Title: Women-Focused Cardiovascular Rehabilitation: An International Council of Cardiovascular Prevention and Rehabilitation Clinical Practice Guideline

Short title: ICCPR Guideline: Women-Focused CR

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Brief Summary

This guideline provides guidance on how best to deliver women-focused cardiovascular rehabilitation (CR). Recommendations related to referral, setting and delivery were developed based on a review in accordance with AGREEII and finalized through a modified Delphi process. Certainty of evidence for the final 15 recommendations was low to moderate, and strength mostly strong. It is suggested that all programs should offer women-focused programming, comprising as many of the definitional elements as possible, to optimize outcomes.
Abstract

Women-focused cardiovascular rehabilitation (CR; phase II) aims to better engage women, and may result in better quality-of-life than traditional programs. This first clinical practice guideline by the International Council of Cardiovascular Prevention and Rehabilitation (ICCPR) provides guidance on how to deliver women-focused programming. The writing panel comprised experts with diverse geographic representation, including multidisciplinary healthcare providers, a policy-maker, and patient partners. The guideline was developed in accordance with AGREE II and RIGHT. Initial recommendations were based on a meta-analysis. These were circulated to a Delphi panel (comprised of corresponding authors from review articles and of programs delivering women-focused CR identified through ICCPR’s audit; N=76), who were asked to rate each on a 7-point Likert scale in terms of impact and implementability (higher scores positive). A webcall was convened to achieve consensus; 15 panelists confirmed strength of revised recommendations (GRADE). The draft underwent external review from CR societies internationally and was posted for public comment. The 14 drafted recommendations related to referral (systematic, encouragement), setting (model choice, privacy, staffing) and delivery (exercise mode, psychosocial, education, self-management empowerment). Nineteen (25.0%) survey responses were received. For all but one recommendation, ≥75% voted to include; implementability ratings were <5/7 for 4 recommendations, but only one for impact. Ultimately one recommendation was excluded, one separated into two and all revised (two substantively); one recommendation was added. Overall, certainty of evidence for the final recommendations was low to moderate, and strength mostly strong. These recommendations and associated tools can support all programs to feasibly offer some women-focused programming.
Cardiovascular disease (CVD) prevalence in women is very high at 6403 cases per 100,000, and is particularly high in the Middle East and North African, Eastern European and Central Asian regions. While globally there has been a decrease in CVD burden since 1990, it has increased in many of these African, Asian as well as Western-Pacific countries, and prevalence declines have stagnated in women since 2010 globally. Patients with CVD are at increased risk of mortality and morbidity, and indeed CVDs are the leading cause of death among women globally.

Cardiovascular rehabilitation (CR) is an outpatient model of secondary preventive care proven to mitigate this burden. Therein, internationally-agreed core CR components such as structured exercise, medical risk factor management, patient education and counselling are delivered by a multidisciplinary team. Indeed, rigorous reviews have established the approximately 20% reductions in mortality and morbidity with CR, as well as clinically-meaningful increases in quality of life. As in most CVD research, women are also under-represented in CR research, but there are real-world population-level data to support that these CR benefits hold in women as well, although often men’s outcomes are better than women’s. Nevertheless, CVD clinical practice guidelines, including those in women, highly recommend CR referral.

Consistent with the fact that fewer women with CVD receive diagnostic tests, secondary prevention drugs, and revascularization procedures compared with men, they are also less likely to attend CR. Accordingly, “women-focused” models of CR have been developed, to better engage women and optimize their outcomes. By women-focused CR, we are referring to holistic programs: (a) with at least some CR components (i.e., can be women-focused sessions) delivered with ≥50% women (e.g., could be “women-only”), and (b) comprising some form(s) of
tailoring to meet women’s needs or preferences (e.g., comprehensive psychosocial screening and programming, education content, and/or forms of exercise). Moreover, women should be given (c) the choice of delivery mode (i.e., to address women’s common transportation barriers and time constraints related to caregiving and work responsibilities), and where the setting is not remote, programs should consider women’s preferences around environment (e.g., respect for privacy). Finally, (d) the interprofessional staff should have a depth of knowledge in the area (e.g., specialization in risk factor management, exercise prescription, and mental health in women with CVDs), as well as have the sensitivities and approaches to effectively work with patients who identify as women. The International Council of Cardiovascular Prevention and Rehabilitation’s (ICCPR) global CR audit revealed 686 women-focused programs in 45 countries.

