiovasc Nurs*. 2002;17(1):8-17.

84. Resurrección DM, Motrico E, Rigabert A, et al. Barriers for Nonparticipation and Dropout of Women in Cardiac Rehabilitation Programs: A Systematic Review. *J Women's Heal*. 2017;26(8):849-859.

85. Grace SL, Gravely-Witte S, Kayaniyil S, Brual J, Suskin N, Stewart DE. A multisite examination of sex differences in cardiac rehabilitation barriers by participation status. *J Women's Heal*. 2009;18(2):209-216.

86. Thomas RJ, Beatty AL, Beckie TM, et al. Home-based cardiac rehabilitation: a scientific statement from the american association of cardiovascular and pulmonary rehabilitation, the american heart association, and the american college of cardiology. *Circulation*. 2019;140(1):E69-E89.

87. Grace SL, Midence L, Oh P, et al. Cardiac rehabilitation program adherence and functional capacity among women: a randomized controlled trial. *Mayo Clin Proc*. 2016;91(2):140-148.

88. Anderson L, Sharp GA, Norton RJ, et al. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev*. 2017;2017(6):CD007130.

89. Beckie TM, Beckstead JW. Predicting cardiac rehabilitation attendance in a gender-tailored randomized clinical trial. *J Cardiopulm Rehabil Prev*. 2010;30(3):147-156.

90. Moore SM. Women's views of cardiac rehabilitation programs. *J Cardiopulm Rehabil*. 1996;16(2):123-129.

91. Price J, Landry M, Rolfe D, Delos-Reyes F, Groff L, Sternberg L. Women's cardiac rehabilitation: improving access using principles of women's health. *Can J Cardiovasc Nurs*. 2005;15(3):32-41.

92. Grace SL, McDonald J, Fishman D, Caruso V. Patient preferences for home-based versus hospital-based cardiac rehabilitation. *J Cardiopulm Rehabil*. 2005;25(1):24-29.

93. Santiago De Araujo Pio C, Marzolini S, Pakosh M, Grace SL. Effect of Cardiac

Rehabilitation Dose on Mortality and Morbidity: A Systematic Review and Meta-regression Analysis. *Mayo Clin Proc*. 2017;92(11):1644-1659.

94. Chase J-AD. Systematic review of physical activity intervention studies after cardiac rehabilitation. *J Cardiovasc Nurs*. 2011;26(5):351-358.
95. Edwards ES, Sackett SC. Psychosocial Variables Related to Why Women are Less Active than Men and Related Health Implications. *Clin Med Insights Women's Heal*. 2016;9s1(Suppl 1):CMWH.S34668.
96. Kirkpatrick D. Great ideas revisited: revisiting Kirkpatrick's four-level model. *Train Dev*. 1996;50(1):54-59.
97. Santiago de Araújo Pio C, Gagliardi A, Suskin N, Ahmad F, Grace SL. Implementing recommendations for inpatient healthcare provider encouragement of cardiac rehabilitation participation: development and evaluation of an online course. *BMC Health Serv Res*. 2020;20(1):768.
98. IBM Corp. *IBM SPSS Statistics for Macintosh, Version 26.0*. Armonk, NY: IBM Corp; 2019.
99. Krippendorff K. *Content Analysis: An Introduction to Its Methodology*. 2nd ed. Thousand Oaks, California: Sage Publications, Inc.; 2004.
100. Ghisi GLM, Scane K, Sandison N, Maksymiu S, Skeffington V, Oh P. Development of an educational curriculum for cardiac rehabilitation patients and their families. *J Clin Exp Cardiolog*. 2015;06(05):1-13.
101. Dalleck LC, Tischendorf JS. *Guidelines for Exercise Testing and Prescription (ACSM)*. 10th ed. (Riebe D, Ehrman JK, Liguori G, Magal M, eds.). Philadelphia, PA: Wolters Kluwer; 2012.
102. Marzolini S, Oh PI, Thomas SG, Goodman JM. Aerobic and resistance training in coronary disease: single versus multiple sets. *Med Sci Sports Exerc*. 2008;40(9):1557-1564.
103. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Pr. *J Am Coll Cardiol*. 2018;71(19):e127-e248.

104. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas*. 1977;1(3):385-401.
105. Pirraglia PA, Peterson JC, Williams-Russo P, Gorkin L, Charlson ME. Depressive symptomatology in coronary artery bypass graft surgery patients. *Int J Geriatr Psychiatry*. 1999;14(8):668-680.
106. Swardfager W, Herrmann N, Dowlati Y, Oh P, Kiss A, Lanctôt K. Relationship between cardiopulmonary fitness and depressive symptoms in cardiac rehabilitation patients with coronary artery disease. *J Rehabil Med*. 2008;40(3):213-218.
107. Ried LD, Tueth MJ, Taylor MD, Sauer BC, Lopez LM, Pepine CJ. Depressive Symptoms in Coronary Artery Disease Patients After Hypertension Treatment. *Ann Pharmacother*. 2006;40(4):597-604.
108. Wassertheil-Smoller S, Applegate WB, Berge K. Change in Depression as a Precursor of Cardiovascular Events. *Arch Intern Med*. 1996;156(5):553.
109. Cantril H. *The Pattern of Human Concern*. New Brunswick, New Jersey: Rutgers University Press; 1965.
110. Tingström PR, Kamwendo K, Bergdahl B. Effects of a problem-based learning rehabilitation programme on quality of life in patients with coronary artery disease. *Eur J Cardiovasc Nurs*. 2005;4(4):324-330.
111. Ståhle A, Mattsson E, Rydén L, Unden AL, Nordlander R. Improved physical fitness and quality of life following training of elderly patients after acute coronary events. A 1 year follow-up randomized controlled study. *Eur Heart J*. 1999;20(20):1475-1484.
112. Vaccarino V, Parsons L, Every NR, Barron H V., Krumholz HM. Sex-Based Differences in Early Mortality after Myocardial Infarction. *N Engl J Med*. 1999;341(4):217-225.
113. Hochman JS, Tamis JE, Thompson TD, et al. Sex, Clinical Presentation, and Outcome in Patients with Acute Coronary Syndromes. *N Engl J Med*. 1999;341(4):226-232.
114. Milcent C, Dormont B, Durand-Zaleski I, Steg PG. Gender differences in hospital mortality and use of percutaneous coronary intervention in acute myocardial infarction: microsimulation analysis of the 1999 nationwide French hospitals database. *Circulation*. 2007;115(7):833-839.
115. Palmerini T, Serruys P, Kappetein AP, et al. Clinical outcomes with percutaneous coronary revascularization vs coronary artery bypass grafting surgery in patients with

unprotected left main coronary artery disease: A meta-analysis of 6 randomized trials and 4,686 patients. *Am Heart J*. 2017;190:54-63.

116. Malenka DJ, Leavitt BJ, Hearne MJ, et al. Comparing Long-Term Survival of Patients With Multivessel Coronary Disease After CABG or PCI Analysis of BARI-Like Patients in Northern New England. 2005.

117. Hannan EL, Wu C, Walford G, et al. Drug-Eluting Stents vs. Coronary-Artery Bypass Grafting in Multivessel Coronary Disease. *N Engl J Med*. 2008;358(4):331-341.

118. Scrutinio D, Giannuzzi P. Comorbidity in patients undergoing coronary artery bypass graft surgery: impact on outcome and implications for cardiac rehabilitation. *Eur J Cardiovasc Prev Rehabil*. 2008;15:379-385.

119. Higgins J, Thomas J, Chandler J, et al. *Cochrane Handbook for Systematic Reviews of Interventions Version 6.0*. Cochrane; 2019.

120. Shea BJ, Reeves BC, Wells G, et al. AMSTAR 2: A critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. 2017;358:1-9.

121. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ*. 2009;339(7716):332-336.

122. The Cochrane Collaboration. Cochrane recommends Covidence for new reviews. Available at: https://www.cochrane.org/news/cochrane-recommends-covidence-new-reviews.

123. Sterne JAC, Savović J, Page MJ, et al. RoB 2: A revised tool for assessing risk of bias in randomised trials. *BMJ*. 2019;366.

124. Schünemann H, Brożek J, Guyatt G, A O, Editors. GRADE handbook for grading quality of evidence and strength of recommendations. The GRADE Working Group.

125. *Review Manager (RevMan) Version 5.3 [Computer Program]*. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration; 2014.

126. Reid R, Blanchard CM, Wooding E, et al. Ecologically optimizing exercise maintenance in men and women post-cardiac rehabilitation: Protocol for a randomized controlled trial of efficacy with economics (ECO-PCR). *Contemp Clin Trials*. 2016;50:116-123.

127. Reid RD, Wooding E, Blanchard CM, et al. Promoting Exercise Maintenance Post-Cardiac Rehab: A randomized trial. *Can J Cardiol*. 2020:Available online November 5,

2020.

128. Lear SA, Spinelli JJ, Linden W, et al. The Extensive Lifestyle Management Intervention (ELMI) after cardiac rehabilitation: A 4-year randomized controlled trial. *Am Heart J*. 2006;152(2):333-339.

129. Izawa KP, Watanabe S, Oka K, Kobayashi T, Osada N, Omiya K. The effects of unsupervised exercise training on physical activity and physiological factors after supervised cardiac rehabilitation. *J Japanese Phys Ther Assoc*. 2006;9(1):1-8.

130. Madssen E, Arbo I, Granoien I, Walderhaug L, Moholdt T. Peak oxygen uptake after cardiac rehabilitation: a randomized controlled trial of a 12-month maintenance program versus usual care. *PLoS One*. 2014;9(9):e107924.

131. Pinto BM, Goldstein MG, Papandonatos GD, et al. Maintenance of exercise after phase II cardiac rehabilitation: a randomized controlled trial. *Am J Prev Med*. 2011;41(3):274-283.

132. Pinto BM, Dunsiger SI, Farrell N, Marcus BH, Todaro JF. Psychosocial outcomes of an exercise maintenance intervention after phase II cardiac rehabilitation. *J Cardiopulm Rehabil Prev*. 2013;33(2):91-98.

133. Pinto BM, Dunsiger SI. Mediators of exercise maintenance after cardiac rehabilitation. *J Cardiopulm Rehabil Prev*. 2015;35(1):13-20.

134. Brubaker PH, Rejeski WJ, Smith MJ, et al. A home-based maintenance exercise program after center-based cardiac rehabilitation: effects on blood lipids, body composition, and functional capacity. *J Cardiopulm Rehabil*. 2000;20(1):50-56.

135. Lear SA. Extensive lifestyle management intervention following cardiac rehabilitation. PhD Dissertation. Available at: https://search.proquest.com/docview/305471675/fulltextPDF/3A45F1E1256480BPQ/1?accountid=15182.

136. Lear SA, Ignaszewski A, Laquer EA, Pritchard PH, Frohlich JJ. Extensive lifestyle management intervention following cardiac rehabilitation: pilot study. *Rehabil Nurs J*. 2001;26(6):227-232.

137. Lear SA, Ignaszewski A, Linden W, et al. A randomized controlled trial of an extensive lifestyle management intervention (ELMI) following cardiac rehabilitation: Study design and baseline data. *Curr Control Trials Cardiovasc Med*. 2002;3(1):9.

138. Sunamura M, Ter Hoeve N, van den Berg-Emons HJ, et al. OPTImal CArdiac

REhabilitation (OPTICARE) following Acute Coronary Syndromes: Rationale and design of a randomised, controlled trial to investigate the benefits of expanded educational and behavioural intervention programs. *Netherlands Hear J*. 2013;21(7-8):324-330.

139. Lear SA. The Extensive Lifestyle Management Intervention (ELMI) following cardiac rehabilitation trial. *Eur Heart J*. 2003;24(21):1920-1927.

140. Sunamura M, Ter Hoeve N, Van Den Berg-Emons RJG, et al. Randomised controlled trial of two advanced and extended cardiac rehabilitation programmes. *Heart*. 2018;104(5):430-437.

141. ter Hoeve N, Sunamura M, Stam HJ, van Domburg RT, van den Berg-Emons RJG. A secondary analysis of data from the OPTICARE randomized controlled trial investigating the effects of extended cardiac rehabilitation on functional capacity, fatigue, and participation in society. *Clin Rehabil*. 2019;33(8):1355-1366.

142. Vieira ASDS, Cristina Damas Argel de Melo M, Andreia Raquel Santos Noites SP, Machado JP, Joaquim Gabriel MM. The effect of virtual reality on a home-based cardiac rehabilitation program on body composition, lipid profile and eating patterns: A randomized controlled trial. *Eur J Integr Med*. 2017;9:69-78.

143. Vieira A, Melo C, Machado J, Gabriel J. Virtual reality exercise on a home-based phase III cardiac rehabilitation program, effect on executive function, quality of life and depression, anxiety and stress: a randomized controlled trial. *Disabil Rehabil Assist Technol*. 2018;13(2):112-123.

144. Giannuzzi P, Temporelli PL, Marchioli R, et al. Global secondary prevention strategies to limit event recurrence after myocardial infarction (GOSPEL). *Arch Intern Med*. 2008;168(20):2194-2204.

145. Giannuzzi P, Temporelli PL, Maggioni A Pietro, et al. Global Secondary Prevention strategies to limit event recurrence after myocardial infarction: The GOSPEL study. A trial from the Italian Cardiac Rehabilitation Network: Rationale and design. *Eur J Cardiovasc Prev Rehabil*. 2005;12(6):555-561.

146. Giallauria F, Lucci R, D’Agostino M, et al. Two-year multicomprehensive secondary prevention program: favorable effects on cardiovascular functional capacity and coronary risk profile after acute myocardial infarction. *J Cardiovasc Med*. 2009;10(10):772-780.

147. Chowdhury M, Heald FA, Sanchez-Delgado JC, Pakosh M, Jacome-Hortua AM, Grace

SL. The effects of maintenance cardiac rehabilitation: A systematic review and Meta-analysis, with a focus on sex. *Hear Lung*. 2021;50(4):504-524.

148. Turk-Adawi K, Supervia M, Lopez-Jimenez F, et al. Cardiac rehabilitation availability and density around the globe. *EClinicalMedicine*. 2019;13:31-45.

149. Babu AS, Lopez-Jimenez F, Thomas RJ, et al. Advocacy for outpatient cardiac rehabilitation globally. *BMC Health Serv Res*. 2016;16(1):471.

150. Grace SL, Turk-Adawi KI, Contractor A, et al. Consensus statement: Cardiac rehabilitation delivery model for low-resource settings. *Heart*. 2016;102(18):1449-1455.

151. Santiago de Araújo Pio C, Chaves GS, Davies P, Taylor RS, Grace SL. Interventions to promote patient utilisation of cardiac rehabilitation. *Cochrane Database Syst Rev*. 2019;2(2):CD007131.

152. Andraos C, Arthur HM, Oh P, Chessex C, Brister S, Grace SL. Women's preferences for cardiac rehabilitation program model: a randomized controlled trial. *Eur J Prev Cardiol*. 2015;22(12):1513-1522.

153. Grace SL, Gravely-Witte S, Kayaniyil S, Brual J, Suskin N, Stewart DE. A multisite examination of sex differences in cardiac rehabilitation barriers by participation status. *J Women's Heal*. 2009;18(2):209-216.

154. Thomas E, Gallagher R, Grace SL. Future-proofing cardiac rehabilitation: transitioning services to telehealth during COVID-19. *Eur J Prev Cardiol*. 2020;0(0):1-2.

155. Kavanagh T, Mertens DJ, Hamm LF, et al. Prediction of long-term prognosis in 12 169 men referred for cardiac rehabilitation. *Circulation*. 2002;106(6):666-671.

156. Kavanagh T, Mertens DJ, Hamm LF, et al. Peak oxygen intake and cardiac mortality in women referred for cardiac rehabilitation. *J Am Coll Cardiol*. 2003;42(12):2139-2143.

157. Keteyian SJ, Brawner CA, Savage PD, et al. Peak aerobic capacity predicts prognosis in patients with coronary heart disease. *Am Heart J*. 2008;156(2):292-300.

158. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. *N Engl J Med*. 2002;346(11):793-801.

159. Midence L, Arthur HM, Oh P, Stewart DE, Grace SL. Women's health behaviours and psychosocial well-being by cardiac rehabilitation program model: a randomized controlled trial. *Can J Cardiol*. 2016;32(8):956-962.

160. Beckie TM, Beckstead JW. The effects of a cardiac rehabilitation program tailored for

women on global quality of life: a randomized clinical trial. *J Women's Heal*. 2010;19(11):1977-1985.

161. Beckie TM, Beckstead JW, Schocken DD, Evans ME, Fletcher GF. The effects of a tailored cardiac rehabilitation program on depressive symptoms in women: a randomized clinical trial. *Int J Nurs Stud*. 2011;48(1):3-12.
162. Terada T, Chirico D, Tulloch HE, Scott K, Pipe AL, Reed JL. Sex differences in psychosocial and cardiometabolic health among patients completing cardiac rehabilitation. *Appl Physiol Nutr Metab*. 2019;44(11):1237-1245.
163. Cannistra LB, Balady GJ, O'Malley CJ, Weiner DA, Ryan TJ. Comparison of the clinical profile and outcome of women and men in cardiac rehabilitation. *Am J Cardiol*. 1992;69(16):1274-1279.
164. Feola M, Garnero S, Daniele B, et al. Gender differences in the efficacy of cardiovascular rehabilitation in patients after cardiac surgery procedures. *J Geriatr Cardiol*. 2015;12(5):575-579.
165. Stehli J, Duffy SJ, Burgess S, et al. Sex disparities in myocardial infarction: biology or bias? *Hear Lung Circ*. 2021;30(1):18-26.
166. Mamataz T, Ghisi GLM, Pakosh M, Grace SL. Women-focused cardiac rehabilitation: A systematic review. *BMC Women's Heal*. 2020:Under review.
167. Turk-Adawi K, Supervia M, Lopez-Jimenez F, Adawi A, Sadeghi M, Grace SL. Women-only cardiac rehabilitation delivery around the world. *Heart Lung Circ*. 2021;30(1):135-143.
168. Sánchez-Delgado JC, Camargo Sepulveda DC, Cardona Zapata A, et al. The effects of maintenance cardiac rehabilitation: a systematic review. *J Cardiopulm Rehabil Prev*. 2020;40(4):224-244.

TABLES

Table 1. Study 1: Reach and Characteristics of Health Care Providers Initiating Online Course by Retention

Characteristics	Completed Post-Test n=414 (79.3%)	Did not Complete Post-Test n=108 (20.7%)	Total[a] N=522
Sex			
Female	261 (76.5%)	80 (23.5%)	341 (74.9%)
Male	93 (81.6%)	21 (18.4%)	114 (25.1%)
Profession			
Physician	73 (75.3%)	24 (24.7%)	97 (21.7%)
Nurse or nurse-practitioner	147 (81.7%)	33 (18.3%)	180 (40.2%)
Allied health care provider or other	127 (74.3%)	44 (25.7%)	171 (38.2%)
Years in practice	11.12 ± 10.18	14.19 ± 10.07	11.80 ± 10.22[c]
Course language			[b]
English	226 (76.4%)	70 (23.6%)	296 (56.7%)[e]
Portuguese	30 (75.0%)	10 (25.0%)	40 (7.7%)[f]
French	17 (63.0%)	10 (37.0%)	27 (5.2%)[g]
Spanish	36 (70.6%)	15 (29.4%)	51 (9.8%)[h]
Chinese	105 (97.2%)	3 (2.8%)	108 (20.7%)[e,f,g,h]
Country			
Andorra[j]	1 (100.0%)	0 (0.0%)	1 (0.2%)
Australia	6 (100.0%)	0 (0.0%)	6 (1.3%)
Azerbaijan[j,k]	0 (0.0%)	1 (100.0%)	1 (0.2%)
Barbados	0 (0.0%)	1 (100.0%)	1 (0.2%)
Brazil[k]	28 (73.7%)	10 (26.3%)	38 (8.3%)
Brunei Darussalam	1 (100.0%)	0 (0.0%)	1 (0.2%)
Canada	107 (82.9%)	22 (17.1%)	129 (28.2%)
Chile	1 (100.0%)	0 (0.0%)	1 (0.2%)
China[k]	107 (97.3%)	3 (2.7%)	110 (24.1%)
Colombia[k]	9 (64.3%)	5 (35.7%)	14 (3.1%)

Egypt[k]	1 (100.0%)	0 (0.0%)	1 (0.2%)
France	9 (47.4%)	10 (52.6%)	19 (4.2%)
Greece	1 (100.0%)	0 (0.0%)	1 (0.2%)
India[k]	4 (36.4%)	7 (63.6%)	11 (2.4%)
Iraq[j,k]	0 (0.0%)	1 (100.0%)	1 (0.2%)
Ireland	6 (54.5%)	5 (45.5%)	11 (2.4%)
Malaysia[k]	1 (100.0%)	0 (0.0%)	1 (0.2%)
Myanmar[j,k]	1 (100.0%)	0 (0.0%)	1 (0.2%)
New Zealand	1 (50.0%)	1 (50.0%)	2 (0.4%)
Pakistan[k]	0 (0.0%)	1 (100.0%)	1 (0.2%)
Paraguay[k]	5 (50.0%)	5 (50.0%)	10 (2.2%)
Peru[k]	3 (100.0%)	0 (0.0%)	3 (0.7%)
Puerto Rico	1 (100.0%)	0 (0.0%)	1 (0.2%)
Qatar	5 (83.3%)	1 (16.7%)	6 (1.3%)
Russia[k]	2 (66.7%)	1 (33.3%)	3 (0.7%)
Saudi Arabia	2 (66.7%)	1 (33.3%)	3 (0.7%)
Singapore	2 (33.3%)	4 (66.7%)	6 (1.3%)
South Africa[k]	1 (100.0%)	0 (0.0%)	1 (0.2%)
Spain	18 (75.0%)	6 (25.0%)	24 (5.3%)
Thailand[k]	1 (50.0%)	1 (50.0%)	2 (0.4%)
United Arab Emirates	1 (100.0%)	0 (0.0%)	1 (0.2%)
United Kingdom	15 (57.7%)	11 (42.3%)	26 (5.7%)
United States of America	15 (75.0%)	5 (25.0%)	20 (4.4%)

Note: number of sample and percentages, or mean and standard deviation are shown.