Objectives

The objectives of this first clinical practice guideline are to provide guidance to the CR community on how to best engage women with cardiovascular diseases including stroke and peripheral arterial disease (PAD) in their programs through design of their programming, while optimizing their outcomes (i.e., mortality, morbidity, functional capacity, psychosocial well-being and quality of life). Cost, resource implications, feasibility and patient preferences are foremost considerations in the recommendations.

Methods

Please see the Supplemental Methods for details on focus, target audience, writing panel composition, evidentiary basis as well as the recommendation development and consensus processes. A synopsis of the development process is shown in Figure 1.
Results

Please see the Supplemental Results for details regarding the recommendation development and consensus process. Panelist recommendation ratings are summarized in Supplemental Table S1, as well as final decisions on each. Final recommendations, along with level and certainty of evidence, are shown in Table 1 (see summary in Figure 1). An explication of these recommendations follows.

CR Referral Process

Lack of referral to CR is one of the largest predictors of non-enrollment for women (and men).\textsuperscript{29-31} While there is wide variation, referral is significantly lower in women (40\% vs 50\% in men),\textsuperscript{21} and this could be due to some unconscious clinician bias.\textsuperscript{32} Physician recommendation or endorsement is one of the most important predictors of CR participation, because patients generally require their referral and often closely heed their recommendations.\textsuperscript{33} However, physicians can also be a hindrance to referral, such as where they inform patients they are “too well” or “too sick” to be appropriate CR candidates.\textsuperscript{34,35}

While women may seek out their own referrals if they are aware of CR services,\textsuperscript{34,36,37} research and guidelines recommend the institution of automated / systematic referral, which overcomes sex biases.\textsuperscript{38,39} Increased education of physicians and other healthcare providers is needed to raise awareness of the importance of CR, as well as the indications, exercise contraindications and safety of CR programs.\textsuperscript{34} Referral should be accompanied by bedside education and discussion to encourage women’s attendance at CR programs.\textsuperscript{40,41} In particular, common barriers women face should be discussed such as transportation, care-giving responsibilities and perceptions towards exercise\textsuperscript{28} (see implementation tools in Supplemental Appendix S1\textsuperscript{42}).
**CR Environment**

The context of CR programs can influence women’s decision-making with respect to program enrollment and completion. At a macro-level, women’s engagement may be influenced by the perceived safety of the clinic/community center location itself.

The staff delivering care in a women-focused CR program should be considered. Staff should have expertise in women with CVD, and deliver patient-centered care for women. The multidisciplinary team should include a regulated mental healthcare professional where possible, given the high rate of psychosocial distress in women with CVD. While some programs may aim to employ female staff to deliver women-focused programming, it is most important that staff have the sensitivities and awareness to develop a therapeutic relationship with them.

Where women-only CR is being delivered, ability to provide separate spaces should be considered. Regardless, facilities should be such that privacy can be ensured, such as for changing or assessing body composition for example, as this is important to women. As women also report disliking rushing and crowding, allowing women time and space to change and prepare for class is important, as is the time following class as this may be a chance to connect with peers or ask CR staff any individual questions. Indeed, women also express a strong desire for social interaction, wanting to meet other individuals who have had the same lived experiences and with whom they can connect.

**CR Delivery**

**Intake Assessment**

Initial assessment is a core component of CR, to ascertain safety, determine patient goals and develop a plan of care. While clinical recommendations are available elsewhere, there are some particular considerations relating to women.
Women’s context and history should be considered. Demographic information, social
determinants of health as well as enquiry into psychosocial health is important to identify
potential barriers to participation and ensure the care plan addresses all relevant issues. Screening
for gender-based violence is important, as this is more prevalent in women and negatively
impacts CVD outcomes as well.\textsuperscript{24,52}