[a]chi-square or Mann-Whitney U test comparing post-test completers to non-completers (i.e., answered all items).

[b]indicates $P<.05$.

[c]indicates $P<.01$.

[d]indicates $P<.001$.

[e,f,g,h,i]*post-hoc* test with Bonferroni when significant; $P<.001$

[j]country has no cardiac rehabilitation to our knowledge.[148]
[k]low or middle-income country according to World Bank (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)

Table 2. Study 1: Provider Knowledge by Assessment Point

Test Item	Pre-test n=472	Post-test[a] n=414
1) Which of the following are benefits of CR? (all 3)	336 (71.2%)	346 (83.6%)[b]
2) There is high-quality evidence from trials demonstrating that cardiac rehabilitation should be recommended for acute coronary syndrome, coronary revascularization and ventricular arrhythmia patients.	131 (27.8%)	201 (48.6%)[b]
3) Patients with comorbid schizophrenia, advanced dementia and/or substance dependence are good candidates for cardiac rehabilitation.	327 (69.3%)	300 (72.5%)
4) Which one of the following patients is not a good candidate for CR?	254 (53.8%)	358 (79.6%)[b]
5) Which of the following is not a core component of CR?	231 (48.9%)	240 (58.0%)[b]
6) Who is responsible to communicate and provide positive cardiac rehab endorsement to the patient?	452 (95.8%)	390 (94.2%)
7) The evidence suggests it is key for a peer mentor or volunteer, not a health care provider, to encourage patients to participate in cardiac rehab.	307 (65.0%)	280 (67.6%)
8) Key messages you should convey to patients at the bedside about cardiac rehab do not include:	305 (64.6%)	332 (80.2%)[b]
9) Some patient groups, such as women, are less likely to participate in cardiac rehab, so precious time spent promoting attendance could be directed to patients that you believe are interested in attending.	133 (41.2%)	111 (38.7%)
10) Which of the following factors should NOT affect whom you encourage to attend cardiac rehab? (all 3)	202 (61.4%)	179 (62.4%)
Total score[c]	**6.28 ± 1.76**	**7.22 ± 2.14[b]**

Abbreviation: CR, cardiac rehabilitation.

Note: Number of participants and percentage of those who answered each question correctly are shown.

[a]McNemar's test for individual items or Wilcoxon signed-rank test for the total score.

[b]indicates $P<.001$.

[c]Mean and standard deviation of overall test score out of 10.

Table 3. Study 1: Provider Cardiac Rehabilitation Knowledge, Attitudes, Discussion Self-Efficacy, and Practice by Assessment Point

Test Item	Pre-test n=308	Post-test n=271
1) How familiar are you with what is offered and delivered to patients in CR?[a]	3.34 ± 1.28	4.01 ± 0.94[f]
2) Do you intend to discuss CR participation with eligible/indicated patients at the bedside?[b]	3.72 ± 1.53	4.40 ± 1.12[f]
3) Do you perceive you have all the information you need to comprehensively discuss CR at the bedside with your patients?[c]	3.12 ± 1.23	3.99 ± 0.90[f]
4) Do you provide any materials to patients about CR to take home with them (e.g., pamphlet or handout with weblink)?[b]	3.14 ± 1.73	3.87 ± 1.54[f]
5) How important is it to you to provide information about CR to patients before they are discharged?[d]	4.39 ± 0.95	4.43 ± 1.09
6) How confident are you that you can address any barriers patients raise regarding CR attendance?[e]	3.22 ± 1.03	3.77 ± 1.06[f]
7) How confident are you in answering questions patients raise about attending CR?[e]	3.29 ± 1.11	3.82 ± 1.08[f]
Overall Discussion Practice	**3.44 ± 1.35**	**4.13 ± 1.11[f]**
Overall Self-Efficacy	**3.21 ± 0.97**	**3.86 ± 0.85[f]**
Overall Total[g]	**3.48 ± 0.91**	**4.04 ± 0.73[f]**

Abbreviation: CR, cardiac rehabilitation.

Note: Mean and standard deviation are shown. Q-1 assesses knowledge; Q-5 attitudes; Q-3,6,7 self-efficacy; and Q-2,4 practice as per level 2 (learning) of Kirkpatrick's model.[96]

[a]scored on a 5-point Likert scale: 5=Very familiar; 4=Quite familiar; 3=Somewhat familiar; 2=Scantly familiar; 1=I am not familiar with CR

[b]scored on a 3-point Likert scale: 3=Yes, most of the time; 2=Sometimes; 1=No; converted into a 5-point Likert scale in analysis for comparability

[c]scored on a 5-point Likert scale: 5=Yes, I definitely have all the information I need to discuss CR; 4=Yes, I have the information I need; 3=I have most of the information I need; 2=I don't really have the information I need; 1=No

[d]scored on a 5-point Likert scale: 5=Very important; 4=Quite important; 3=Somewhat important; 2=Slightly important; 1=Not at all important

[e]scored on a 5-point Likert scale: 5=Very confident; 4=Quite confident; 3=Somewhat confident; 2=Not very confident; 1=Not at all confident

[f]Wilcoxon signed-rank test: $P<.001$.

[g]out of 5; higher score indicates better knowledge, attitudes, self-efficacy, or practice.

Table 4. Study 2: Participant's Sociodemographic and Clinical Characteristics Pre-Program by Model and Sex

	Men*	Women†			
	Mixed-sex N=454	Mixed-sex N=543 (74.7%)	Women-only N=160 (22.0%)	Home-based N=24 (3.3%)	Total N=727
Sociodemographic					
Age	66.8 ± 11.8	66.7 ± 12.1	68.1 ± 12.1	61.3 ± 16.9	66.9 ± 12.3
Marital status (% married / common-law)	290 (82.2%)***	257 (67.8%)	67 (63.2%)	9 (60.0%)	333 (66.6%)
Highest educational attainment (% ≥high school)	226 (93.8%)	299 (92.3%)	79 (94.0%)	12 (100.0%)	390 (92.9%)
Language spoken (% English)	313 (95.1%)	411 (96.3%)	111 (98.2%)	20 (100.0%)	542 (96.8%)
Occupational status					
Retired/no formal employment	147 (54.9%)	220 (64.1%)‡‡	74 (80.4%)‡‡	6 (54.5%)	300 (67.3%)†
Full-time/part-time/ modified/restricted duties	101 (37.7%)	103 (30.0%)‡	16 (17.4%)‡	4 (36.4%)	123 (27.6%)†
Other (e.g., disability)	20 (7.5%)	20 (5.8%)	2 (2.2%)	1 (9.1%)	23 (5.2%)
Travel time to CR centre (% 0-30 mins)	124 (63.3%)	143 (61.1%)	34 (58.6%)	2 (40.0%)	179 (60.3%)
Living situation					
With spouse/partner	212 (70.2%)***	201 (50.9%)	44 (43.6%)	11 (68.8%)	256 (50.0%)
Alone	41 (13.6%)***	123 (31.1%)	37 (36.6%)	4 (25.0%)	164 (32.0%)
With family/friends/others	49 (16.2%)	71 (18.0%)	20 (19.8%)	1 (6.3%)	92 (18.0%)

Clinical characteristics					
Referral event/procedure§					
PCI	228 (50.6%)***	185 (34.4%)	54 (34.0%)	7 (31.8%)	246 (34.2%)
Valvular heart disease	34 (7.5%)*	62 (11.5%)	20 (12.6%)	1 (4.5%)	83 (11.5%)
CABG	41 (9.1%)	50 (9.3%)	21 (13.2%)	1 (4.5%)	72 (10.0%)
Stroke/TIA	40 (8.9%)	52 (9.7%)	13 (8.2%)	2 (9.1%)	67 (9.3%)
Primary prevention	8 (1.8%)***	41 (7.6%)	10 (6.3%)	1 (4.5%)	52 (7.2%)
Arrhythmia/Rhythm device	21 (4.7%)	35 (6.5%)	14 (8.8%)	0 (0.0%)	49 (6.8%)
Heart failure	16 (3.5%)	22 (4.1%)	3 (1.9%)	1 (4.5%)	26 (3.6%)
Angina pectoris (stable/unstable)	25 (5.5%)	21 (3.9%)	3 (1.9%)	1 (4.5%)	25 (3.5%)
Cardiomyopathy	7 (1.6%)	17 (3.2%)	4 (2.5%)	3 (13.6%)	24 (3.3%)
MI	3 (0.7%)**	17 (3.2%)	4 (2.5%)	1 (4.5%)	22 (3.1%)
PVD	18 (4.0%)	13 (2.4%)	5 (3.1%)	1 (4.5%)	19 (2.6%)
SCAD	0 (0.0%)	3 (0.6%)	2 (1.3%)	0 (0.0%)	5 (0.7%)
Other	10 (2.2%)	20 (3.7%)	6 (3.8%)	3 (13.6%)	29 (4.0%)
Cardiovascular risk factors					
Hypertension	258 (57.0%)	314 (58.0%)	96 (60.4%)	13 (54.2%)	423 (58.4%)
Family history	193 (42.7%)***	300 (55.7%)‡	70 (43.8%)‡	14 (58.3%)	384 (53.1%)†
Dyslipidemia	241 (53.1%)	273 (50.7%)	77 (48.1%)	12 (50.0%)	362 (50.1%)
Diabetes	116 (25.6%)	128 (23.7%)	46 (28.9%)	6 (25.0%)	180 (24.9%)
Comorbidities					
Sleep apnea	91 (20.0%)*	76 (14.0%)	19 (11.9%)	4 (16.7%)	99 (13.6%)

Osteoarthritis	24 (5.3%)***	72 (13.3%)	26 (16.3%)	6 (25.0%)	104 (14.3%)
Cancer	24 (5.3%)**	56 (10.3%)	15 (9.4%)	3 (12.5%)	74 (10.2%)

Note: N (%) or mean ± standard deviation shown

*Mann-Whitney U or chi-square test for difference between men and women in mixed-sex model: *p<.05, **p<.01, ***p<.001

†Kruskal-Wallis or chi-square test for difference between model among women: †p<.05; ††p<.01; †††p<.001

‡post-hoc test results, where above significant: ‡p<.05; ‡‡p<.01; ‡‡‡p<.001

§main referral event or procedure for each participant; in women, comparisons were only between supervised models due to low sample size in home-based

CABG=coronary artery bypass graft; CAD=coronary artery disease; CR=cardiac rehabilitation; MI=myocardial infarction; N=sample size; PCI=percutaneous coronary intervention; PVD=peripheral vascular disease; SCAD=spontaneous coronary artery dissection; TIA=transient ischemic attack

Table 5. Study 2: Program Utilization by Model and Sex, N=1181

	Men*	**Women†**			
	Mixed-sex N=454	**Mixed-sex N=543**	**Women-only N=160**	**Home-based N=24**	**Total N=727**
Session adherence					
Number of sessions attended§||	14.3 ± 7.4	14.7 ± 7.2†	13.6 ± 6.6†	9.9 ± 5.6 (of 15)	14.4 ± 7.01°
Proportion of prescribed sessions attended (%)^	57.3 ± 58.8	58.8 ± 28.9‡	54.3 ± 26.3‡	65.8 ± 37.1	58.0 ± 28.7†
Dropout reason^_					
Clinical reasons	25 (32.5%)	48 (46.2%)	12 (42.9%)	3 (42.9%)	62 (45.3%)
Other reasons	52 (67.5%)	56 (53.8%)	16 (57.1%)	4 (57.1%)	76 (54.7%)
Program completion^	283 (62.3%)	324 (59.7%)□	96 (60.0%)‡	8 (33.3%)‡□	428 (58.9%)†

Note: N (%) or mean ± standard deviation shown

*Mann-Whitney U or chi-square test for difference between men and women in mixed-sex model: *p<.05

†Mann-Whitney U, Kruskal-Wallis or chi-square test for difference between model among women: †p<.05

‡post-hoc test results, where above significant: ‡□ *P*<.05

§of 25 for supervised and 15 for home-based

||compared between mixed-sex and women-only only, as home-based has lower number of prescribed sessions and they are calls, not visits

^compared between all models

°mean for women's 2 supervised models only, as home-based denominator smaller

_not available for all participants who did not complete the post-program assessment (i.e., completion)

N=sample size

Table 6. Study 2: Women's Pre-CR Characteristics by Retention Status, N=727

	Retained/Completed N=428 (58.9%)	**Lost to follow-up/Dropouts N=299 (41.1%)**	***P value****
Sociodemographic			
Age	67.5 ± 11.7	65.9 ± 13.1	.148
Marital status (% married / common-law)	201 (68.4)	132 (64.1)	.317
Highest educational attainment (% ≥high school)	247 (94.3)	143 (90.5)	.146
Language spoken (% English)	328 (98.2)	214 (94.7)	**.021**
Occupational status			.067
Retired/ no formal employment	185 (66.3)	115 (68.9)	-
Full-time/part-time/ modified/restricted duties	84 (30.1)	39 (23.4)	-
Other (e.g., disability)	10 (3.6)	13 (7.8)	-
Travel time to CR centre (% 0-30 mins)	104 (56.5)	75 (66.4)	.092
Living situation			.229
With spouse/partner	165 (52.4)	91 (46.2)	-
Alone	100 (31.7)	64 (32.5)	-
With family/friends/others	50 (15.9)	42 (21.3)	-
Clinical			
Referral event/procedure§			.217
PCI	158 (37.3)	88 (29.8)	-
Valvular heart disease	49 (11.6)	34 (11.5)	-
CABG	45 (10.6)	27 (9.2)	-
Stroke/TIA	39 (9.2)	28 (9.5)	-

Primary prevention	30 (7.1)	22 (7.5)	-
Arrhythmia/Rhythm device	25 (5.9)	24 (8.1)	-
Heart failure	9 (2.1)	17 (5.8)	-
Angina pectoris (stable/unstable)	12 (2.8)	13 (4.4)	-
Cardiomyopathy	13 (3.1)	11 (3.7)	-
MI	16 (3.8)	6 (2.0)	-
PVD	11 (2.6)	8 (2.7)	-
SCAD	3 (0.7)	2 (0.7)	-
Other	14 (3.3)	15 (5.1)	-
Cardiovascular risk factors			
Hypertension	251 (58.9)	172 (57.7)	.747
Family history of CVD	237 (55.9)	147 (49.2)	.074
Dyslipidemia	229 (54.0)	133 (44.6)	**.013**
Diabetes	95 (22.3)	85 (28.6)	.053
Comorbidities			
Sleep apnea	50 (11.7)	49 (16.4)	.069
Osteoarthritis	65 (15.2)	39 (13.0)	.417
Cancer	42 (9.8)	32 (10.7)	.696

Note: N (%) or mean ± standard deviation shown

* Mann-Whitney U or chi-square test for difference between retained/completed and lost to follow-up/dropouts

§main referral event or procedure for each participant

CABG=coronary artery bypass graft; CAD=coronary artery disease; CR=cardiac rehabilitation; MI=myocardial infarction; N=sample size; PCI=percutaneous coronary intervention; PVD=peripheral vascular disease; SCAD=spontaneous coronary artery dissection; TIA=transient ischemic attack

Table 7. Study 2: Outcomes by Time and Model, in Women Completers

	Mixed-sex N=324			Women-only N=96			Between Group†	Home-based N=8		
	Intake	Discharge	Change*	Intake	Discharge	Change*	P	Intake	Discharge	Change*
Cardiorespiratory fitness										
VO_{2peak} (ml/kg/min)	17.7 ± 5.3	20.8 ± 6.0	2.8 ± 2.7***	16.0 ± 4.5	19.8 ± 4.5	3.0 ± 2.7***	.008	18.3 ± 6.4	18.6 ± 6.2	0.6 ± 2.0
METs	5.1 ± 1.5	5.9 ± 1.7	0.8 ± 0.8***	4.6 ± 1.3	5.6 ± 1.3	0.9 ± 0.8***	.005	5.2 ± 1.8	5.2 ± 1.8	0.0 ± 0.7
Cardiovascular risk factors										
SBP (mmHg)	121.6 ± 17.6	120.3 ± 15.6	-0.8 ± 17.1	124.0 ± 17.0	123.9 ± 15.1	1.9 ± 16.7	.068	123.9 ± 20.3	116.6 ± 17.5	-5.4 ± 12.3
DBP (mmHg)	72.9 ± 9.8	73.1 ± 8.0	0.2 ± 9.4	72.2 ± 8.0	74.2 ± 8.0	1.9 ± 9.4	.997	67.7 ± 8.8	66.8 ± 6.6	-1.7 ± 10.8
Total cholesterol (mmol/L)	4.1 ± 1.1	4.1 ± 1.2	-0.0 ± 0.8	4.0 ± 1.2	4.0 ± 1.1	-0.0 ± 0.6	.827	4.0 ± 1.3	5.0 ± 1.2	0.5 ± 1.3
Triglycerides (mmol/L)	1.3 ± 0.7	1.3 ± 0.7	-0.0 ± 0.6	1.3 ± 0.8	1.3 ± 0.7	-0.1 ± 0.4	.899	1.0 ± 0.3	1.5 ± 0.8	0.4 ± 0.3
HDL-C (mmol/L)	1.5 ± 0.4	1.5 ± 0.4	0.1 ± 0.2**	1.6 ± 0.5	1.5 ± 0.4	-0.0 ± 0.0	.309	1.5 ± 0.5	1.2 ± 0.1	0.1 ± 0.2
LDL-C (mmol/L)	2.0 ± 1.0	2.0 ± 1.0	-0.1 ± 0.6	2.0 ± 1.0	1.9 ± 0.9	0.0 ± 0.1	.752	2.1 ± 1.0	3.2 ± 0.7	0.2 ± 1.0
Tobacco use, (% current)	3 (5.9%)	2 (5.1%)	-1 (2.7%)	0 (0.0%)	0 (0.0%)	0	N/A	0 (0.0%)	0 (0.0%)	0

Waist circumference (cm)	89.2 ± 13.9	87.9 ± 13.9	-1.3 ± 6.3**	90.3 ± 13.5	89.2 ± 14.5	-0.0 ± 0.7	.304	95.9 ± 17.6	92.6 ± 23.2	-3.1 ± 7.2
BMI (kg/m^2)	27.5 ± 5.7	27.3 ± 5.6	-0.1 ± 1.4	27.8 ± 5.2	27.8 ± 5.9	0.0 ± 0.2	.524	31.9 ± 11.0	30.3 ± 11.9	-1.6 ± 2.1
Psychosocial well-being										
Depressive symptoms (CES-D)	12.6 ± 9.9	10.4 ± 8.7	-1.5 ± 8.1*	13.8 ± 8.5	11.2 ± 10.7	-1.4 ± 2.3	.468	11.0 ± 6.8	13.0 ± 4.4	2.5 ± 0.7
Quality of life (Cantril's ladder of life; 0-10)	6.8 ± 1.9	7.5 ± 1.5	0.7 ± 1.7**	7.2 ± 1.6	7.7 ± 1.6	0.3 ± 0.3	.157	7.0§	7.0§	0§§

Note: N (%) or mean ± standard deviation shown for available sample at given assessment point; change score shown only in participants with scores at both time points.

*paired-samples t-test for change from intake to discharge within each CR model; *p<.05; **p<.01; ***p<.001

†compared between mixed-sex and women-only only, as valid N in home-based is too low for some outcomes. General linear mixed model adjusts for baseline value.

‡baseline difference between mixed-sex and women-only: ‡p<.05; ‡‡p<.01; ‡‡‡p<.001

§sample size=1, standard deviation not available

§§no valid pair available for change score

BMI=body mass index; CES-D=Center for Epidemiologic Studies-Depression scale; DBP=diastolic blood pressure; HDL-C=high-density lipoprotein cholesterol; LDL-C=low-density lipoprotein cholesterol; METs=metabolic equivalent of task; N=sample size; N/A=not applicable; SBP=systolic blood pressure; VO_{2peak}=maximum rate of oxygen consumption measured during cardiopulmonary exercise test

Table 8. Study 2: Outcomes by Time in Matched, Completing Men in Mixed-Sex Model, and Difference from Women in Mixed-Sex Model

	Men N=283			Intake Sex Difference† N=270	Sex Difference Over 6 Months‡		
	Intake	Discharge	Change*		Estimate	SE	95% CI (Lower, Upper)
Cardiorespiratory fitness							
VO_{2peak} (ml/kg/min)	21.8 ± 6.6	26.4 ± 8.2	4.4 ± 4.7***	-4.5 ± 7.2***	-4.80***	0.35	-5.49, -4.12
METs	6.3 ± 1.9	7.5 ± 2.4	1.2 ± 1.4***	-1.4 ± 2.1***	-1.39***	0.10	-1.58, -1.19
Cardiovascular risk factors							
SBP (mmHg)	119.5 ± 16.2	120.6 ± 16.2	1.2 ± 17.1	0.9 ± 23.0	0.37	0.97	-1.53, 2.28
DBP (mmHg)	72.1 ± 10.5	72.7 ± 9.2	0.3 ± 10.7	1.1 ± 14.6	0.77	0.61	-0.43, 1.97
Total cholesterol (mmol/L)	3.4 ± 1.0	3.5 ± 0.9	0.1 ± 0.7	0.5 ± 2.5**	0.67***	0.07	0.54, 0.80
Triglycerides (mmol/L)	1.3 ± 0.7	1.2± 0.6	-0.1 ± 0.5	0.2 ± 1.0**	0.11*	0.05	0.02, 0.20
HDL-C (mmol/L)	1.2 ± 0.3	1.3 ± 0.3	0.1 ± 0.2***	0.3 ± 0.5***	0.28***	0.24	0.23, 0.33
LDL-C (mmol/L)	1.7 ± 0.8	1.7 ± 0.7	-0.0 ± 0.6	0.2 ± 2.4	0.33***	0.05	0.22, 0.43
Tobacco use, (% current)	5 (10.6%)	3 (10.3%)	-2 (7.1%)	3 (3.3%)	N/A	N/A	N/A

Waist circumference (cm)	97.2 ± 12.1	95.8 ± 12.5	-1.5 ± 5.1***	N/A	N/A	N/A	N/A
BMI (kg/m^2)	27.6 ± 4.5	27.4 ± 4.7	-0.3 ± 1.5**	0.4 ± 7.8	-0.21	0.31	-0.81, 0.40
Psychosocial well-being							
Depressive symptoms (CES-D)	9.7 ± 8.1	8.2 ± 7.5	-1.7 ± 6.0**	4.8 ± 12.9***	3.39***	0.63	2.16, 4.63
Quality of life (Cantril's ladder of life)	7.1 ± 1.7	7.4 ± 1.5	0.6 ± 1.5**	-0.4 ± 2.5	-0.48**	0.16	-0.79, -0.18

Note: N (%) or mean ± standard deviation shown

*paired-samples t-test for change from intake to discharge in men; *p<.05; **p<.01; ***p<.001

†paired-samples t-test for baseline difference between women and men (matched), men as reference category

‡general linear mixed model for sex difference; estimates for women with men as reference category

BMI=body mass index; CES-D=Center for Epidemiologic Studies-Depression scale; CI=confidence interval; DBP=diastolic blood pressure; HDL-C=high-density lipoprotein cholesterol; LDL-C=low-density lipoprotein cholesterol; METs=metabolic equivalent of task; N=sample size; N/A=not applicable (i.e., sample size too small to run general linear mixed model, or not appropriate to test for sex differences in waist circumference due to biological differences); SBP=systolic blood pressure; SE=standard error; VO_{2peak}=maximum rate of oxygen consumption measured during cardiopulmonary exercise test

Table 9. Study 3: Summary of All Included Trials, N=10

Study Author, Year, Country	Sample (Size; Mean Age; Proportion female; Proportion non-CAD participants)	Arms		Results
		Control **Usual care and / or Comparison**	**Experimental** (Duration; contact frequency; setting; Ex Rx [FITT]; comprehensive; any tech: y/n)	**Results** Outcome, unit of measurement, adjustment, duration of follow-up
Brubaker et al., 2000, USA	N=31 (intx=16, control=15); Age: intx=61 ± 11 yrs, control=59 ± 14 yrs; % Female: NR; Non CAD: congestive heart failure (6.5%), valvular heart disease/surgery patients (3.2%)	Usual care control: y Comparison: n (excluded as not randomized)	9 months; every other week; supervised and unsupervised; 3 to 5 times per week, exercise in their target heart rate range (50-75% of the heart rate reserve from exercise test performed at 3 months), 30 to 40 minutes, aerobic exercise (option of selecting the mode of endurance activity most appropriate for their situation [i.e., treadmill, stationary cycling, walking, etc]); comprehensive: y (education, review of changes in medical status and compliance, general support); tech: n	Exercise capacity (METS), adjusted (9 months) pre-intx 8.0±2.3; post-intx 9.2±0.4; pre-control 8.4±3.0; post-control 8.8±0.4. Significant differences within groups (P<0.05). No significant difference between groups. % body fat, adjusted (9 months) pre-intx 21±6; post-intx 21±1; pre-control 22±4; post-control 22±1. No significant differences within groups or between groups. Total cholesterol (mmol/L), adjusted (9 months) pre-intx 4.94±0.80; post-intx 4.91±0.16; pre-control 4.94±0.96; post-control 5.20±0.16. No significant differences within groups or between groups. HDL-C (mmol/L), adjusted (9 months) pre-intx 0.96±0.23; post-intx 1.14±0.03; pre-control 1.03±0.36; post-control 1.16±0.05. Significant differences within groups (P<0.05). No significant difference between groups. TC/HDL-C (ratio), adjusted (9 months) pre-intx 5.16; post-intx 4.32; pre-control 4.77; post-control 4.47. No significant differences within groups or between groups. LDL-C, (mmol/L), adjusted (9 months) pre-intx 3.18±0.72; post-intx 3.00±0.13; pre-control 3.10±0.80; post-control 3.41±0.16. No significant differences within groups or between groups. Triglyceride (mmol/L), adjusted (9 months) pre-intx 1.87±0.87; post-intx 1.75±0.14; pre-control 1.48±0.89; post-control 1.33±0.15. No significant differences within groups or between groups.
Giallauria et al., 2009, Italy	N=52 (intx=26, control=26); Age: intx=58.2 ± 7.8 yrs, control=57.4 ± 9.7 yrs; Female: intx=15.4%, control=15.4%; Non CAD: none	Usual care control: y Comparison: n	21 months; monthly, supervised; monthly sessions with the target of 60–70% of the VO2peak achieved at the initial symptom-limited exercise test, 30 minutes with 5-minute warm-up and followed by a 5-minute cool-down, aerobic exercise with bicycle ergometer; comprehensive: y (education and lifestyle behavior; tech: n	VO2peak (ml/kg per min), (21 months) pre-intx 20.5 ±2.4 ; post-intx 21.6±2.3; pre-control 20.9±1.1; post-control 15.4±2.0. Significant differences within groups (P<0.001, <0.001) and between groups. (P<0.001). VO2AT (ml/kg per min) (21 months) pre-intx 13.5±3.1; post-intx 13.9±2.2; pre-control 13.3 ±3.4; post-control 9.8±2.7. Significant differences within usual care group (P <0.001) and between groups (P<0.001). No significant difference within intervention group. VE/VCO2slope (21 months) pre-intx 35.2±3.3; post-intx 29.3±4.2; pre-control 34.9±4.5; post-control 39.8±4.9. Significant differences within groups (P<0.001, <0.001) and between groups (P<0.001). $Watt_{max}$(W) (21 months) pre-intx 132.0±6.8; post-intx 128.9±5.3 ; pre-control 131.6±9.0; post-control 94.5±3.0. Significant differences within groups (P<0.05, <0.001) and between groups (P<0.001).

				BMI (kg/m^2) (21 months) pre-intx 27.2±2.3; post-intx 26.7±2.5; pre-control 27.4±2.2; post-control 28.3±2.9. Significant differences within groups (P<0.05, <0.05) and between groups (P<0.001). SBP (mmHg) (21 months) pre-intx 127.2±4.5; post-intx 120±4.0; pre-control 128.7±5.9; post-control 130.6±2.9. Significant differences within intervention group (P <0.001) and between groups (P<0.001). No significant difference within usual care group. DBP (mmHg), (21 months) pre-intx 75.6±2.2; post-intx 74.3±2.1; pre-control 75.9±4.5; post-control 77.6±3.9. Significant differences within intervention group (P <0.05) and between groups (P<0.05). No significant difference within usual care group. Total Cholesterol (mmol/L), (21 months) pre-intx 4.7±1.1; post-intx 4.6±0.8; pre-control 4.6±0.8; post-control 5.7±0.6. Significant differences within groups (P<0.05, <0.05) and between groups (P<0.001). LDL-C (mmol/L), (21 months) pre-intx 2.8±1.1; post-intx 2.3±0.1; pre-control 2.8±0.8; post-control 4.0±0.7. Significant differences within groups (P<0.05, <0.001) and between groups (P<0.001). HDL-C (mmol/L) (21 months) pre-intx 1.3±0.2; post-intx 1.3±0.1; pre-control 1.2±0.1; post-control 0.9±0.1. Significant differences within usual care group (P <0.001) and between groups (P<0.001). No significant difference within intervention group. Triglycerides (mmol/L) (21 months) pre-intx 1.4±0.4; post-intx 1.4±0.3; pre-control 1.4±0.3; post-control 1.9±0.3. Significant differences within usual care group (P <0.001) and between groups (P<0.001). No significant difference within intervention group. HR (beats/min) (21 months) pre-intx 72.0±3.9; post-intx 68.0±3.3; pre-control 73.0±2.7; post-control 73.3±3.3. Significant differences within intervention group (P <0.001) and between groups (P<0.001). No significant difference within usual care group. LVEF (21 months) pre-intx 47.2±3.1; post-intx 47.1±3.4; pre-control 46.7±2.5; post-control 45.1±2.3. Significant differences within usual care group (P <0.05) and between groups (P<0.05). No significant difference within intervention group.
Giannuzzi et al., 2005, Italy	N=52 (intx=1620, control=1621); Age: intx=57.8 ± 9.1 yrs, control=58.0 ± 9.3 yrs; Female: intx=14.1%, control=13.3%; Non CAD: none	Usual care control: y Comparison: n	36 months; monthly from month 1 to month 6, then every 6 months for 3 years; supervised; at least 3 h/wk, 60% to 75% of the mean maximum heart rate, 30 minutes, aerobic exercise; comprehensive: y (lifestyle and risk factor counseling lasting at least 1 hour, and reinforcement of preventive interventions	Total mortality (36 months) post-intx 34; post-control 43. No significant between group difference (P=0.29). CV mortality (36 months) post-intx 18; post-control 24. No significant between group difference (P=0.35). Sudden death (36 months) post-intx 10; post-control 16. No significant between group difference (P=0.24). CV mortality, MI and stroke (36 months) post-intx 52; post-control 77 . Significant between group difference (P=0.02). Cardiac death and non-fatal MI (36 months) post-intx 41; post-control 64. Significant between group (P=0.02). Overall events (36 months) post-intx 261; post-control 295. Not ignificant between group (P=0.12). Nonfatal MI (36 months) post-intx 23; post-control 44. Significant between group (P=0.01).

			lasting approximately 30 minutes); tech: n	Nonfatal stroke (36 months) post-intx 11; post-control 13. Not significant between group (P=0.67). PCI (36 months) post-intx 144; post-control 159. Not significant between group (P=0.39). CABG (36 months) Post-intx 45; post-control 50. Not significant between group (P=0.6). Hospitalization for HF (36 months) post-intx 24; post-control 33. Not significant between group (P=0.22). Hospitalization for AP (36 months) post-intx 80; post-control 91. Not significant between group (P=0.39). Fatal and Nonfatal Stroke (36 months) post-intx 11; post-control 16. Not significant between group (P=0.33). BMI (kg/m^2) (6 months) pre-intx 26.5±3.5; post-intx 26.6±3.5; pre-control 26.6±3.6; post-control 26.8±3.5. Not significant between group (P=0.17). However, there was a 0.2% lower increase in BMI in the intervention group (P=0.17). During the course of the study, BMI increased by 1.7% and 2.1% in the intervention and usual care groups, respectively, a difference that was statistically significant (0.4%; P=0.03). Physical activity (score) (6 months) pre-intx 6.7±2.5; post-intx 7.5±2.2; pre-control 6.6±2.4; post-control 7.1±2.3. Significant between group (P=0.005). Tobacco use (n, %) (6 months) pre-intx 688 (42.5%); post-intx 137 (19.8%) ; pre-control 692 (42.7%); post-control 173 (24.9%). Significant difference between groups (P=0.02). Self/Stress management (score) (6 months) pre-intx 16.3±3.8 ; post-intx 14.0±3.4; pre-control 16.2±3.8; post-control 14.5±3.6. Significant between group (P<0.001). Dietary habits (score) (6 months) pre-intx 16.6±2.8; post-intx 19.1±2.2; pre-control 16.6±2.7; post-control 18.6±2.3. Significant difference between groups (P<0.001).
Izawa et al. 2006, Japan	N=24 (intx=12, comparison=12); Age: intx=65.2 ± 9.7 yrs, comparison=66.8 ± 9.9 yrs; Female: intx=10%, comparison=12.5%; Non CAD: none	Usual care control: n Comparison: y Duration: 6 months, twice weekly, aerobic exercise program comprised of walking at least twice weekly for 1 hour; comprehensive: n, tech: n	6 months; twice weekly; unsupervised; intx: at least twice/week, a rating of 11-13 on the 20-scale Borg scale of perceived exertion for aerobic exercise, low-intensity muscle strength training, 1 hour, combination of walking as aerobic exercise and resistance training; comprehensive: n; tech: n	Physical activity (steps) (6 months) pre-intx 10458.7±2210.1; post-intx 9945.7±2812.7; pre-control (1) 9622.4±2582.6; post-control (1) 9812.3±2652.3. No significant difference within group and between group (P=0.09). Peak VO_2 (ml/kg/min) (6 months) pre-intx 30.2±7.8; post-intx 30.8±6.6; pre-control (1) 27.4±6.6; post-control (1) 25.9±5.9. No significant difference within group and between group (P=0.08). Knee extension strength (Nm/kg) (6 months) pre-intx 1.8±0.4; post-intx 2.1±0.4; pre-control (1) 1.9±0.3; post-control (1) 1.6±0.3. Significant difference (P < 0.05) was seen between groups.
Lear et al. 2006, Canada	N=302 (intx=151, control=151); Age: intx=64.8 ± 8.8 yrs, control=63.4 ± 10.2 yrs; Female: intx=17%, control=18%; Non CAD: none	Usual care control: y Comparison: n	48 months; First year: 6 supervised CR sessions, 6 telephones follow-ups, 3 lifestyle and risk factor counselling sessions. Second year: 4 telephone follow-ups, 2 lifestyle	Exercise capacity (METs) (48 months) pre-intx 10.4±2.4; post-intx 9.8±2.7; pre-control 10.4±2.4; post-control 9.8±2.6. Significant differences within groups (P <0.01). No significant difference between groups (P=0.765). Physical activity (kcal/wk) (48 months)

			and risk factor counselling sessions. Third year: 4 telephone follow-ups, 2 lifestyle and risk factor counselling sessions. Fourth year: 4 telephone follow-ups, 2 lifestyle and risk factor counselling sessions. Supervised and unsupervised; frequency as above, each session consists of a warm-up, a medically prescribed target heart rate and a cool down period, 75 minutes, aerobic exercise; comprehensive: y (lifestyle & risk factor counselling); tech: telephone	pre-intx 2907±1812; post-intx 2099±2074; pre-control 3009±2204; post-control 2349±2018. Significant differences within groups ($P < 0.001$). No significant difference between groups ($P=0.574$). Framingham Risk score (score) (48 months) Pre-intx 6.50 ±3.11; post-intx 5.90±2.88; pre-control 6.45±3.10; post-control 6.46±2.86. Significant differences within intervention group ($P < 0.05$). No significant difference within usual care group or between groups ($P=0.81$). BMI (kg/m^2) (48 months) pre-intx 28.0±4.3; post-intx 28.3±5.0; pre-control 26.7±3.6; post-control 27.1±3.8. Significant differences within usual care groups ($P < 0.01$). No significant difference within intervention groups or between groups ($P=0.482$). Waist Circumference (cm) (48 months) pre-intx 95.3±12.8; post-intx 96.9±14.7; pre-control 91.3±10.7; post-control 93.9±11.5. Significant differences within intervention and usual care groups ($P < 0.05$, < 0.01). No significant difference between groups ($P=0.237$). Total Cholesterol (mmol/L) (48 months) pre-intx 4.43±;0.87 post-intx 4.21±0.84; pre-control 4.54±0.89; post-control 4.54±0.95. Significant differences within intervention groups ($P < 0.05$). No significant difference within usual care group or between groups ($P=0.051$). LDL-C (mmol/L) (48 months) pre-intx 2.49±0.73; post-intx 2.34±0.68; pre-control 2.66±0.71; post-control 2.67±0.79. Significant differences within intervention groups ($P < 0.05$). No significant difference within usual care group or between groups ($P=0.093$). HDL-C (mmol/L) (48 months) pre-intx 1.13±0.31; post-intx 1.16±0.33; pre-control 1.16±0.28; post-control 1.20±0.33. Significant differences within usual care groups ($P < 0.05$). No significant difference within intervention group or between groups ($P=0.418$). Triglycerides (mmol/L) (48 months) pre-intx 1.75±0.95; post-intx 1.60±1.53; pre-control 1.57±0.76; post-control 1.47±0.82. No significant difference within groups or between groups ($P=0.748$). TC/HDL-C (48 months) pre-intx 4.12±1.16; post-intx 3.82±1.10; pre-control 4.08±1.01; post-control 3.97±1.07. Significant differences within intervention group ($P < 0.001$). No significant difference within usual care group or between groups ($P=0.157$). Glucose (mmol/L) (48 months) pre-intx 5.7±1.1; post-intx 5.8±1.2; pre-control 5.8±1.9; post-control 5.7±1.2. No significant difference within groups or between groups ($P=0.239$). SBP (mm Hg) (48 months) pre-intx 128±21; post-intx 126±18; pre-control 125±20; post-control 131±19. Significant differences within usual care groups ($P < 0.01$) and between groups ($P=0.005$). No significant difference within intervention group. DBP (mm Hg) (48 months) pre-intx 72±11; post-intx 74±10; pre-control 72±10; post-control 77±11. Significant differences within intervention and usual care groups ($P < 0.05$, < 0.001). No significant difference between groups ($P=0.103$). Tobacco use (current) (48 months) pre-intx 2; post-intx 1 ; pre-control 4; post-control 5. No significant difference within groups or between groups. Dietary fat (% daily kcal)- Total (48 months)

				pre-intx 22.0±6.5; post-intx 25.2±7.08; pre-control 21.6±7.7; post-control 24.9±7.2. Significant differences within usual care groups (P <0.001). No significant difference within intervention group. or between groups (P=0.989). Dietary fat (% daily kcal)- Saturated (48 months) pre-intx 6.3±2.4; post-intx 8.2±3.6; pre-control 6.0±2.5; post-control 7.7±3.3. Significant differences within intervention and usual care groups (P <0.001, <0.001). No significant difference between groups (P=0.632). Dietary fat (% daily kcal)- Unsaturated (48 months) pre-intx 13.0±4.3; post-intx 14.1±4.5; pre-control 12.6±4.7; post-control 14.0±4.3. Significant differences within intervention and usual care groups (P <0.05, <0.01). No significant difference between groups (P=0.589). Perceived stress (48 months) pre-intx 33±7; post-intx 32±8; pre-control 33±8; post-control 32±8. No significant difference within groups. or between groups (P=0.840). Illness intrusiveness (48 months) pre-intx 29±13; post-intx 27±13; pre-control 30±14; post-control 27±13. Significant differences within usual care groups (P <0.05). No significant difference within intervention group. or between groups (P=0.494). Self efficacy (48 months) pre-intx 43±4; post-intx 42±4; pre-control 42±5; post-control 42±5. No significant difference within groups. or between groups (P=0.885). Exercise self-efficacy (48 months) pre-intx 68±10; post-intx 63±14; pre-control 66±13; post-control 62±15. Significant differences within intervention and usual care groups (P <0.001, <0.01). No significant difference between groups (P=0.457). Lipid-lowering medication (n, % yes) (48 months) pre-intx 112 (86.2%) ; post-intx 115 (88.5%); pre-control 98 (82.4%); post-control 95 (79.8%). No significant difference within groups. HMG-CoA reductase inhibitor (n, %) (48 months) pre-intx 102 (78.5%); post-intx 110 (84.5%); pre-control 88 (73.9%); post-control 89 (74.8%). No significant difference within groups. β-blocker (n, %) (48 months) pre-intx 88 (67.7%); post-intx 89 (68.5%); pre-control 82 (68.9%); post-control 76 (63.9%). No significant difference within groups. ACE-inhibitor (n, %) (48 months) pre-intx 59 (45.4%) ; post-intx 68 (52.3%); pre-control 49 (41.2%); post-control 58 (48.7%). No significant difference within groups. Calcium-channel blocker (n, %) (48 months) pre-intx 35 (26.9%); post-intx 36 (27.7%); pre-control 23 (19.3%); post-control 29 (24.4%). No significant difference within groups. Diuretic (n, %) (48 months) pre-intx 21(16.2%); post-intx 36 (27.7%); pre-control 13 (10.9%); post-control 21 (17.6%). Significant difference within intervention groups (P<0.01). No significant difference within usual care groups. ASA (n, %) (48 months) pre-intx 112 (86.2%); post-intx 102 (78.5%); pre-control 100 (84%); post-control 99 (83.2%). Significant difference within intervention groups (P<0.01). No significant difference within usual care groups.