A careful clinical history should be taken, ensuring comprehensive assessment to
minimize any safety issues due to unidentified cardiac or other issues, given women often have
other forms of heart disease and diagnostic tests are less sensitive in women than men.\textsuperscript{1} This
should also include consideration of history of cancer due to the cardiotoxicity of some
treatments,\textsuperscript{53} as well as comorbidities more common in women that may complicate prognosis,
such as autoimmune conditions.\textsuperscript{54} Careful attention to function and mobility is important as
women experience more osteoporosis, frailty and have a higher incidence of falls.\textsuperscript{55}

Cardiovascular risk factors such as blood pressure are also assessed, and then used to
track progress in CR. Women have additional risk factors, and some CVD risk factors are
manifested differently or are more hazardous in women.\textsuperscript{56} Preeclampsia, gestational diabetes,
pregnancy-induced hypertension, small for gestational age infants, preterm births and early or
surgical menopause have all been recognized as early indicators of increased cardiovascular risk
but are not routinely documented as important data.\textsuperscript{57}

Finally, sex and gender-related symptoms should be documented.\textsuperscript{58} Menopausal
symptoms, and urinary incontinence due to pelvic floor changes arising from pregnancy may
also be a concern for women embarking in an exercise program. As in any CR program, the
comprehensive information from the assessment should be used to inform the individualized
treatment plan. The reader is referred to key articles which describe in full tailoring CR based on
sociodemographic characteristics, type of cardiac indication for CR (see supplement Tables XI-XVII), and comorbidities (see Supplemental Tables XIV, XX-XXII).

**Exercise Component**

The CR exercise practitioner must consider safety, dose and modality of exercise that will result in optimal adherence and outcomes when prescribing as well as progressing aerobic and resistance training to men and women with CVD. Specific to this guideline, the practitioner should prescribe exercise with attention to the physical and psychosocial obstacles that women more commonly experience, while being sensitive to issues related to gender.

Safety is especially important for women. Women have indicated that being monitored during exercise, and having their co-existing conditions taken into consideration in their exercise prescription makes them feel safe. Pre-participation education should include a description of risks and benefits of exercise, about their individually-tailored prescription, allowing time to discuss with others. Moreover, exercise logs and/or tracking devices to record heart rate, perceived exertion, fatigue, and pain level as appropriate, should be incorporated into the program and reviewed regularly by CR staff. Finally, benefits and precautions to ensure safety of exercise for those with co-existing conditions such as diabetes should be addressed; this may help mitigate the higher CR attrition in women than men with comorbid diabetes.

Musculoskeletal issues disproportionately affect women, and should be considered from the initial exercise prescription. Arthritis/joint pain are predominant, particularly in the knees, hip and back, and are less likely to resolve in women than men, leading to withdrawal from CR. To address this, current and previous musculoskeletal issue(s), location, and circumstance(s) that exacerbate pain or discomfort should be assessed pre-CR. This should inform choice of modality for aerobic exercise and selection of resistance exercises, as well as gradual progression of volume and intensity of exercise.
Fatigue greatly impacts women’s motivation and experience exercising.\textsuperscript{25,26,71} Patients should be educated on the causes (e.g., low cardiorespiratory fitness, employment and caregiver responsibilities) and what can be done to mitigate fatigue (e.g., exercise, planning based on energy level, shorter but more frequent bouts).\textsuperscript{72} Action planning and motivational interviewing can be utilized to help mitigate this.\textsuperscript{73,74}

The previously-mentioned obstacles may prevent a greater proportion of women than men from reaching a true physiological maximum on an exercise stress test, and this may be exacerbated by the fact that most exercise test protocols were validated in men. Therefore, prescribing aerobic exercise based on peak values attained (heart rate or \( \dot{V}\text{O}_2\text{peak} \)) may lead to a suboptimal training intensity. For CR programs that conduct cardiopulmonary exercise tests, a more metabolically-uniform measure for prescription of exercise intensity would be ventilatory anaerobic threshold, as it does not require maximal performance on the test and most people with CVD can reach this intensity.\textsuperscript{75,76} When ergospirometry is not available, the talk test and rating of perceived exertion\textsuperscript{77} in combination with predicted/measured % of heart rate peak can be used to guide exercise intensity.