				Hypoglycemic agents (n, %) (48 months) pre-intx 16 (12.3%); post-intx 22 (16.9%); pre-control 18 (15.1%); post-control 21 (17.7%). No significant difference within groups. Angiotensin receptor blocker (n, %) (48 months) pre-intx 4 (3.1%); post-intx 15 (11.5%) ; pre-control 4 (3.4%); post-control 10 (8.4%). Significant difference within intervention group (P<0.01). No significant difference within usual care group.
Madssen et al. 2014, Norway	N=49 (intx=24, control =25); Age: intx=64.4 yrs, control=58.5 yrs; Female: intx=25%, control=28%; Non CAD: valve replacement (6.1%), cardiomyopathy (4.1%)	Usual care control: y Comparison: n	12 months; monthly; supervised; three sessions of HIIT per week, and monthly supervised exercise session at the hospital, target heart rate was 85–95% of the maximum heart rate and 70% of maximum heart rate in the active pauses, 8–10 minutes of warmup followed by four times four minutes intervals, with an active pause of three minutes in-between intervals and at the end (walked or ran on treadmills), aerobic exercise with HIIT; comprehensive: n; tech: n	VO_{2peak} (ml/kg/min) (12 months) pre-intx 27.9±4.7; post-intx 28.8±5.6; pre-control 32.8±6.2; post-control 32.8±5.8. No significant difference within groups. or between groups (P=0.58). VO_{2peak} (ml/min) (12 months) pre-intx 2405±517; post-intx 2533±576; pre-control 2535±760; post-control 2614±734. No significant difference within groups or between groups (P=0.70). RER_{peak} (12 months) pre-intx 1.09±0.07; post-intx 1.09±0.09; pre-control 1.10±0.07; post-control 1.09±0.06. No significant difference within groups or between groups (P=0.71). BMI (kg/m^2) (12 months) pre-intx 28.0±3.9; post-intx 28.7±4.1; pre-control 25.8±3.3; post-control 26.1±3.2. Significant differences within intervention groups (P <0.05). No significant difference within usual care group or between groups (P=0.16). Waist Circumference (cm) (12 months) pre-intx 101.4±12.1; post-intx 103.2±11.7; pre-control 93.0±9.4; post-control 93.0±9.4. Significant differences within intervention groups (P <0.05) and between groups (P=0.04). No significant difference within usual care group. SBP (mmHg) (12 months) pre-intx 132.8±14.7; post-intx 133.7±16.4; pre-control 131.3±14.5; post-control 134.3±14.0. No significant difference within groups or between groups (P=0.69). DBP (mmHg) (12 months) pre-intx 78.8±7.2; post-intx 79.3±7.5; pre-control 75.1±10.7; post-control 77.5±10.0. No significant difference within groups or between groups (P=0.97). Heart rate recovery (beats) (12 months) pre-intx 27.7±11.2; post-intx 31.2±14.6; pre-control 28.9±10.0; post-control 30.1±10.2. No significant difference within groups or between groups (P=0.60). Resting Heart rate (beats/min) (12 months) pre-intx 64.0±10.2; post-intx 65.7±11.6; pre-control 61.2±11.5; post-control 63.2±11.1. No significant difference within groups or between groups (P=0.92). TC (mmol/L) (12 months) pre-intx 4.3±1.0; post-intx 4.3±0.8; pre-control 3.9±0.6; post-control 3.9±0.8. No significant difference within groups or between groups (P=0.57). LDL-C (mmol/L) (12 months) pre-intx 2.2±0.9; post-intx 2.2±0.7; pre-control 2.0±0.5; post-control 2.0±0.6. No significant difference within groups or between groups (P=0.70). HDL- C (mmol/L) (12 months) pre-intx 1.5±0.4; post-intx 1.5±0.4; pre-control 1.3±0.4; post-control 1.3±0.4. No significant difference within groups or between groups (P=0.34). Triglycerides (mmol/L) (12 months) pre-intx 1.4±0.8; post-intx 1.2±0.7; pre-control 1.2±0.6; post-control 1.3±1.1. No significant difference within groups or between groups (P=0.24). Glucose (mmol/L) (12 months)

				pre-intx 6.7±3.7; post-intx 6.4±2.2; pre-control 6.0±1.8; post-control 6.2±2.4. No significant difference within groups or between groups (P=0.43). HbA1c (%) (12 months) pre-intx 6.1±1.2; post-intx 6.0±1.0; pre-control 6.1±0.7; post-control 6.2±1.4. Significant differences within intervention group (P <0.05). No significant difference within usual care groups or between groups (P=0.21). hsCRP (mg/L) (12 months) pre-intx 1.09±0.9; post-intx 1.07±0.6; pre-control 1.2±0.9; post-control 1.5±2.5. No significant difference within groups or between groups (P=0.51). QOL- Emotional domain (MacNew) (12 months) pre-intx 6.0±0.8; post-intx 6.0±0.6; pre-control 5.7±0.8; post-control 6.1±0.8. No significant difference within groups or between groups (P=0.69). QOL- Physical domain (MacNew) (12 months) pre-intx 6.2±0.7; post-intx 6.3±0.6; pre-control 6.3±0.6; post-control 6.4±0.5. No significant difference within groups or between groups (P=0.40). QOL- Social domain (MacNew) (12 months) pre-intx 6.4±0.6; post-intx 6.5±0.4; pre-control 6.4±0.6; post-control 6.7±0.4. No significant difference within groups or between groups (P=0.37).
Pinto et al., 2011, USA	N=130 (intx=64, control =66); Age: intx=62.9 ± 9.3 yrs, control=54.3 ± 10.0 yrs; Female: intx=21.9%, control=19.7%; Non CAD: none	Usual care control: y Comparison: n	6 months; weekly over the first 2 months, bi-weekly for the next 2 months, and monthly for the last 2 months; unsupervised; 3 times/week, at least moderate-intensity exercise, about 90 minutes/session, aerobic exercise, comprehensive: motivational counselling; tech: telephone	QOL-Total (MacNew) (12 months) pre-intx 5.9±0.8; post-intx 6.2±0.6; pre-control 5.9±0.8; post-control 5.9±0.7. Significant difference between groups (P=0.002). QoL-Mental (SF-36) (12 months) pre-intx 53.9±7.8; post-intx 54.4±7.0; pre-control 53.7±8.8; post-control 52.4±10.4. No significant difference between groups (P=0.09). Cardiac Depression (scale) (12 months) pre-intx 65.4±22.3; post-intx 65.1±18.9; pre-control 68.0±26.0; post-control 66.1±24.8. Significant difference between groups (P=0.009). Self-efficacy (6 months) pre-intx 3.38±0.96; post-intx 3.56±0.87; pre-control 3.22±0.75; post-control 3.20±1.01. No significant difference between groups (P=0.23). Decisional balance index (6 months) pre-intx 2.02±1.05; post-intx 2.07±1.26; pre-control 1.75±0.93; post-control 1.86±1.15. No significant difference between groups (P=0.83). Behavioural processes (6 months) pre-intx 3.14±0.62; post-intx 3.10±0.74; pre-control 3.10±0.63; post-control 2.97±0.71. No significant difference between groups (P=0.64). Enjoyment (6 months) pre-intx 102.48±22.11; post-intx 102.35±17.48; pre-control 102.24±22.91; post-control 97.39±23.90. No significant difference between groups (P=0.22). Social Support (Friends) (6 months) pre-intx 1.30±0.75; post-intx 1.24±0.56; pre-control 1.25±0.64; post-control 1.20±0.52. Significant difference between groups (P=0.02). Social Support (Family) (6 months) pre-intx 1.49±1.03; post-intx 1.57±0.98; pre-control 1.65±1.08; post-control 1.47±0.78 No significant difference between groups (P=0.08).
Reid et al., 2020, Canada	N=449 (intx=226, control=223); Age: intx=63.7 ± 9.9 yrs, control=64.0 ± 9.8 yrs; Female: intx=30.2%,	Usual care control: y Comparison: n	50 weeks; 9 sessions; unsupervised; ≥150 minutes MVPA/week, aerobic exercise (mostly	Exercise capacity (ml O2/kg/min) (12 months) pre-intx 24.76±6.47; post-intx 24.64±5.92; pre-control 24.97±7.04; post-control 25.21 ±8.04). No significant difference within intervention group (P=0.864) or control groups (P=0.796) and between groups (P=0.598). Exercise capacity,(METS) (12 months)

	control=30.1%; Non CAD: none		walking); comprehensive: n, tech: telephone	pre-intx 7.7±2.8; post-intx 7.00±1.7; pre-control 7.3±2.2; post-control 7.18 ±2.3. Significant differences within intervention groups (P =0.001). No significant difference within usual care groups (P=0.283) or between groups (P=0.559). Weekly MVPA (non-bouted; in minutes) (12 months) pre-intx 294.9±185.2; post-intx 266.7 ±194.9; pre-control 302.7±200.1; post-control 264.4±186.6. Significant differences within intervention and usual care groups (P<0.001, 0.008). No significant difference between groups (P=0.916). Body mass index (kg/m2) (12 months) pre-intx 28.42±4.94; post-intx 28.61±5.04; pre-control 28.47±5.05; post-control 29.02±5.27. Significant differences within intervention and usual care groups (P=0.006, 0.01). No significant difference between groups (P=0.468). Waist circumference (cm) (12 months) pre-intx 99.2±13.6; post-intx 100.3±13.9; pre-control 98.4±13.3; post-control 100.0±13.9. Significant differences within intervention groups (P =0.017). No significant difference within usual care groups (P=0.066) or between groups (P=0.839). Systolic blood pressure (mmHg) (12 months) pre-intx 120.6±15.9; post-intx 124.4±14.9; pre-control 120.6±17.6; post-control 126.53±15.3. . Significant differences within intervention and usual care groups (P<0.001, <0.001). No significant difference between groups (P=0.203). Quality of life (EQ-5d VAS), (12 months) pre-intx 75.5±14.5; post-intx 79.2±12.9; pre-control 79.1±12.5; post-control 79.8±11.3. Significant differences within intervention groups (P =0.006). No significant difference within usual care groups (P=0.747) or between groups (P=0.668).
Sunamura et al., 2018, Netherlands	N=914 (intx=309, comparison=299, control=306); Age: intx=57.5 ± 9.2 yrs, comparison=57.1 ± 9.7 yrs, control=57.4 ± 9.3yrs; Female: intx=20.7%, comparison=17.1%, control=19.6%; Non CAD: none	Usual care control: y Comparison: y; 9 months; unsupervised; 5-6 telephone coaching sessions at 5 to 6-week intervals; at least 5 times a week, moderate intensity, 30 minutes, aerobic exercise; comprehensive: lifestyle counselling; tech: telephone	9 months; 3 group sessions at 1, 3, and 9 months; supervised; at least 5 times a week, moderate intensity, 30 minutes, aerobic exercise (running/brisk walking); comprehensive: lifestyle counselling; tech: n.	Mortality (18 months) post-intx 1; post-control (1) 1; post-control (2) 0. No significant difference between groups (P=0.56, 0.56). Total events (18 months) post-intx 83; post-control (1) 79; post-control (2) 70. No significant difference between groups (P=0.25, 0.44). STEMI (18 months) post-intx 1; post-control (1) 5; post-control (2) 2. No significant difference between groups (P=0.56, 0.24). NSTEMI (18 months) post-intx 5; post-control (1) 3; post-control (2) 3. No significant difference between groups (P=0.49, 0.98). Unstable angina (18 months) post-intx 4; post-control (1) 3; post-control (2) 2. No significant difference between groups (P=0.4, 0.64). Stable angina (18 months) post-intx 14; post-control (1) 13; post-control (2) 9. No significant difference between groups (P=0.65, 0.64). Chest pain (18 months) post-intx 16; post-control (1) 12; post-control (2) 11. No significant difference between groups (P=0.58, 0.53). Ventricular fibrillation (18 months) post-intx 6; post-control (1) 2; post-control (2) 2. No significant difference between groups (P=0.16, 0.98). Atrial fibrillation (18 months)

				post-intx 0; post-control (1) 1; post-control (2) 0. No significant difference between intervention and usual care groups (P=0.31). Arrhythmia (18 months) post-intx 0; post-control (1) 1; post-control (2) 0. No significant difference between intervention and usual care groups (P=0.31). Cerebrovascular accident (18 months) post-intx 0; post-control (1) 0; post-control (2) 0. Coronary angiogram (18 months) post-intx 8; post-control (1) 5; post-control (2) 7. No significant difference between groups (P=0.81, 0.59). PCI (18 months) post-intx 9; post-control (1) 9; post-control (2) 12. No significant difference between groups (P=0.98, 0.85). CABG (18 months) post-intx 1; post-control (1) 0; post-control (2) 2. No significant difference between groups (P=0.56, 0.16). Admission to cardiac ER (18 months) post-intx 18; post-control (1) 24; post-control (2) 20. No significant difference between groups (P=0.55, 0.90). Functional Capacity (6MWT in meter) (9 months) pre-intx 608±84; post-intx 600±85; pre-control (1) 601±89; post-control (1) 597±79 pre-control (2) 598±82; post-control (2) 596±82. SBP (mm Hg) (9 months) pre-intx 126; post-intx 132.8; pre-control (1) 125.2; post-control (1) 133.3; pre-control (2) 126.5; post-control (2) 132.2. DBP (mm Hg) (9 months) pre-intx 76.6; post-intx 79.0; pre-control (1) 79.9; post-control (1) 80.1; pre-control (2) 80.7; post-control (2) 79.0. Total cholesterol (mmol /L) (9 months) pre-intx 4.0; post-intx 4.1; pre-control (1) 4.2; post-control (1) 4.3; pre-control (2) 4.2; post-control (2) 4.3. HDL-C cholesterol (mmol /L) (9 months) pre-intx 1.1; post-intx 1.2; pre-control (1) 1.2; post-control (1) 1.3; pre-control (2) 1.1; post-control (2) 1.2. LDL-C cholesterol (mmol /L) (9 months) pre-intx 2.3; post-intx 2.3; pre-control (1) 2.5; post-control (1) 2.4 ; pre-control (2) 2.5; post-control (2) 2.5. Triglyceride (mmol /L) (9 months) pre-intx 1.5; post-intx 1.5; pre-control (1) 1.7; post-control (1) 1.7 ; pre-control (2) 1.8; post-control (2) 1.8. Body mass index (kg/m2) (9 months) pre-intx 28.0; post-intx28.2; pre-control (1) 27.8; post-control (1) 28.0; pre-control (2) 27.8; post-control (2) 28.1. Waist circumference (cm) (9 months) pre-intx 99.8; post-intx 102.6; pre-control (1) 100.0; post-control (1) 102.5; pre-control (2) 99.7; post-control (2) 102.6. Tobacco Use (9 months) pre-intx 25.2; post-intx 26.9; pre-control (1) 21.1; post-control (1) 25.8; pre-control (2) 27.1; post-control (2) 27.5. Significant difference between intervention and

				usual care groups (P<0.001). No significant difference between intervention and active comparison groups (P=0.34). QOL- Emotional (MacNew) (9 months) pre-intx 5.48±1.12; post-intx 5.64±1.01; pre-control (1) 5.57±1.01; post-control (1) 5.76±0.96; pre-control (2) 5.38 ±1.20; post-control (2) 5.51±1.04. QOL-Physical (MacNew) (9 months) pre-intx 5.74±1.09; post-intx 5.99±1.01; pre-control (1) 5.75 ±1.07; post-control (1) 6.01±0.98, pre-control (2) 5.62±1.18; post-control (2) 5.85±1.05. QOL-Social (MacNew) (9 months) pre-intx 6.11±1.10; post-intx 6.25±0.78; pre-control (1) 6.25±0.98; post-control (1) 6.41±0.80; pre-control (2) 5.92±1.18; post-control (2) 6.33±0.89. Fatigue (9 months) pre-intx 3.29±1.48; post-intx 2.56±1.18; pre-control (1) 3.32±1.52; post-control (1) 2.74±1.33 pre-control (2) 3.33±1.38; post-control (2) 2.87±1.46. Participation in Society- Frequency Score (9 months) pre-intx 37.2±10.9; post-intx 36.5±11.1; pre-control (1) 37.3±10.6; post-control (1) 36.2±10.6 pre-control (2) 36.7±10.6; post-control (2) 36.2±10.4. Participation in Society-Restriction Score (9 months) pre-intx 100±37.1; post-intx 100±52.1; pre-control (1) 100±29.1; post-control (1) 100±33.1; pre-control (2) 100±56.1; post-control (2) 100±7.1. Participation in Society- Satisfaction Score (9 months) pre-intx 73.8±15.8; post-intx 74.5±15.6; pre-control (1) 74.5±15.1; post-control (1) 76.3±13.6 pre-control (2) 73.4±15.8; post-control (2) 73.8±16.4.
Vieira et al., 2018, Portugal	N=46 (intx=15, comparison=15, control=16); Age: intx=55 ± 9.0 yrs, comparison=59 ± 11.3 yrs, control=59 ± 5.8 yrs; Female=0; Non CAD: none	Usual care control: y Comparison: y; 6 months; weekly; unsupervised; 3 times/week, moderate intensity at 65% of the HR reserve in the first 3 months and 70% of the HR reserve after 3 months (a rating of 12-13 on the 20-scale Borg scale of perceived exertion), 71-86 minutes, aerobic exercise (step forward, sideways and backward, walk; in addition, walking for 30 minutes daily was recommended) and strength training (squats, crossing, ankle movement, backward movements of the arms, sit and stand), warm up and stretching; exercise protocol was performed	6 months; weekly; unsupervised; 3 times/week, moderate intensity at 65% of the HR reserve in the first 3 months and 70% of the HR reserve after 3 months (a rating of 12-13 on the 20-scale Borg scale of perceived exertion), 71-86 minutes, aerobic exercise (step forward, sideways and backward, walk; in addition, walking for 30 minutes daily was recommended) and strength training (squats, crossing, ankle movement, backward movements of the arms, sit and stand), warm up and stretching; exercise protocol was performed with Kinect; comprehensive: n, tech: Kinect (virtual reality-	Body mass index (kg/m^2) (6 months) pre-intx 27.4±3.0; post-intx 27.4±4.2; pre-control (1) 26.9±4.7; post-control (1) 25.9±3.0 pre-control (2) 28.0±3.6; post-control (2) 28.1±3.5. No significant difference between or within groups. Waist-to-hip ratio pre-intx 0.95±0.004; post-intx 0.93±0.04; pre-control (1) 0.94±0.08; post-control (1) 0.94±0.005 pre-control (2) 0.94±0.04; post-control (2) 0.95±0.06. No significant difference between or within groups. Waist-to-height-ratio (6 months) pre-intx 0.56±0.04; post-intx 0.56±0.06; pre-control (1) 0.55±0.07; post-control (1) 0.56±0.06 pre-control (2) 0.57±0.06; post-control (2) 0.57±0.06. No significant difference between or within groups. % Body fat at trunk (6 months) pre-intx 28.7±5.4; post-intx 28.7±5.9; pre-control (1) 25.7±5.9; post-control (1) 25.8±5.7 pre-control (2) 24.0±5.9; post-control (2) 25.8±5.7. No significant difference between or within groups. Lean Mass (kg) (6 months) pre-intx 55.0±6.4; post-intx 54.0±6.0; pre-control (1) 54.8±9.5; post-control (1) 54.7±9.0 pre-control (2) 58.6±7.0; post-control (2) 57.5±6.5. No significant difference between or within groups. Total cholesterol (mmol/L) (6 months) pre-intx 3.74±1.53; post-intx 3.66±0.69; pre-control (1) 3.82±0.93; post-control (1) 4.54±1.17 pre-control (2) 3.80±1.10; post-control (2) 4.37±0.59. No significant difference between or within groups. High-density lipoprotein cholesterol (mmol/L) (6 months)

		with a paper booklet; comprehensive: n, tech: email or telephone	based technology), telephone	pre-intx 1.09±0.16; post-intx 1.17±0.17; pre-control (1) 1.05±0.21; post-control (1) 1.03±0.16 pre-control (2) 1.13±0.21; post-control (2) 1.26±0.26. No significant difference between or within groups. Low-density protein cholesterol (mmol/L) (6 months) pre-intx 2.03±0.97; post-intx 1.85±0.73; pre-control (1) 2.04±0.48; post-control (1) 2.56±0.89 pre-control (2) 2.21±1.00; post-control (2) 2.53±0.56. No significant difference between or within groups. Triglycerides (mmol/L) (6 months) pre-intx 1.19±0.44; post-intx 1.18±0.43; pre-control (1) 1.41±0.64; post-control (1) 1.76±0.74 pre-control (2) 1.04±0.19; post-control (2) 1.14±0.16. No significant difference between or within groups. % Body fat (6 months) pre-intx 25.5±4.3; post-intx 25.7±5.4; pre-control (1) 23.5±5.1; post-control (1) 23.5±6.0 pre-control (2) 22.5±4.9; post-control (2) 24.1±5.2. No significant difference between or within groups. QOL (MacNew)-Total (6 months) pre-intx 5.7±1.0; post-intx 6.2±0.8; pre-control (1) 5.7±0.7; post-control (1) 6.0±0.6 pre-control (2) 5.9±0.6; post-control (2) 6.0±0.6. Significant difference within intervention group (P=0.032). No significant difference within active comparison or usual care and between groups. QOL (MacNew)- Physical (6 months) pre-intx 5.7±1.0; post-intx 6.2±0.8; pre-control (1) 5.5±0.9; post-control (1) 6.0±0.8 pre-control (2) 5.8±0.8; post-control (2) 6.0±0.8. No significant difference between or within groups. QOL (MacNew)- Emotional (6 months) pre-intx 5.6±0.9; post-intx 6.0±0.9; pre-control (1) 5.4±0.7; post-control (1) 5.9±0.8 pre-control (2) 5.6±0.7; post-control (2) 5.9±0.8. No significant difference between or within groups. QOL (MacNew)-Social (6 months) pre-intx 6.2±1.1; post-intx 6.6±0.8; pre-control (1) 6.0±1.0; post-control (1) 6.6±0.6 pre-control (2) 6.5±0.6; post-control (2) 6.6±0.6. No significant difference between or within groups. DASS 21- Total (6 months) pre-intx 24.6±29.3; post-intx 15.3±19.8; pre-control (1) 23.2±15.0; post-control (1) 19.5±20.7 pre-control (2) 24.6±17.2; post-control (2) 21.6±19.7. No significant difference between or within groups. DASS 21- Depression (6 months) pre-intx 2.2±2.5; post-intx 2.4±3.6; pre-control (1) 8.6±6.1; post-control (1) 5.6±6.7 pre-control (2) 4.2±3.8; post-control (2) 5.5±5.4. Significant difference between intervention and usual care groups (P=0.012) at baseline but no significant difference between or within groups following the intervention. DASS 21- Anxiety (6 months) pre-intx 2.7±2.0; post-intx 0.9±1.1; pre-control (1) 8.0±9.1; post-control (1) 5.2±5.6 pre-control (2) 6.9±7.4; post-control (2) 4.4±4.5. No significant difference between or within groups. DASS 21- Stress (6 months) pre-intx 11.1±12.0; post-intx 8.2±9.1; pre-control (1) 11.6±11.2; post-control (1) 8.7±8.7 pre-control (2) 12.0±7.6; post-control (2) 11.8±11.3. No significant difference between or within groups. Trail Making Test (6 months)

				pre-intx 64.9±29.0; post-intx 44.5±17.1; pre-control (1) 105.5 ±41.7; post-control (1) NR; pre-control (2) 51.2±32.3; post-control (2) 53.0±29.8. Significant difference between intervention and usual care groups (P=0.003) and within active comparison group (P=0.11). No significant difference between intervention and active comparison groups (P=0.27). Verbal Digit Span (6 months) pre-intx 1.9±1.3; post-intx 2.2±1.3; pre-control (1) 1.5±1.3; post-control (1) 1.8±1.0 pre-control (2) 2.1±1.1; post-control (2) 1.4±1.1. No significant difference between or within groups. Stroop test (6 months) pre-intx -4.7±8.8; post-intx 1.7±7.1; pre-control (1) 2.8±8.0; post-control (1) -0.9±6.8 pre-control (2) -1.3±8.0; post-control (2) -2.4±5.7. Significant difference between intervention (P=0.21) and active comparison group (P=0.002) with usual care group and also significant difference within intervention group (P=0.02). No significant difference within active comparison or usual care group.

6MWT=6-minute walk test, ACE=angiotensin-converting enzyme, AP=angina pectoris, ASA= acetylsalicylic acid, BMI=body mass index, CABG=coronary artery bypass grafting, CAD=coronary artery disease, control 1=active comparison, control 2=usual care, CV=cardiovascular, DASS= depression, anxiety and stress scale, DBP=diastolic blood pressure, ER=emergency room, Ex Rx=exercise prescription, FITT=frequency, intensity, time, type of exercise, HDL-C=high-density lipoprotein cholesterol, HIIT=High-intensity interval training, HR=heart rate, intx=intervention, intx=intervention, LDL-C=low-density lipoprotein cholesterol, LVEF=left ventricular ejection fraction, METs=metabolic equivalent task, MI=myocardial infarction, MVPA=moderate to vigorous intensity physical activity, n=no, NSTEMI=non-ST-elevation myocardial infarction, PCI=percutaneous coronary intervention, QOL=quality of life, RER= respiratory exchange ratio, SBP=systolic blood pressure, STEMI=ST-elevation myocardial infarction, TC=total cholesterol, tech=technology, y=yes

Table 10. Study 3: Summary of Findings and Certainty Assessment - Intervention Compared to Usual Care

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
Total mortality											
2	not serious	not serious	not serious	serious [a,b]	none	35/1929 (1.8%)	43/1927 (2.2%)	**RR 0.81** (0.52 to 1.26)	**4 fewer per 1,000** (from 11 fewer to 6 more)	⊕⊕⊕◯ MODERATE	CRITICAL
Myocardial Infarction											
2	not serious	not serious	not serious	serious [a,b]	none	29/1929 (1.5%)	49/1927 (2.5%)	**RR 0.66** (0.32 to 1.36)	**9 fewer per 1,000** (from 17 fewer to 9 more)	⊕⊕⊕◯ MODERATE	CRITICAL
Angina											
2	not serious	serious [c]	not serious	serious [b]	none	98/1929 (5.1%)	102/1927 (5.3%)	**RR 1.08** (0.61 to 1.91)	**4 more per 1,000** (from 21 fewer to 48 more)	⊕⊕◯◯ LOW	IMPORTANT
PCI											
2	not serious	not serious	not serious	serious [a,b]	none	153/1929 (7.9%)	171/1927 (8.9%)	**RR 0.90** (0.73 to 1.10)	**9 fewer per 1,000** (from 24 fewer to 9 more)	⊕⊕⊕◯ MODERATE	CRITICAL

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
CABG											
2	not serious	not serious	not serious	serious [a,b]	none	46/1929 (2.4%)	52/1927 (2.7%)	**RR 0.89** (0.60 to 1.31)	**3 fewer per 1,000** (from 11 fewer to 8 more)	⊕⊕⊕◯ MODERATE	CRITICAL
Exercise Capacity (METs)											
3	serious [d,e]	not serious	not serious	serious [a]	none	223	224	-	MD **0.15 higher** (0.24 lower to 0.54 higher)	⊕⊕◯◯ LOW	IMPORTANT
VO2 Peak											
4	serious [e,f]	serious [g]	not serious	serious [a,b]	none	192	207	-	MD **0.53 higher** (4 lower to 5.05 higher)	⊕◯◯◯ VERY LOW	IMPORTANT
Body Mass Index (BMI)											
5	serious [e]	serious [g]	not serious	serious [a]	none	348	360	-	MD **0.23 higher** (1.15 lower to 1.61 higher)	⊕◯◯◯ VERY LOW	LIMITED IMPORTANCE

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
Waist Circumference											
3	serious [e]	serious [g]	not serious	serious [a]	none	316	323	-	MD **3.82 higher** (0.78 lower to 8.42 higher)	⨁◯◯◯ VERY LOW	LIMITED IMPORTANCE
Systolic Blood Pressure											
4	serious [e]	serious [g]	not serious	serious [a]	none	343	349	-	MD **5.1 lower** (10.47 lower to 0.28 higher)	⨁◯◯◯ VERY LOW	IMPORTANT
Diastolic Blood Pressure											
4	serious [e]	serious [c]	not serious	serious [a]	none	343	349	-	MD **1.68 lower** (3.72 lower to 0.37 higher)	⨁◯◯◯ VERY LOW	IMPORTANT
Heart rate											
2	serious [f]	serious [g]	not serious	serious [a,b]	none	50	51	-	MD **2.02 lower** (9.57 lower to 5.52 higher)	⨁◯◯◯ VERY LOW	LIMITED IMPORTANCE

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
Total cholesterol (TC)											
5	serious [e]	serious [g]	not serious	serious [a,b]	none	202	191	-	MD **0.48 lower** (1.01 lower to 0.05 higher)	⨁◯◯◯ VERY LOW	IMPORTANT
Low-density lipoprotein cholesterol (LDL-C)											
5	serious [e]	serious [g]	not serious	serious [b]	none	202	190	-	MD **0.58 lower** (1.06 lower to 0.1 lower)	⨁◯◯◯ VERY LOW	IMPORTANT
High-density lipoprotein cholesterol (HDL-C)											
5	serious [e]	serious [g]	not serious	serious [a,b]	none	202	191	-	MD **0.09 higher** (0.14 lower to 0.33 higher)	⨁◯◯◯ VERY LOW	IMPORTANT
Triglycerides (TG)											
5	serious [e]	serious [g]	not serious	serious [a,b]	none	202	191	-	MD **0.02 higher** (0.46 lower to 0.51 higher)	⨁◯◯◯ VERY LOW	IMPORTANT

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
TC/HDL-C											
2	serious [d,e]	not serious	not serious	serious [b]	none	144	132	-	MD **0.12 lower** (0.34 lower to 0.09 higher)	⨁⨁◯◯ LOW	IMPORTANT
Glucose											
2	serious [d,e]	not serious	not serious	serious [a,b]	none	154	144	-	MD **0.11 higher** (0.19 lower to 0.4 higher)	⨁⨁◯◯ LOW	IMPORTANT
Tobacco Use											
2	serious [d,e]	serious [c]	not serious	serious [a]	none	70/387 (18.1%)	74/371 (19.9%)	**RR 0.60** (0.13 to 2.71)	**80 fewer per 1,000** (from 174 fewer to 341 more)	⨁◯◯◯ VERY LOW	IMPORTANT
Quality of Life (MacNEW)- Total											
2	serious [e]	not serious	not serious	serious [a,b]	none	55	63	-	MD **0.28 higher** (0.05 higher to 0.52 higher)	⨁⨁◯◯ LOW	CRITICAL

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Usual care	Relative (95% CI)	Absolute (95% CI)		
Quality of Life (MacNEW)- Emotional											
3	serious [d]	not serious	not serious	serious [a]	none	159	288	-	MD **0.05 higher** (0.13 lower to 0.24 higher)	⊕⊕◯◯ LOW	CRITICAL
Quality of Life (MacNEW)- Physical											
3	serious [d]	not serious	not serious	serious [a]	none	159	288	-	MD **0.04 higher** (0.13 lower to 0.22 higher)	⊕⊕◯◯ LOW	CRITICAL
Quality of Life (MacNEW)- Social											
3	not serious	not serious	not serious	serious [a]	none	159	288	-	MD **0.01 lower** (0.15 lower to 0.12 higher)	⊕⊕⊕◯ MODERATE	CRITICAL

CI: Confidence interval; **RR:** Risk ratio; **MD:** Mean difference

Explanations

a. CI overlaps no effect and the upper and/or lower confidence limit crosses the minimal important difference (an effect size of 0.5 in either direction is used instead of calculating the effect size for each outcome measure).

b. Total population size or number of events is less than 400.

c. I square is substantial >50%.

d. High risk of reporting bias (selective outcome reporting) in trials with > >60% weight.

e. High risk of attrition bias in trials with >20% weight.

f. Inadequate allocation concealment in trials with >20% weight.

g. P value for heterogeneity (chi square) is <.05, I square is substantial >50%.

Table 11. Study 3: Summary of Findings and Certainty Assessment - Intervention Compared to Active Comparison

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Active comparison	Relative (95% CI)	Absolute (95% CI)		
VO2 Peak											
2	serious [a,b]	serious [c]	serious [d]	serious [e]	none	261	253	-	MD **1.58 higher** (2.91 lower to 6.07 higher)	⨁◯◯◯ VERY LOW	IMPORTANT
Quality of Life (MacNEW)- Emotional											
2	serious [b]	not serious	not serious	serious [e,f]	none	133	259	-	MD **0.18 lower** (0.39 lower to 0.03 higher)	⨁⨁◯◯ LOW	CRITICAL
Quality of Life (MacNEW)- Physical											
2	serious [b]	not serious	not serious	serious [e,f]	none	133	259	-	MD **0.02 higher** (0.19 lower to 0.23 higher)	⨁⨁◯◯ LOW	CRITICAL

Certainty assessment						№ of patients		Effect		Certainty	Importance
№ of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Intervention	Active comparison	Relative (95% CI)	Absolute (95% CI)		
Quality of Life (MacNEW)- Social											
2	serious [b]	not serious	not serious	serious [e,f]	none	133	259	-	MD **0.02 higher** (0.15 lower to 0.18 higher)	⊕⊕◯◯ LOW	CRITICAL

CI: Confidence interval; **MD:** Mean difference

Explanations

a. Inadequate allocation concealment in trials with >20% weight.

b. >60% selective outcome reporting.

c. I square is substantial >50%.

d. measurement did not follow similar procedure

e. CI overlaps no effect and the upper and/or lower confidence limit crosses the minimal important difference (an effect size of 0.5 in either direction is used instead of calculating the effect size for each outcome measure).

f. Total population size is less than 400.

Table 12. Study 3: Selected Trial Outcomes by Sex

	Pre-Maintenance CR				Post-Maintenance CR				Sex Difference at Post-Maintenance CR¤	
	Male		Female		Male		Female			
	Intervention	Usual care	Intervention	Usual care	Intervention	Usual care	Intervention	Usual care	Inter-vention	Usual care
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	P	P
Main Outcomes										
Exercise capacity (METs)										
Lear 2006	12.1 ± 14.1	11.9 ± 12.0	7.4 ± 2.1	9.6 ± 8.3	12.0 ± 19.0	10.1 ± 2.4†	8.0 ± 2.0	8.1 ± 2.0	.411	.138
Reid 2020	8.19 ± 2.98	7.78 ± 2.32	6.49 ± 1.99	6.04 ± 1.33	7.20 ± 1.83†	7.81 ± 2.35	6.56 ± 1.36	5.83 ± 1.37	.506§	.023§
Exercise capacity (Peak VO_2; ml/kg/min)										
Madssen 2014	28.40 ± 5.03	32.99 ± 5.60*	26.37 ± 3.68	29.43 ± 7.45	29.51 ± 5.48	33.63 ± 5.75*	26.62 ± 5.98	30.63 ± 5.90	.554	.889
Reid 2020	26.19 ± 6.41	26.49 ± 7.26	21.24 ± 5.20	20.77 ± 4.19	25.39 ± 6.23	27.42 ± 8.19	22.95 ± 4.86	20.33 ± 5.06	.728§	.302§
SBP (mmHg)										

Lear 2006	126.5 ± 20.3	124.9 ± 20.4	135.5 ± 24.1	133.3 ± 20.6	125.7 ± 17.3	130.4 ± 20.2†	126.2 ± 22.2	131.2 ± 16.3	.458	.233
Madssen 2014	132.2 ± 13.8	130.4 ± 10.7	136.0 ± 17.2	133.7 ± 22.6	133.4 ± 17.6	138.1 ± 11.1†	134.8 ± 13.7	124.4 ± 16.5	.766	.004
Reid 2020	121.1 ± 15.7	120.1 ± 17.1	119.5 ± 16.3	121.8 ± 18.8	125.3 ± 14.5†	126.2 ± 15.2†	122.5 ± 15.7†	127.2 ± 15.6†	.439	.727
DBP (mmHg)										
Lear 2006	72.7 ± 10.8	72.4 ± 10.1	69.3 ± 11.3	70.9 ± 7.2	74.4 ± 9.6†	77.4 ± 11.9†	71.1 ± 10.1	73.1 ± 6.8	.218	.189
Madssen 2014	77.7 ± 7.4	77.1 ± 10.9	80.7 ± 6.7	70.1 ± 9.0*	80.4 ± 7.7	80.4 ± 7.8	76.2 ± 6.4	70.0 ± 11.8	.035	.050
Reid 2020	72.9 ± 9.0	72.6 ± 10.0	71.4 ± 10.1	71.9 ± 9.3	75.7 ± 9.3†	80.2 ± 11.7	72.5 ± 10.5	73.8 ± 7.6	.088	.457
BMI (kg/m^2)										
Lear 2006	28.2 ± 4.1	27.2 ± 3.6*	26.9 ± 4.9	26.3 ± 3.6	28.6 ± 5.0	27.2 ± 3.9*	26.7 ± 4.9	26.6 ± 3.3	.431	.561
Madssen 2014	28.1 ± 3.6	26.9 ± 3.2	27.8 ± 4.9	23.2 ± 1.5	28.8 ± 4.1†	27.0 ± 3.2	28.3 ± 4.7	23.7 ± 1.8	.793	.885§
Reid 2020	29.02 ± 4.75	28.27 ± 4.77	27.02 ± 5.11	28.94 ± 5.67*	29.27 ± 4.60†	28.94 ± 5.42†	27.06 ± 5.70	29.21 ± 4.95*	.250§	.487
Waist circumference (cm)										
Lear 2006	97.8 ± 11.6	94.8 ± 10.1*	84.7 ± 12.9	82.8 ± 9.8	99.5 ± 13.9†	96.6 ± 10.7†	84.5 ± 12.2	83.0 ± 8.0	.418§	.054§
Madssen 2014	103.5 ± 11.4	96.8 ± 8.1	97.8 ± 16.0	82.0 ± 4.2	105.5 ± 11.0†	96.8 ± 7.9*	99.3 ± 13.5	83.1 ± 4.9*	.623	.887§
Reid 2020	102.2 ± 12.9	100.0 ± 12.9	91.7 ± 12.3	94.7 ± 13.5	103.5 ± 12.7†	102.0 ± 14.2†	92.8 ± 13.7	95.4 ± 12.0	.095§	.011§