On a related note, exercise prescription dose also deserves close attention, as women may not have the same increases in cardiorespiratory fitness with CR as men.\textsuperscript{78} In prescribing and progressing intensity, we want women to fully reap the benefits of exercise,\textsuperscript{79} but have to balance that with efforts to minimize pain and fatigue so women do not drop-out of the program.

Women may need more flexibility with scheduling of exercise sessions, due to multiple role obligations for example.\textsuperscript{80} Moreover, modality of aerobic exercise can effect women’s enjoyment and hence engagement.\textsuperscript{62} Women report treadmill and cycle only exercise to be boring, and preferred to have a choice.\textsuperscript{25} While alternative types of exercise such as Tai Chi and
yoga may be more enjoyable, the effect on CVD risk reduction, morbidity and mortality is somewhat limited.\textsuperscript{81–83} Nevertheless, incorporating alternative types of exercise such as dance and yoga may be appreciated as an adjunct to CR programming.\textsuperscript{84} Unfortunately, not many programs tend to offer these alternatives,\textsuperscript{85} thus challenges to implementation need to be identified and overcome.

\textit{Patient Education}

Patient education is an internationally-agreed core component of CR,\textsuperscript{48,49,86} given proven benefits in CVD patients (although reviews include a low proportion of women).\textsuperscript{87} Women have different preferences for delivery mode and information needs than men,\textsuperscript{88–91} and lower knowledge pre-program.\textsuperscript{92} Available CR guidelines do not address tailoring patient education to women however.\textsuperscript{48} Ten of the 28 studies included in the reviews which form the basis for this guideline explicitly reported offering gender-tailored education.\textsuperscript{74,93–101} None of the studies included disease-related knowledge as an outcome, thus more work is needed in this area.

Best practices in adult education for CR (for men and women) are available elsewhere,\textsuperscript{102–104} as are recommendations on standardized CR education content.\textsuperscript{105} Comprehensive evidence-based CR education is available open access online.\textsuperscript{106–110} Recommendations for gender-tailoring CR for women include consideration of process/mode and content. Women may have greater transportation barriers than men, more family responsibilities constraining their time, and need for social support,\textsuperscript{25,26} hence women’s preferred education mode should be assessed (e.g., remote [and if so, technology type or platform] or face-to-face; group or individual; synchronous or asynchronous), and where possible education should be delivered in accordance with their preferences, although delivery via multiple modes may be best. Programs should ensure staff delivering education to women have the relevant expertise and deliver it in accordance with best practices.\textsuperscript{44}
There are additional topics that should be covered for women with CVD, including but not limited to: ensuring women are informed about CR (see above section on referral and encouragement), the different pathophysiology of CVD in females, different forms of CVD more common in women and how they are diagnosed, impacts of menopause, risk factors (including psychosocial issues) and comorbidities (e.g., autoimmune diseases) more common in women, cardiac effects of chemotherapy and breast irradiation treatment, as well as sex differences in risks and effectiveness of CVD treatments such as revascularization, medication and even CR itself.\textsuperscript{1} Given the greater volume of content to be covered, it is advisable programs assess knowledge and information needs in patients at intake, and only offer needed education based on specific patient circumstances.

*Psychosocial Component*

Several social determinants of health\textsuperscript{111–115} and psychosocial issues (e.g., social isolation, stress)\textsuperscript{116–121} are closely related to CVD outcomes, and are more predominant in women than men (e.g., depression, anxiety, low socioeconomic status, intimate partner violence, adverse childhood experiences).\textsuperscript{45} Therefore, women-focused CR programs should make every effort to assess these factors. Research on depression screening in cardiac patients outside the CR setting does not suggest benefit,\textsuperscript{122} however there are no data in the CR setting where there is long-term follow-up; hence we do recommend such screening if program patients can access providers trained in mental healthcare.

Where psychosocial issues are identified, women should be provided evidence-based treatments where they are established\textsuperscript{123,124} where there are no evidence-based treatments, the support, education and exercise as delivered in women-focused CR can attenuate these excess
risks.\textsuperscript{125–127} Positive psychological exercises could also be considered (e.g., mindfulness, pleasurable and meaningful acts, expressive writing).\textsuperscript{128}

Guidance on best practices in delivering the psychosocial component of CR is available elsewhere.\textsuperscript{129} Caution is warranted however, as there has been an inclination toward harm in two major trials of psychosocial interventions delivered to women with CVD,\textsuperscript{130,131} and hence programs need to ensure only regulated mental healthcare providers are delivering any psychosocial counselling to women, and that it is evidence-based.