TC (mmol/L)										
Lear 2006	4.38 ± 0.82	4.51 ± 0.88	4.87 ± 0.99	4.95 ± 1.09	4.09 ± 0.75†	4.51 ± 0.94*	4.81 ± 1.03	4.70 ± 0.99	.002§	.957§
Madssen 2014	4.43 ± 1.05	4.08 ± 0.60	4.05 ± 0.66	3.57 ± 0.53	4.43 ± 1.05	4.08 ± 0.60	4.18 ± 0.93	3.41 ± 0.46	.820	.287
LDL-C (mmol/L)										
Lear 2006	2.49 ± 0.71	2.68 ± 0.69*	2.69 ± 0.85	2.69 ± 0.96	2.30 ± 0.67†	2.68 ± 0.77*	2.53 ± 0.70	2.65 ± 0.89	.164	.909
Madssen 2014	2.39 ± 0.98	2.11 ± 0.40	1.82 ± 0.67	1.76 ± 0.58	2.30 ± 0.64	2.17 ± 0.51	1.89 ± 0.87	1.65 ± 0.57	.552	.190
HDL-C (mmol/L)										
Lear 2006	1.07 ± 0.25	1.10 ± 0.25	1.45 ± 0.41	1.37 ± 0.31	1.09 ± 0.25	1.15 ± 0.32	1.53 ± 0.42	1.43 ± 0.29	.001§	.243§
Madssen 2014	1.40 ± 0.36	1.27 ± 0.39	1.68 ± 0.36	1.44 ± 0.29	1.42 ± 0.38	1.28 ± 0.47	1.81 ± 0.40	1.43 ± 0.27	.167	.423
Triglycerides (mmol/L)										
Lear 2006	1.78 ± 0.97	1.59 ± 0.80	1.61 ± 0.75	1.93 ± 0.95	1.52 ± 0.74†	1.47 ± 0.85	1.99 ± 3.44	1.45 ± 0.71†	.108	.133
Madssen 2014	1.46 ± 0.92	1.46 ± 0.57	1.13 ± 0.47	0.68 ± 0.26	1.23 ± 0.81	1.52 ± 1.22	1.09 ± 0.51	0.76 ± 0.19	.644	.561§
HbA1c (%)										
Lear 2006	6.05 ± 0.91	6.30 ± 1.15	6.31 ± 1.67	5.52 ± 0.60	6.33 ± 0.61	6.73 ± 1.42	5.90 ± 0.00	6.17 ± 0.64	-	.643§
Madssen 2014	6.07 ± 1.16	6.19 ± 0.83	6.22 ± 1.47	5.74 ± 0.33	6.07 ± 0.94	6.36 ± 1.57	6.17 ± 1.25	5.74 ± 0.17	.332	.658
Tobacco users, n (%)										
Lear 2006	5 (4.0)	6 (4.8)	0 (0)	1 (3.7)	1 (0.9)	4 (4.2)	0 (0.0)	1 (4.3)	1.000	1.000
Madssen 2014	0 (0.0)	1 (5.6)	1 (16.7)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (14.3)	-	.280

Other outcomes										
Lear 2006										
Framingham risk score	6.17 ± 2.83	6.16 ± 3.02	8.50 ± 3.69	8.19 ± 3.58	5.63 ± 2.58†	6.13 ± 2.72	7.33 ± 3.67	7.32 ± 3.11	.433§	.688§
TC/HDL-C ratio	4.28 ± 1.15	4.26 ± 1.10	3.57 ± 1.07	3.74 ± 0.93	3.89 ± 0.92†	4.10 ± 1.10	3.46 ± 1.73	3.40 ± 0.69	.779§	.054§
Total dietary fat (% daily kcal)	22.09 ± 6.88	22.23 ± 7.68	20.96 ± 6.13	20.91 ± 5.59	25.61 ± 7.16†	25.17 ± 7.24†	23.00 ± 5.54	24.26 ± 7.13	.268	.374
Saturated fat (% daily kcal)	6.52 ± 2.56	6.28 ± 2.55	5.73 ± 2.26	5.68 ± 2.36	8.23 ± 3.69†	7.75 ± 3.32†	7.58 ± 2.84†	7.37 ± 3.27	.684	.254
Unsaturated fat (% daily kcal)	12.86 ± 4.45	12.70 ± 4.69	12.77 ± 4.29	12.82 ± 4.03	14.39 ± 4.60†	14.08 ± 4.43†	13.00 ± 3.76	14.37 ± 4.30	.217	.893
Perceived stress	32.53 ± 7.21	33.05 ± 8.32	33.43 ± 6.14	31.13 ± 8.63	31.11 ± 7.50†	31.74 ± 7.43	36.58 ± 6.94	29.74 ± 8.73*	.007	.497
Illness intrusive	30.30 ± 14.37	32.29 ± 15.32	27.11 ± 10.67	28.94 ± 15.23	28.15 ± 13.61	27.41 ± 13.90†	27.68 ± 13.92	23.95 ± 10.50	.991	.628
Self-efficacy	42.69 ± 3.77	41.77 ± 5.13	43.04 ± 4.08	42.35 ± 5.29	42.41 ± 4.05	41.32 ± 4.77	42.70 ± 3.47	43.24 ± 3.60	.898	.060
Exercise self-efficacy	67.46 ± 10.51	64.44 ± 12.85	66.54 ± 10.13	63.89 ± 15.25	63.09 ± 13.61†	61.08 ± 15.61†	62.88 ± 13.53	64.38 ± 13.06	.981	.198
Madssen 2014										
Peak HR (beats)	153.50 ± 13.69	162.22 ± 9.90*	154.83 ± 14.37	156.57 ± 14.46	153.88 ± 17.31	163.94 ± 10.52*	161.33 ± 10.21	155.57 ± 17.63	.286	.375

HR recovery (beats)	25.78 ± 11.83	27.28 ± 10.55	32.67 ± 5.85	33.83 ± 6.61	31.00 ± 16.10	29.00 ± 10.85	31.67 ± 10.39	33.86 ± 7.03	.479	.621
Resting HR (beats/minute)	63.06 ± 9.76	62.83 ± 12.19	66.33 ± 11.78	57.00 ± 8.66	65.94 ± 12.78	63.00 ± 9.63	64.83 ± 7.81	63.71 ± 15.19	.218	.202
Reid 2020										
Weekly total MVPA (in bouts of ≥ 10 minute)	178.05 ± 149.07	187.60 ± 137.38	132.69 ± 138.29	130.33 ± 116.93	148.42 ± 149.12†	152.80 ± 148.85†	132.63 ± 135.23	111.78 ± 113.14†	.305§	.305§
Weekly total MVPA, unbouted (minutes)	318.53 ± 193.94	331.03 ± 207.39	242.09 ± 152.55	238.59 ± 167.10	284.54 ± 205.26†	284.78 ± 186.52	225.17 ± 163.00	216.85 ± 179.78†	.642§	.182§
Quality of life (VAS)	75.71 ± 14.31	79.13 ± 12.38*	75.08 ± 14.96	79.08 ± 12.85	79.88 ± 12.09†	80.17 ± 11.73	77.71 ± 14.49	78.86 ± 10.31	.487	.397

*intervention vs usual care within sex group; P < .05

†change score from pre- to post-maintainance CR within each sex and comparison group; P < .05

§sex difference at baseline; P < .05

¤using ANCOVA with baseline value as covariate

BMI=body mass index, CR=cardiac rehabilitation, DBP=diastolic blood pressure, HbA1c=glycated hemoglobin, HDL-C=high-density lipoprotein cholesterol, HR=heart rate, LDL-C=low-density lipoprotein cholesterol, METs=metabolic equivalent of tasks, MVPA=moderate-to-vigorous physical activity, Peak VO2=peak oxygen consumption, SBP=systolic blood pressure, SD=standard deviation, TC=total cholesterol, VAS=visual analog scale of EQ-5D

Table 13. Study 3: Summary of Subgroup Analysis by Sex (Intervention vs Usual care)

Outcome	RCTs (n)	Sample size	MD [95% CI] or RR [95% CI]¤	Heterogeneity		Test of overall effect (Z statistic)	Test for subgroup differences	
				χ^2	I^2 (%)	p value	χ^2 (p value)	I^2 (%)
Exercise capacity (METs)							0.04	77.3
Female	2	86	0.54 [-0.11, 1.19]	1.10	9	1.64		
Male	2	291	-0.52 [-1.27, 0.23]	1.50	34	1.36		
Exercise capacity (Peak VO_2)							<0.001	93.8
Female	2	148	2.18 [0.55, 3.82]	3.72	73	2.62**		
Male	2	350	-2.34 [-3.81, -0.86]	1.04	4	3.10**		
SBP							0.60	0
Female	3	192	-3.58 [-8.15, 0.99]	3.02	34	1.54		
Male	3	546	-2.16 [-4.85, 0.52]	1.71	0	1.58		
DBP							0.48	0
Female	3	57	-0.32 [-4.90, 4.26]	2.00	50	0.14		
Male	3	232	-2.22 [-4.84, 0.40]	0.97	0	1.66		

BMI								
Female	3	192	-0.52 [-1.90, 0.85]	8.80*	77	0.74	0.08	67.7
Male	3	549	0.90 [0.12, 1.68]	2.29	13	2.25*		
Waist circumference								
Female	3	192	0.36 [-3.02, 3.75]	9.22*	78	0.21	0.23	30.0
Male	3	544	2.81 [0.67, 4.94]	3.89	49	2.58*		
TC								
Female	2	56	0.28 [-0.16, 0.73]	0.72	0	1.24	0.02	80.7
Male	2	234	-0.30 [-0.52, -0.08]	4.80*	79	2.64**		
LDL-C								
Female	2	54	-0.10 [-0.52, 0.33]	0.64	0	0.46	0.45	0
Male	2	233	-0.28 [-0.46, -0.10]	5.40*	81	3.01**		
HDL-C								
Female	2	55	0.17 [-0.02, 0.36]	1.75	43	1.77	0.01	83.3
Male	2	234	-0.09 [-0.17, -0.00]	1.59	37	2.08*		
Triglycerides								
Female	2	56	0.32 [-0.09, 0.73]	0.06	0	1.51	0.14	53.5
Male	2	235	-0.03 [-0.25, 0.18]	0.70	0	0.29		
HbA1c								
Female	2	18	0.50 [-0.55, 1.55]	N/A§	N/A§	0.35	0.15	51.7
Male	2	84	-0.36 [-0.89, 0.16]	0.03	1.35	0.18		

Tobacco Use								
Female	2	57	0.37 [0.04, 3.31]	0.00	0.89	0.38	0.75	0
Male	2	237	0.22 [0.03, 1.97]	N/A§§	N/A§§	0.18		

*P<.05; **P<.01

¤Mean Difference for continuous outcomes and Risk Ratio for binary outcome

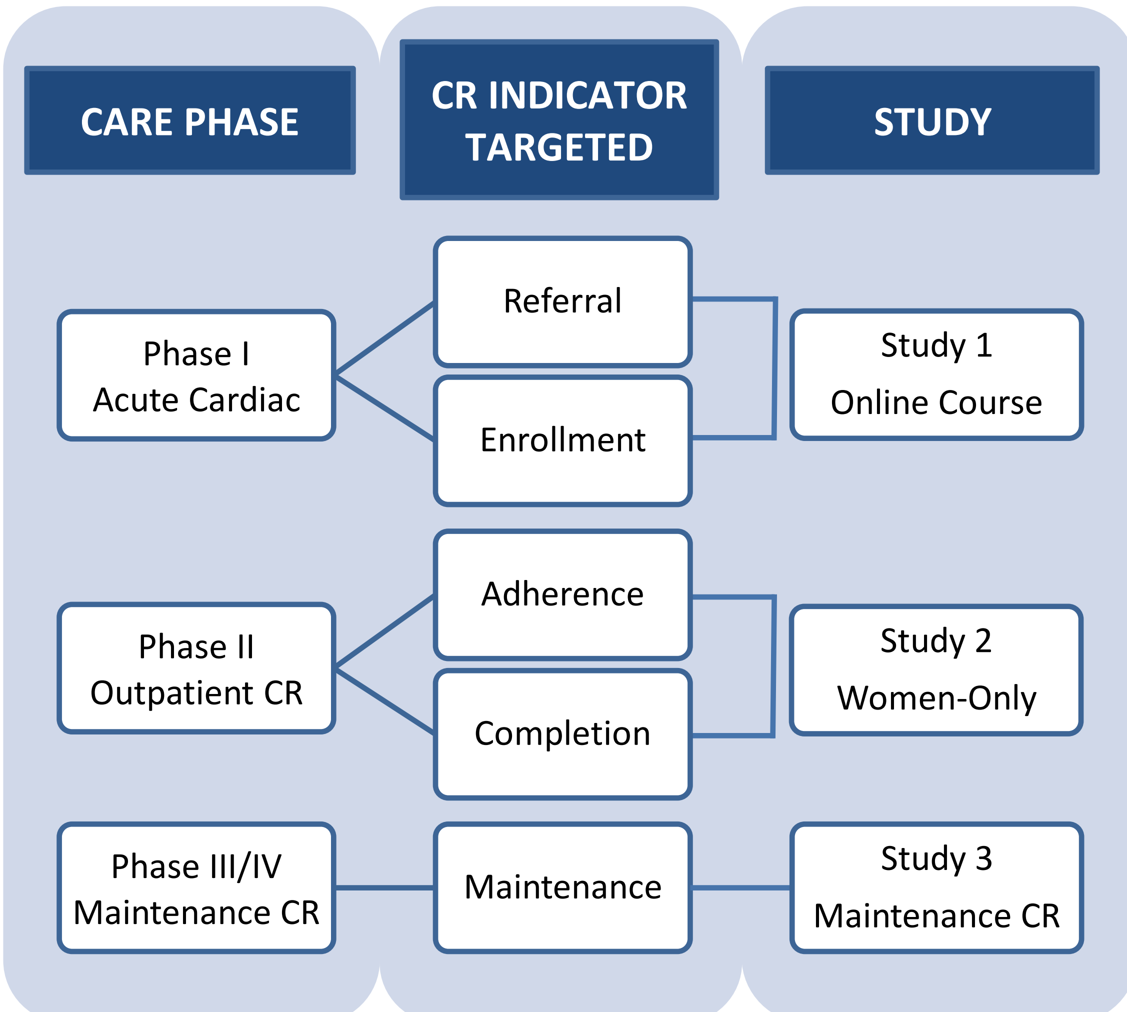
§Not estimable; 1 trial had very low sample size and SD = 0

§§Not estimable; 1 trial had 0 events

BMI=body mass index, CI=confidence interval, DBP=diastolic blood pressure, HbA1c=glycated hemoglobin, HDL-C=high-density lipoprotein cholesterol, LDL-C=low-density lipoprotein cholesterol, MD=mean difference, METs=metabolic equivalent of tasks, N/A=not applicable, RCT=randomized controlled trial, RR=risk ratio, SBP=systolic blood pressure, TC=total cholesterol, Peak VO_2=peak oxygen consumption

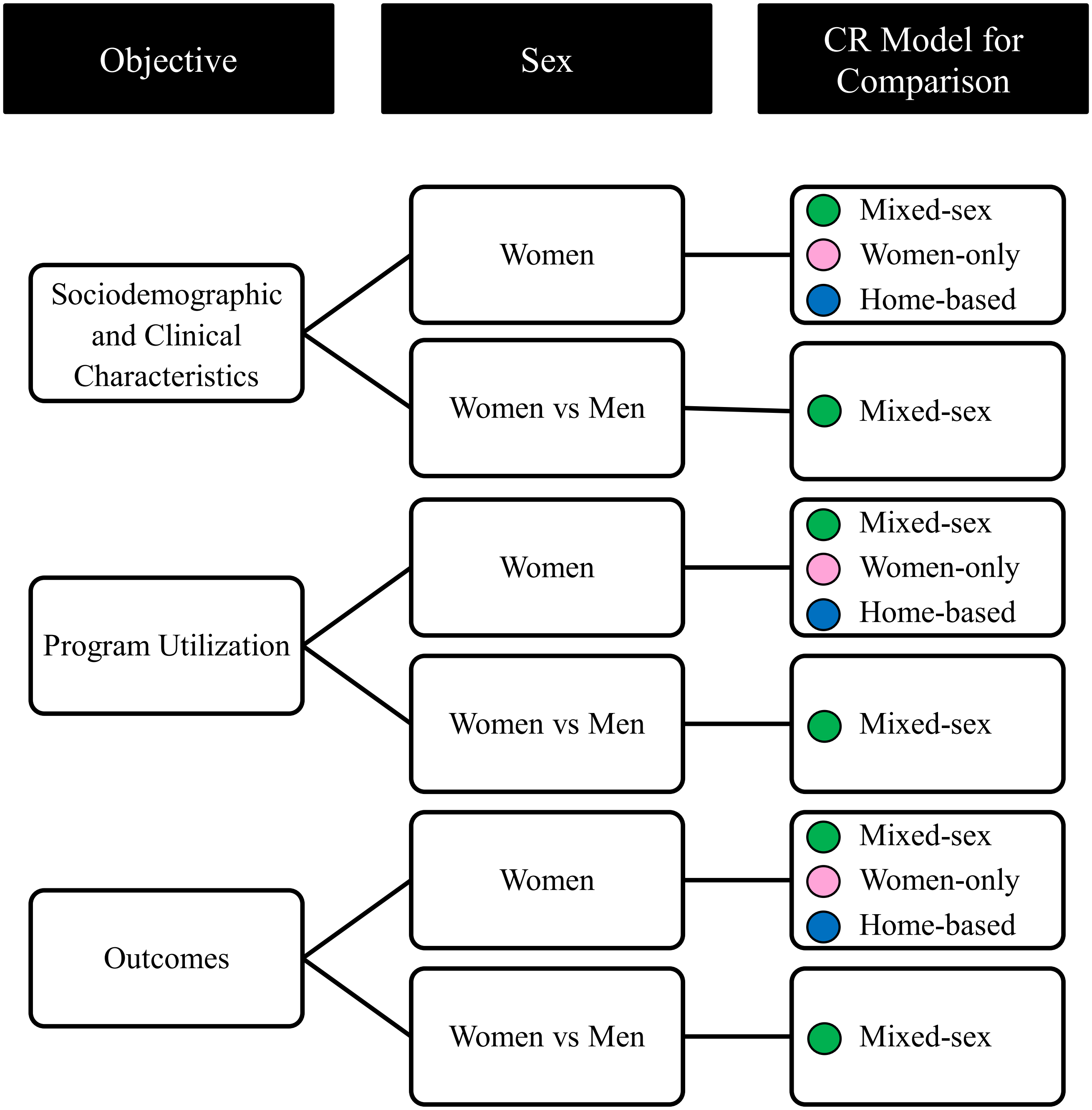
FIGURES

Figure 1. Thesis Studies by Cardiac Rehabilitation Phase and Utilization Indicator



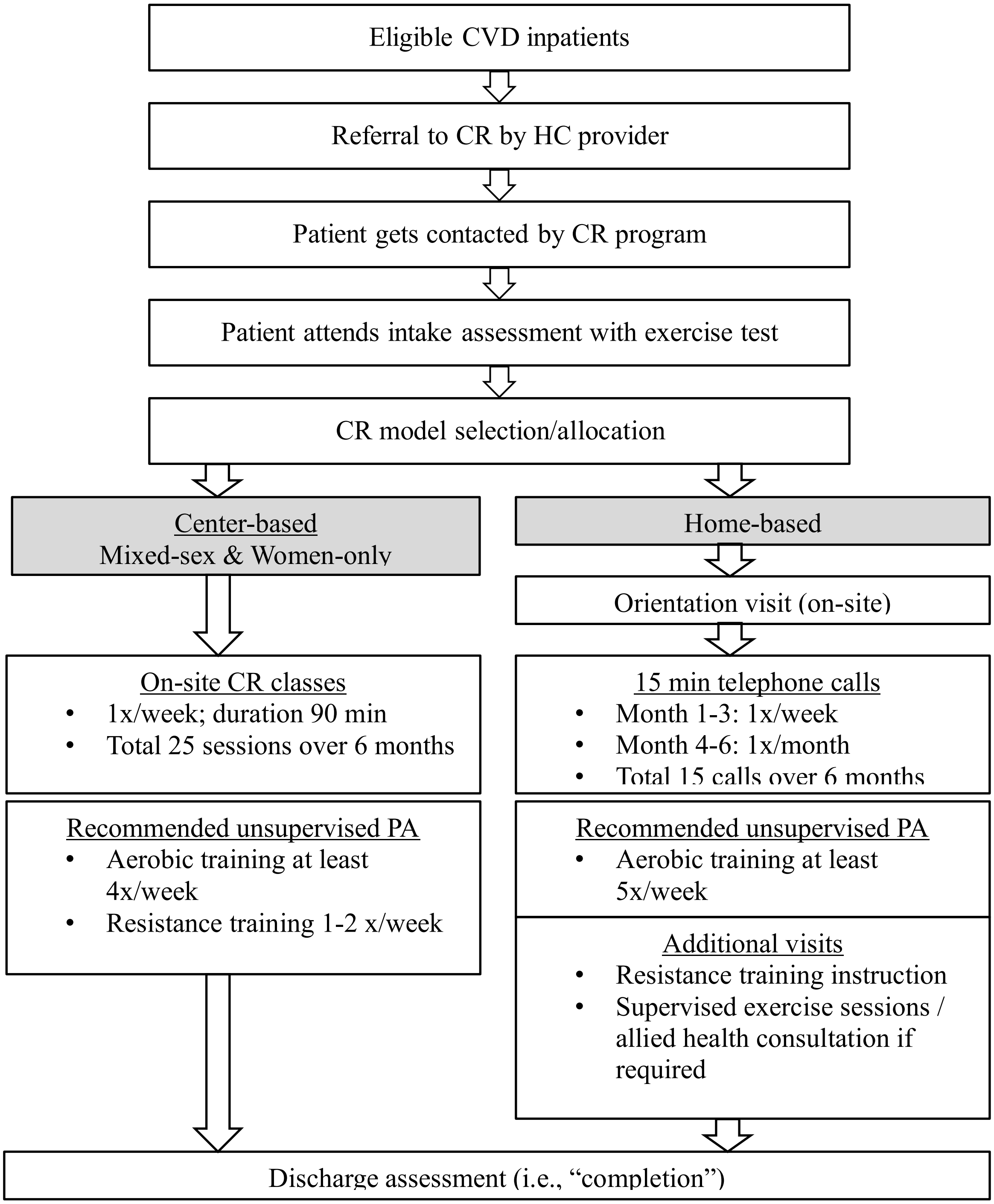
CR=cardiac rehabilitation

Figure 2. Study 2: Group Comparisons Based on Study 2 Objectives



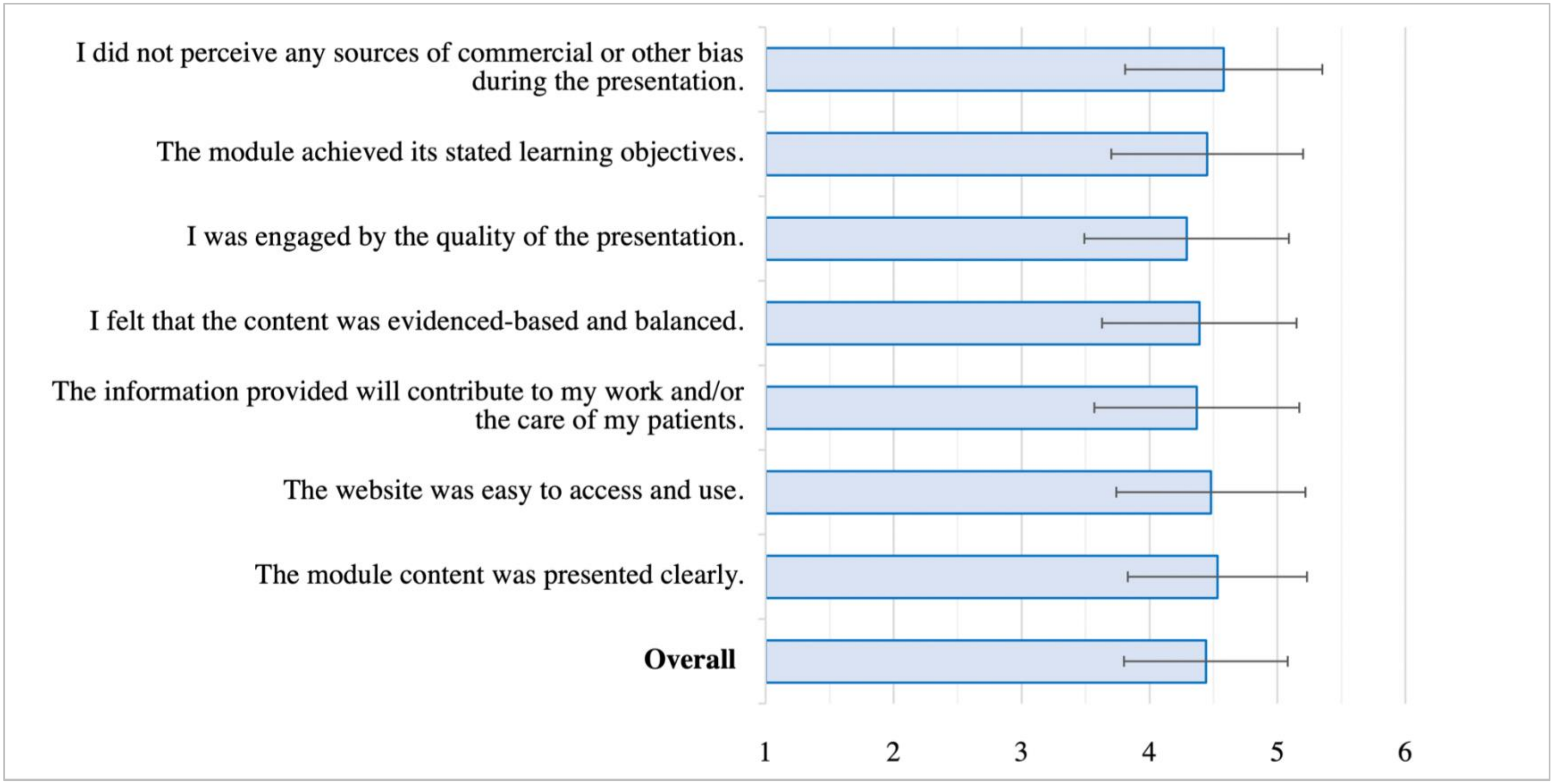
CR=cardiac rehabilitation

Figure 3. Study 2: UHN Cardiac Rehabilitation Program Flow Chart



CR=cardiac rehabilitation; CVD=cardiovascular disease; HC=healthcare; TRI=Toronto Rehabilitation Institute; TWH=Toronto Western Hospital; UHN=University Health Network

Figure 4. Study 1: Course Evaluation (N=302)



Mean and standard deviation shown.

Response options: 5=Strongly agree; 4=Agree; 3=Neither disagree, nor agree; 2=Disagree; 1=Strongly disagree; higher score indicates more positive evaluation.

Figure 5. Study 3: PRISMA Flow Diagram

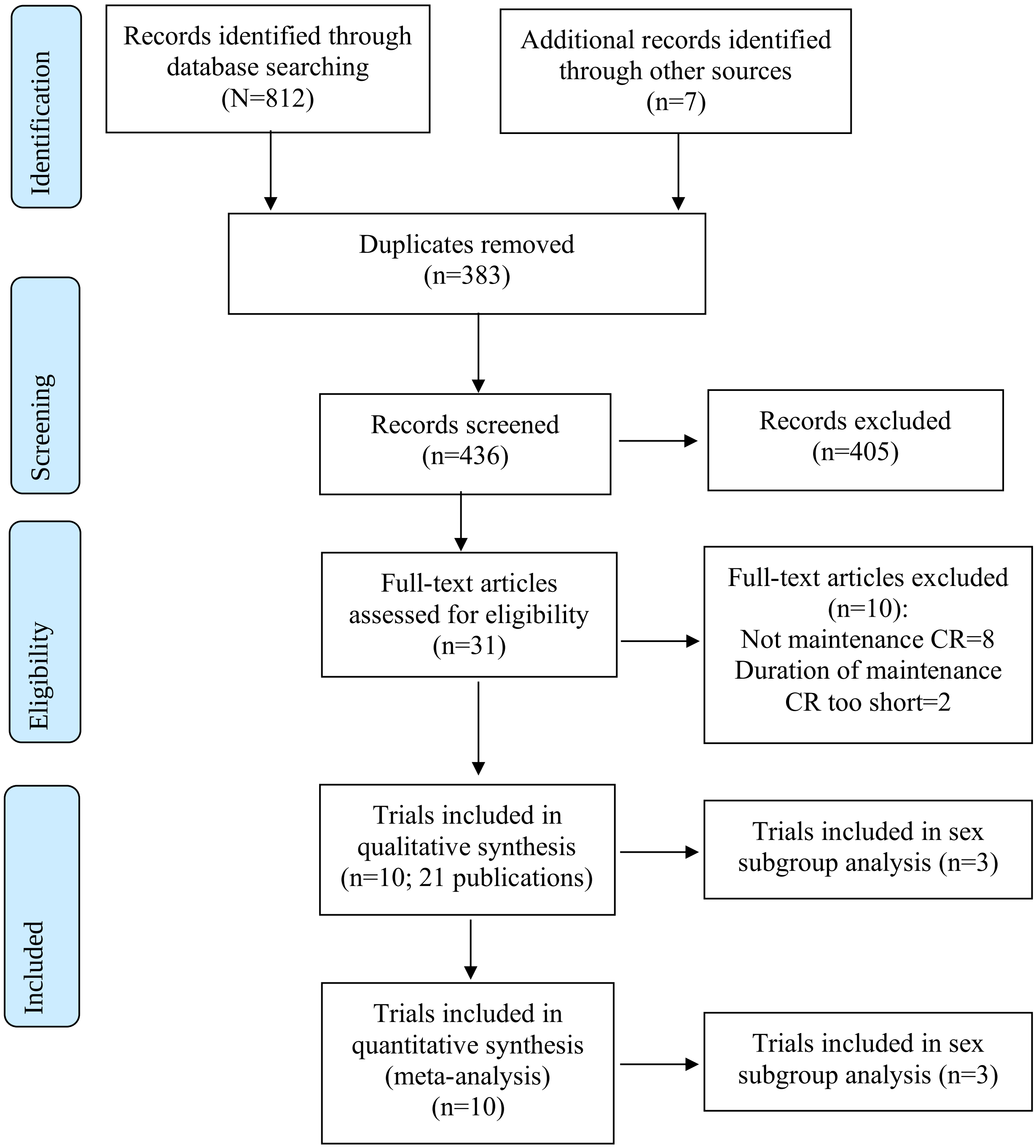


Figure 6. Study 3: Risk of Bias in Each Trial Included in Meta-Analysis

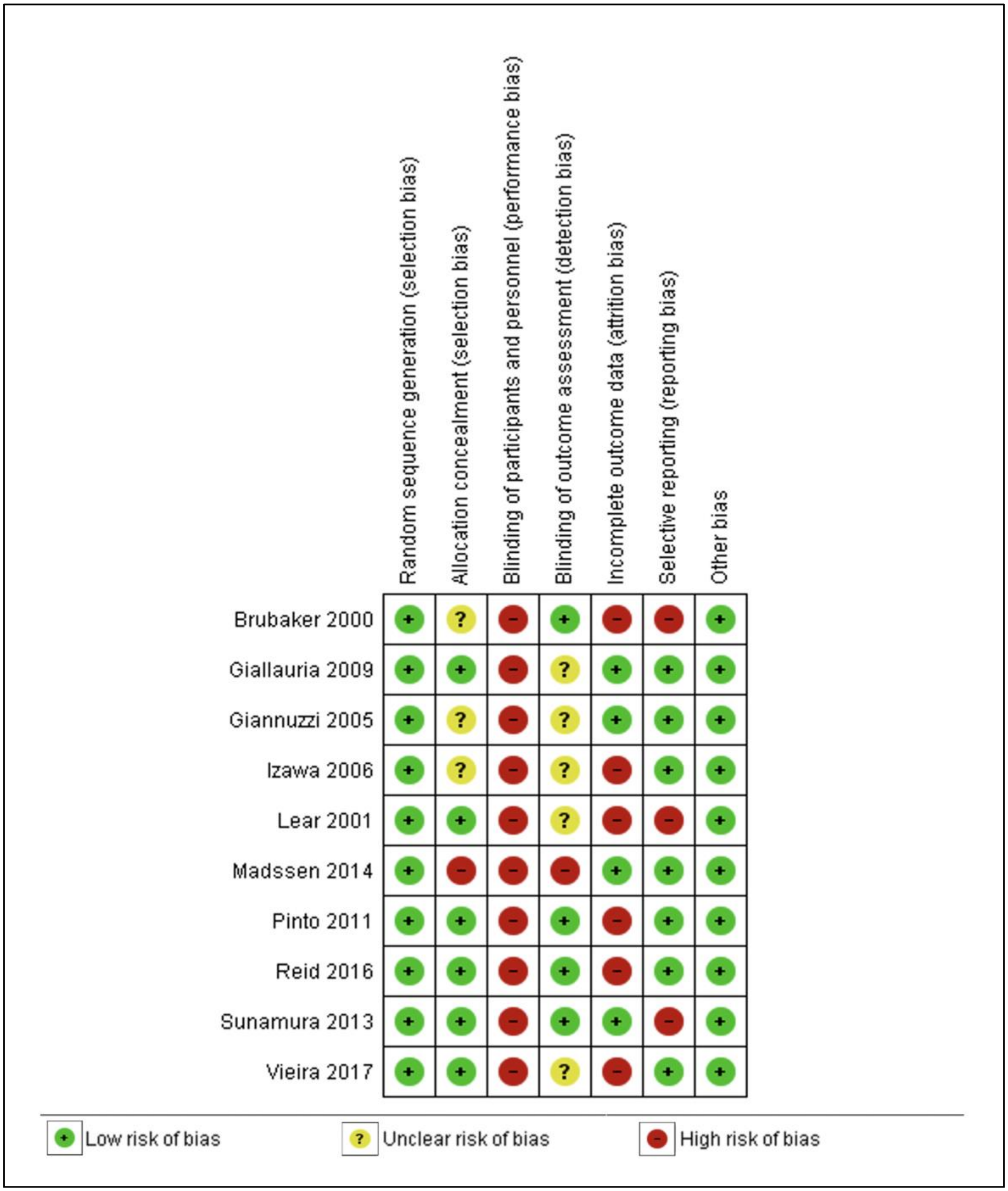


Figure 7. Study 3: Risk of Bias in Across Trials Included in Meta-Analyses

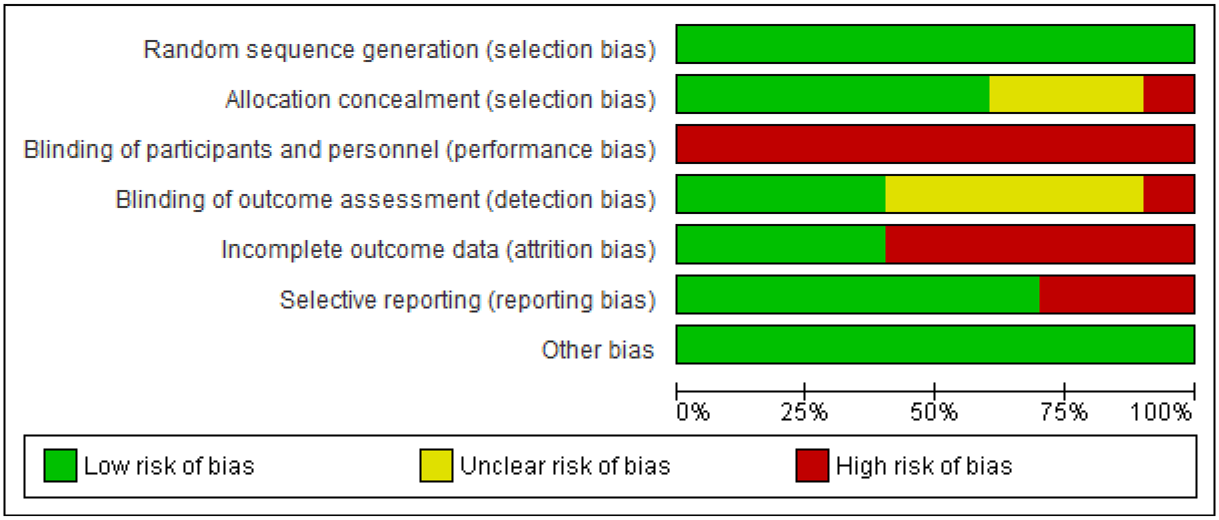


Figure 8. Study 1: Point-of-Care Tool with Discussion Points

CR=cardiac rehabilitation

APPENDICES

Appendix A. Study 1: Pre-Test of Online Course: "Promoting Patient Participation in Cardiac Rehabilitation"

<u>Pre-test</u>

Instructions: Please complete the following quiz. You will be asked to complete some of the same knowledge questions at the end of the course.

1) Please type your initials below (preferably include 3 initials):

   ____

2) In which country do you work? ____________

3) What is your profession?
   - ☐ Physician
   - ☐ Nurse / nurse-practitioner
   - ☐ Allied healthcare provider / Other (please specify below)

   3a) Specify your profession: ____________

4) Years in practice: ____________

5) Select your sex:
   - ☐ Female
   - ☐ Male
   - ☐ Prefer not to answer/other

Section A: Cardiac Rehabilitation Knowledge

1) Which of the following are benefits of cardiac rehabilitation (CR)? (check all that apply)*
   - □ **Reducing cardiovascular death and re-hospitalization**
   - □ **Guiding patients to lead a heart-healthy lifestyle**
   - □ **Significantly improving patient's quality of life**
   - □ Significant and sustained weight loss
   - □ All of the above are benefits of CR

2) There is high-quality evidence from trials demonstrating that cardiac rehabilitation should be recommended for acute coronary syndrome, coronary revascularization and ventricular arrhythmia patients.
   - □ True
   - □ **False**

3) Patients with comorbid schizophrenia, advanced dementia and/or substance dependence are good candidates for cardiac rehabilitation.
   - □ True
   - □ **False**

4) Which one of the following patients is not a good candidate for CR?
   - □ STEMI patient who is depressed
   - □ PCI patient who is depressed
   - □ NSTEMI patient who lives outside of the city
   - □ **Patient with decompensated heart failure that lives outside of the city**
   - □ Older NSTEMI patient without a spouse / informal caregiver to help with CR transportation

5) Which of the following is not a core component of CR? (check all that apply)*
   - □ Nutrition counselling/education
   - □ Smoking cessation interventions

- □ **Inspiratory muscle training**
- □ All of the above are offered as part of CR

6) Who is responsible to communicate and provide positive cardiac rehab endorsement to the patient?*
   - ☐ The acute care specialist
   - ☐ **All providers in the patient's circle of care play a role**
   - ☐ The family doctor

7) The evidence suggests it is key for a peer mentor or volunteer, not a healthcare provider, to encourage patients to participate in cardiac rehab
   - □ True
   - □ **False**

8) Key messages you should convey to patients at the bedside about cardiac rehab do <u>not</u> include:
   - □ **Cardiac rehab is heavily focused on exercise**
   - □ It is recommended patients with their heart condition attend cardiac rehab because of the benefits that are established
   - □ That they have been referred to cardiac rehab and the program will be calling them to arrange starting
   - □ That you perceive they will greatly benefit from participating in cardiac rehab and so you encourage them to go

9) Some patient groups, such as women, are less likely to participate in cardiac rehab, so precious time spent on promoting attendance could be directed to patients that you believe are interested in attending.†
   - □ True
   - □ **False**

10) Which of the following factors should NOT affect whom you encourage to attend cardiac rehab? (check all that apply)†

- □ Patient being discharged to long-term care
- □ **Female patient**
- □ **Patient has peripheral vascular disease**
- □ **Patient lacks English language proficiency**

<u>Section B: Knowledge, Attitudes, Self-efficacy, and Practice</u>

1) How familiar are you with what is offered and delivered to patients in cardiac rehabilitation (CR)?
   - □ Very familiar
   - □ Quite familiar
   - □ Somewhat familiar
   - □ Scantly familiar
   - □ I am not familiar with CR

2) Do you intend to discuss CR participation with eligible/indicated patients at the bedside?
   - □ Yes, most of the time
   - □ Sometimes
   - □ No

3) Do you perceive you have all the information you need to comprehensively discuss CR at the bedside with your patients?
   - □ Yes, I definitely have all the information I need to discuss CR
   - □ Yes, I have the information I need
   - □ I have most of the information I need
   - □ I don't really have the information I need
   - □ No

4) Do you provide any materials to patients about CR to take home with them (e.g., pamphlet or handout with weblink)?
   - □ Yes, most of the time
   - □ Sometimes
   - □ No

5) How important is it to you to provide information about CR to patients before they are discharged?
   - □ Not at all important
   - □ Slightly important
   - □ Somewhat important
   - □ Quite important
   - □ Very important

6) How confident are you that you can address any **barriers** patients raise regarding CR attendance?
   - □ Not at all confident
   - □ Not very confident
   - □ Somewhat confident
   - □ Quite confident
   - □ Very confident

7) How confident are you in answering **questions** patients raise about attending CR?
   - □ Not at all confident
   - □ Not very confident
   - □ Somewhat confident
   - □ Quite confident
   - □ Very confident

Notes:

Section A: assesses knowledge; Q-9,10 relate to focus on promoting CR to women

Section B: Q-1 assesses knowledge; Q-5 assesses CR attitudes; Q-3,6,7 self-efficacy; and Q-2,4 practice.

Scoring: Bold font indicates the correct answer(s) for knowledge questions.

*Item was revised slightly due to ceiling effect.

†Item was added to improve the evaluation.

Appendix B. Study 1: Post-Test of Online Course: "Promoting Patient Participation in Cardiac Rehabilitation"

<u>Post-Test</u>

Instructions: This quiz will test your knowledge of the "Promoting patient participation in cardiac rehab" eLearning Module. For each question, click the circle beside your chosen answer. At the end of the quiz, click on "view score" to see your final score and whether you answered each question correctly or not.
Note: you must complete the course evaluation after this quiz to receive your completion certificate.

Please type your initials below (preferably include 3 initials):

____

<u>Section A: Cardiac Rehabilitation Knowledge</u>

1) Which of the following are benefits of cardiac rehabilitation (CR)? (check all that apply)*
   - ◻ **Reducing cardiovascular death and re-hospitalization**
   - ◻ **Guiding patients to lead a heart-healthy lifestyle**
   - ◻ **Significantly improving patient's quality of life**
   - ◻ Significant and sustained weight loss
   - ◻ All of the above are benefits of CR

2) There is high-quality evidence from trials demonstrating that cardiac rehabilitation should be recommended for acute coronary syndrome, coronary revascularization and ventricular arrhythmia patients.
   - ☐ True
   - ☐ **False**

3) Patients with comorbid schizophrenia, advanced dementia and/or substance dependence are good candidates for cardiac rehabilitation.

☐ True

☐ **False**

4) Which one of the following patients is not a good candidate for CR?

☐ STEMI patient who is depressed

☐ PCI patient who is depressed

☐ NSTEMI patient who lives outside of the city

☐ **Patient with decompensated heart failure that lives outside of the city**

☐ Older NSTEMI patient without a spouse / informal caregiver to help with CR transportation

5) Which of the following is not a core component of CR? (check all that apply)*

☐ Nutrition counselling/education

☐ Smoking cessation interventions

☐ **Inspiratory muscle training**

☐ All of the above are offered as part of CR

6) Who is responsible to communicate and provide positive cardiac rehab endorsement to the patient?*

☐ The acute care specialist

☐ **All providers in the patient's circle of care play a role**

☐ The family doctor

7) The evidence suggests it is key for a peer mentor or volunteer, not a healthcare provider, to encourage patients to participate in cardiac rehab

☐ True

☐ **False**

8) Key messages you should convey to patients at the bedside about cardiac rehab do <u>not</u> include:

- ☐ **Cardiac rehab is heavily focused on exercise**
- ☐ It is recommended patients with their heart condition attend cardiac rehab because of the benefits that are established
- ☐ That they have been referred to cardiac rehab and the program will be calling them to arrange starting
- ☐ That you perceive they will greatly benefit from participating in cardiac rehab and so you encourage them to go

9) Some patient groups, such as women, are less likely to participate in cardiac rehab, so precious time spent on promoting attendance could be directed to patients that you believe are interested in attending.†

- ☐ True
- ☐ **False**

10) Which of the following factors should NOT affect whom you encourage to attend cardiac rehab? (check all that apply)†

- ☐ Patient being discharged to long-term care
- ☐ **Female patient**
- ☐ **Patient has peripheral vascular disease**
- ☐ **Patient lacks English language proficiency**

11) Given women are under-represented in CR, are there any ways you might change how you discuss cardiac rehab with women, after taking this course? If yes, how?†

____

____

____

____

Section B: CR Knowledge, Attitudes, Self-efficacy, and Practice

1) How familiar are you, if at all, with what is offered and delivered to patients in cardiac rehabilitation (CR)?
   - □ Very familiar
   - □ Quite familiar
   - □ Somewhat familiar
   - □ Scantly familiar
   - □ I am not familiar with CR

2) Do you intend to discuss CR participation with eligible/indicated patients at the bedside?
   - □ Yes, most of the time
   - □ Sometimes
   - □ No

3) Do you perceive you have all the information you need to comprehensively discuss CR at the bedside with your patients?
   - ☐ Yes, I definitely have all the information I need to discuss CR
   - ☐ Yes, I have the information I need
   - ☐ I have most of the information I need
   - ☐ I don't really have the information I need
   - ☐ No

4) Do you provide any materials to patients about CR to take home with them (e.g., pamphlet or handout with weblink)?
   - ☐ Yes, most of the time
   - ☐ Sometimes
   - ☐ No

5) How important, if at all, is it to you to provide information about CR to patients before they are discharged?

- ☐ Not at all important
- ☐ Slightly important
- ☐ Somewhat important
- ☐ Quite important
- ☐ Very important

6) How confident are you that you can address any **barriers** patients raise regarding CR attendance?
   - ☐ Not at all confident
   - ☐ Not very confident
   - ☐ Somewhat confident
   - ☐ Quite confident
   - ☐ Very confident

7) How confident are you in answering **questions** patients raise about attending CR?
   - ☐ Not at all confident
   - ☐ Not very confident
   - ☐ Somewhat confident
   - ☐ Quite confident
   - ☐ Very confident

Notes:

Section A: assesses knowledge; Q-9,10,11 relate to focus on promoting CR to women

Section B: Q-1 assesses knowledge; Q-5 assesses CR attitudes; Q-3,6,7 self-efficacy; and Q-2,4 practice.

Scoring: Bold font indicates the correct answer(s) for knowledge questions.

*Item was revised slightly due to ceiling effect.

†Item was added to improve the evaluation.

Appendix C. Study 1: Evaluation and Feedback Form for Online Course: “Promoting Patient Participation in Cardiac Rehabilitation”

<u>Course Evaluation and Feedback</u>

The below information will be used to email you a completion certificate.

Full name: ____

Completion date: ___________________________________

Thinking about the eLearning module you just completed, please indicate to what degree you agree with each statement on the following rating scale:

	Strongly Disagree	Disagree	Neither Disagree, Nor Agree	Agree	Strongly Agree
1. I did not perceive any sources of commercial or other bias during the presentation.					
2. The module achieved its stated learning objectives.					
3. I was engaged by the quality of the presentation.					
4. I felt that the content was evidenced-based and balanced.					
5. The information provided will contribute to my work and/or the care of my patients.					
6. The website was easy to access and use.					
7. The module content was presented clearly.					

8. If you perceived any sources of bias in the program, please explain.

____

____

____

9. What is the most significant thing you learned/took away from this module?

____

____

____

10. As a result of taking this online course, my patients, practice, research or health region will benefit because I will:

____

____

____

11. What barriers and opportunities do you anticipate as you apply what you learned in this session?

____

____

____

12. Additional comments and/or feedback you would like to share:

____

____

____

Appendix D. Study 2: Intake Questionnaires of Cardiac Rehabilitation Program at UHN

UHN Cardiovascul: Prevention an Rehabilitation

Cardiovascular Prevention and Rehabilitation Program

Tell Us About You

Staff Use Only: Affix Patient Label Here

Please answer the questions below and bring this form to your next appointment. The information you share will be reviewed by our team.

Living situation. I live:

- ☐ Alone
- ☐ With spouse/partner
- ☐ With family
- ☐ With others/friends

Marital Status. I am:

- ☐ Single
- ☐ Married
- ☐ Common-law union
- ☐ Separated
- ☐ Divorced
- ☐ Widowed

Travel time to get to the rehab program:

_________________ minutes

Education. I have:

- ☐ Less than high school (no certificates, diplomas or degrees)
- ☐ High school graduation certificate
- ☐ Trades certificate
- ☐ College certificate or diploma; a certificate from a community college, CEGEP, school of nursing, theological college or private college
- ☐ University: a certificate below the bachelor level, bachelor's degree, certificate above the bachelor level, masters degree, earned doctorate or a professional degree in medicine, dentistry, veterinary medicine or optometry

My ethnicity is:

- ☐ Asian – East (e.g., Chinese, Japanese, Korean)
- ☐ Asian – South (e.g., Indian, Pakistani, Sri Lankan)
- ☐ Asian – South East (e.g., Malaysian, Filipino, Vietnamese)
- ☐ Black – African (e.g., Ghanaian, Kenyan, Somali)
- ☐ Black – Caribbean (e.g., Barbadian, Jamaican)
- ☐ Black – North American (e.g., Canadian, American)
- ☐ First Nations
- ☐ Indian – Caribbean (e.g., Guyanese with origin in India)
- ☐ Indigenous Aboriginal *not included elsewhere*
- ☐ Inuit
- ☐ Latin American (e.g., Argentinean, Chilean, Salvadorian)
- ☐ Metis
- ☐ Middle Eastern (e.g., Egyptian, Iranian, Lebanese)
- ☐ White – European (e.g., English, Italian, Portuguese, Russian)
- ☐ White – North American (e.g., Canadian, American)
- ☐ Mixed Heritage(e.g. Black-American and White-North American)
- ☐ Other: ______________________

1

Revision Version 7: October 2, 2018

UHN Cardiovascular Prevention and Rehabilitation

Cardiovascular Prevention and Rehabilitation Program

Tell Us About You

Staff Use Only: Affix Patient Label Here

My occupation is:

____

Current occupational status. I work:

- ☐ Full-time
- ☐ Part-time

OR I am:

- ☐ Unemployed (not working)
- ☐ Retired
- ☐ Not/never employed outside the home

OR I am on:

- ☐ Short term disability
- ☐ Long term disability
- ☐ Permanent restrictions at work
- ☐ Modified duties at work

Level of exertion at work (including unpaid work). My work is:

- ☐ Sedentary (mostly sitting)
- ☐ Light work
- ☐ Medium work
- ☐ Heavy work
- ☐ Very heavy work
- ☐ Not applicable

Desired occupational status. I want to work:

- ☐ Full-time
- ☐ Part-time

OR I want to be:

- ☐ Unemployed
- ☐ Retired
- ☐ Not/never employed outside the home
- ☐ On Disability
- ☐ On Permanent restrictions at work
- ☐ On Modified duties at work

I have returned to work

YES or NO or Not Applicable

If yes, I returned to work on (date): ______________

I wish to speak with my health team in:

- ☐ English
- ☐ French
- ☐ Other: ______________________

Are you confident about your ability to communicate with the staff regarding your care in the English language?

- ☐ YES
- ☐ NO
- ☐ Somewhat

If no, what language do you speak?

- ☐ English
- ☐ French
- ☐ Other: ______________________

Cardiovascular Prevention and Rehabilitation Program

Tell Us About You

Staff Use Only: Affix Patient Label Here

Alcohol (liquor, beer, wine) Intake

On an average day, I have:

- ☐ 0 (zero, none) drinks of alcohol
- ☐ 1 to 2 drinks of alcohol
- ☐ more than 2 drinks of alcohol

In an average week I drink ________ (number) drinks of alcohol.

Drug Use

I currently use recreational drugs: YES NO

Smoking

I am a:

- ☐ current smoker
- ☐ former smoker
- ☐ non-smoker

As a current smoker, I smoke:

- ☐ Every day
- ☐ Occasionally

I smoke ________ cigarettes each day

Number of quit attempts: ________

As a former smoker:

I quit on (date): ____________________

I smoked for (years): ___________

I smoked ________ packs of cigarettes each day

I smoked ________ cigarettes each day

Number of quit attempts: ________

Second hand smoke:

I am exposed to others that smoke: YES or NO

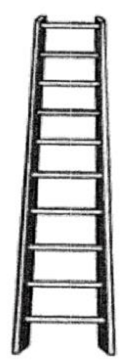
My Quality of Life

Assume that this ladder is a way of picturing your life.

The top of the ladder represents the best possible life for you.

The bottom step of the ladder represents the worst possible life for you.

Circle the number that shows where on the ladder you feel you are right now.



10 Best possible life
9
8
7
6
5
4
3
2
1 Worse possible life

UHN Cardiovascular Prevention and Rehabilitation

Cardiovascular Prevention and Rehabilitation Program

Tell Us About You

Staff Use Only: Affix Patient Label Here

Health Problems

I have the following health problems (check all that apply; and specify details where checked):

- ☐ Heart Disease ______________________________
- ☐ Stroke and/or Transient Ischemic Attack (TIA), mini-stroke
- ☐ Chronic headache/migraine
- ☐ Dementia and/or Alzheimer's disease
- ☐ Depression/anxiety
- ☐ Epilepsy
- ☐ Movement disorder: ______________________________
- ☐ Osteoporosis
- ☐ Spinal cord injury
- ☐ Traumatic brain injury
- ☐ Hernia. If so, where? ______________________________
- ☐ Fibromyalgia
- ☐ Muscle or joint problems. If so, where? ______________________________
- ☐ Lupus
- ☐ Hearing problems
- ☐ Eye or vision problems
- ☐ Cancer. If so, where? ______________________________
- ☐ Kidney problems: ______________________________
- ☐ Lung problems: ______________________________
- ☐ Thyroid problems: ______________________________
- ☐ Infectious disease: ______________________________
- ☐ Other: ______________________________

Cardiovascular Prevention and Rehabilitation Program

Staff Use Only: Affix Patient Label Here

Tell Us About You

Eating Patterns

I eat _____________(number) servings of fruits and or vegetables each day. This does not include fruit juice.

I am concerned about:

- ☐ My eating habits. If so, what do you feel gets in the way of changing your eating habits?

  ____

- ☐ Managing my blood sugar
- ☐ Managing my cholesterol levels

I have a history of dieting: YES or NO

If you wish to speak to a Dietitian, please discuss your needs with your Rehab Supervisor once you begin your program.

Emotional Well-Being

I am concerned about (check all that apply):

- ☐ Housing
- ☐ Finances
- ☐ Access to nutritious food
- ☐ Family
- ☐ Social support
- ☐ Transportation
- ☐ Work
- ☐ Sleep
- ☐ Stress
- ☐ Anger
- ☐ Sadness
- ☐ Smoking
- ☐ Alcohol use
- ☐ Drug use
- ☐ Other lifestyle issues (comment):______________________________

If you wish to speak to a Social Worker or a Psychologist, please discuss your needs with your Rehab Supervisor once you begin the program.

UHN Cardiovascular Prevention and Rehabilitation

Cardiovascular Prevention and Rehabilitation Program

Tell Us About You

Staff Use Only: Affix Patient Label Here

Write down your medicines here. This includes all vitamins and supplements.

Medication name	**Dose** (how much)	**Frequency** (how often)
Example – Metoprolol	12.5mg	2 per day

Thank you for taking the time to tell us about you. We look forward to seeing you soon.

Toronto Rehabilitation Institute

Cardiac Rehabilitation and Secondary Prevention Program

Centre for Epidemiologic Studies-Depression (CES-D) Scale

Instructions: Please answer each of the questions below that ask about how you have felt and how often you have felt that way over the past week:

During the past week:		Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1.	I was bothered by things that usually don't bother me.	**<1**	**1-2**	**3-4**	**5-7**
2.	I did not feel like eating; my appetite was poor.	**<1**	**1-2**	**3-4**	**5-7**
3.	I felt that I could not shake off the blues even with help from my family or friends.	**<1**	**1-2**	**3-4**	**5-7**
4.	I felt that I was just as good as other people.	**<1**	**1-2**	**3-4**	**5-7**
5.	I had trouble keeping my mind on what I was doing.	**<1**	**1-2**	**3-4**	**5-7**
6.	I felt depressed.	**<1**	**1-2**	**3-4**	**5-7**
7.	I felt that everything I did was an effort.	**<1**	**1-2**	**3-4**	**5-7**
8.	I felt hopeful about the future.	**<1**	**1-2**	**3-4**	**5-7**
9.	I thought my life had been a failure.	**<1**	**1-2**	**3-4**	**5-7**
10.	I felt fearful.	**<1**	**1-2**	**3-4**	**5-7**
11.	My sleep was restless.	**<1**	**1-2**	**3-4**	**5-7**
12.	I was happy.	**<1**	**1-2**	**3-4**	**5-7**
13.	I talked less than usual.	**<1**	**1-2**	**3-4**	**5-7**
14.	I felt lonely.	**<1**	**1-2**	**3-4**	**5-7**
15.	People were unfriendly.	**<1**	**1-2**	**3-4**	**5-7**
16.	I enjoyed life.	**<1**	**1-2**	**3-4**	**5-7**
17.	I had crying spells.	**<1**	**1-2**	**3-4**	**5-7**
18.	I felt sad.	**<1**	**1-2**	**3-4**	**5-7**
19.	I felt that people disliked me.	**<1**	**1-2**	**3-4**	**5-7**
20.	I could not get going.	**<1**	**1-2**	**3-4**	**5-7**

Patient Signature: ______________________ **Date:** ____________ **Reviewed By:** ______________________

For Office use: Assessment #__________ **Total score:** ____________

Appendix E. Study 2: Discharge Questionnaires of Cardiac Rehabilitation Program at UHN

UHN onto Rehabilitation Institute Cardiovascular Prevention & Rehabilitation Program **Cardiac Rehab Registry Questionnaire** **CPA # 2/3**	**NAME:**

1. **Employment**

A) Please check the one box below that best describes your current employment status. (If more than one box applies to you, check the box that appears earlier / higher in the list):

- ☐ Work full-time, that is 35 or more hours per week
- ☐ Work part-time, that is, less than 35 hours per week
- ☐ Work for myself (Self-employed)
- ☐ Not working, but looking for work
- ☐ Student
- ☐ Retired
- ☐ Not in the paid workforce (homemaker, not looking for work)
- ☐ On disability
- ☐ Other – please explain: ______________________________

B) Does your employment status (from above) match your desired status? (for example, you are currently working full-time and you want to be working full-time, then you would check the 'yes' box)

- ☐ Yes
- ☐ No

C) If you returned to work since starting Cardiac Rehab, what was the date? ___________ (dd/mm/yyyy)

D) Please check the box that describes the level of exertion at your work:

- ☐ Sedentary
- ☐ Light work
- ☐ Medium work
- ☐ Heavy work
- ☐ Very heavy work
- ☐ Not applicable – I do not work, and am not going back to work

2. **Transportation**

How long did it take you to get to our facility today? _______________ (minutes one way)

3. **Nutrition**

How many fruit and/or vegetable servings do you eat each day not including fruit juice?	___________ servings per day

4. **Support Structure:**

Check the box that best represents your living situation:

- ☐ Live alone
- ☐ Live with spouse or partner
- ☐ Live with friends and / or other family
- ☐ Other

". onto Rehabilitation Institute Cardiovascular Prevention & Rehabilitation Program **Cardiac Rehab Registry Questionnaire** **CPA # 2/3**	**NAME:**

5. Quality of Life:

Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. Suppose we say that the top of the ladder is the best possible life for you and the bottom of the ladder is the worst possible life for you.

Which number on the ladder do you feel you are standing on right now?

10 Best possible life
9
8
7
6
5
4
3
2
1
0 Worst possible life

Appendix F. Study 3: Sample Search Strategy for Medline

Ovid MEDLINE(R) ALL <1946 to January 23, 2020>

----

1 exp Myocardial Ischemia/ (423418)

2 Cardiac Rehabilitation/ (2181)

3 exp Percutaneous Coronary Intervention/ (51985)

4 exp Myocardial Revascularization/ (90811)

5 (coronary adj3 (arterioscleros* or artery disease* or artery bypass* or atheroscleros* or angioplast* or atherectom* or syndrome*)).tw,kw. (160238)

6 ((cardiac or cardiovascular or heart) adj3 rehab*).tw,kw. (7169)

7 (angina* or stenocardia*).tw,kw. (55318)

8 ((myocardi* or heart or cardiac or coronary) adj3 (infarct* or ischemi* or ischaemi* or attack* or preinfarct* or arrest or attack or anoxia or hypoxi*)).tw,kw. (301008)

9 (coronary adj3 percutaneous adj3 (intervention* or revasculari*)).tw,kw. (32596)

10 (revasculari* adj3 (cardiac or coronary or heart or myocardi*)).tw,kw. (17620)

11 or/1-10 (613581)

12 Cardiac Rehabilitation/ (2181)

13 exp Exercise/ (188317)

14 exp Exercise Therapy/ (48853)

15 exp Exercise Movement Techniques/ (7932)

16 exp Physical Fitness/ (28822)

17 (exercis* or kinesiotherap* or kinesitherap*).tw,kw. (290539)

18 (physical* adj3 activ*).tw,kw. (115057)

19 (fit* adj3 (physical* or cardiorespiratory)).tw,kw. (14984)

20 ((cardiac or cardiovascular or heart) adj3 rehab*).tw,kw. (7169)

21 or/12-20 (483435)

22 (phase adj3 ("3" or three or third or III or "4" or four or fourth or IV)).tw,kw. (77793)

23 ((exercis* or cardiac or cardio*) adj3 maintenance).tw,kw. (1728)

24 "lifestyle management intervention".tw,kw. (8)

25 ((home* or community*) adj3 (maintenance or exercis* or CR or model*)).tw,kw. (32262)

26 or/22-25 (111498)

27 11 and 21 and 26 (713)

28 randomized controlled trial.pt. (499280)

29 random*.mp. (1333549)

30 28 or 29 (1333549)

31 27 and 30 (242)