Other considerations for these women-focused CR recommendations are found in the Supplemental Results, including details regarding CR setting / mode of delivery, patient preferences and values, special populations (stroke and PAD patients) as well as consideration of equity and feasibility related to low-resource settings.

\textit{Discussion}

With consideration of key factors now described, it is hoped that where available, CR could be tailored to meet women’s needs and preferences. To support the community in implementing women-focused CR, received evidence-based tools to support delivery are shown in Supplemental Appendix S1. As a first priority, the many barriers to, and low rate of, encouragement of women at the bedside to attend CR\textsuperscript{132,133} need to be addressed. The TAKEHeart program in the United States is an excellent model to support implementation of systematic inpatient referral and encouragement of women to attend at the bedside.

Once women are referred, while we recommend they be provided a choice of program setting, there is little available guidance on triage assessment,\textsuperscript{134} and none specific to women that considers their unique needs such as less common and understood forms of CVD, transportation
barriers, as well as psychological and socioeconomic challenges.\textsuperscript{135} Women should also be given some options with regard to session timing offerings.\textsuperscript{80}

Some barriers to implementation of women-focused CR at the program-level are outlined above. In non-low-resource settings, cost will still be a barrier to implementation, given most CR programs are insufficiently resourced to meet need\textsuperscript{136} and that often staff with additional specialized training would be needed to implement these recommendations. Where it is not feasible to even offer one women-focused CR session, women should be directed to asynchronously-available evidence-based resources tailored to women, such as is provided in the Supplemental Appendix S1 (albeit only in English at this time). Moreover, women patients could be directed to unmoderated peer support chat groups using a freely-available App.

In the Supplemental Discussion, directions for future research and limitations are shown. The latter includes concerns regarding African representation and survey response rate.

\textit{Conclusion}

It is hoped that all programs will offer as many of the women-focused CR elements as possible to every female patient, considering clinical and psychosocial issues as well as delivery processes, given their resources and current offerings. The impact could be greater utilization, and given the dose-response effects of CR,\textsuperscript{137,138} better outcomes in women. Indeed, given the prevalence of CVD in women, implementation of these recommendations and tools could result in significant public health benefit, such as reduced cardiovascular mortality, morbidity and re-hospitalization, as well as optimize role resumption and quality of life in women, and decrease healthcare costs.

Acknowledgements: see Supplement

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Table 1: Final Recommendations for Women-Focused Cardiovascular Rehabilitation, with level of evidence

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Certainty of the evidence (GRADE)</th>
<th>Strength of the recommendations</th>
<th>Evidentiary basis</th>
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<tbody>
<tr>
<td><strong>Women’s Referral to CR</strong></td>
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</tr>
<tr>
<td>1. To facilitate referral of all CR-indicated women and reduce sex/gender bias, CR programs should work with referral sources to institute systematic referral (e.g., acute coronary syndrome and revascularization patients flagged for referral in electronic patient records, with referral information seamlessly flowing to CR site). Barriers and sources of bias in the referral process should be considered and mitigated (e.g., educating providers that comorbidities and older/younger age do not preclude referral).</td>
<td>☑️ ☑️ ☑️ ☑️ High</td>
<td>Strong</td>
<td>39,139–142</td>
</tr>
<tr>
<td>2. CR programs should educate providers (e.g., physicians, nurses, physiotherapists) at the referral sources regarding the importance of encouraging women’s attendance at the bedside, and tailoring that discussion to women’s personal barriers and preferences. Where possible, essential care partners / support persons may be included in these discussions. Materials on the importance of CR for women could be provided to patients. A process to ensure these discussions take place should be implemented, and overseen by a champion.</td>
<td>☑️ ☑️ ☑️ High</td>
<td>Strong</td>
<td>28,40, 143</td>
</tr>
<tr>
<td><strong>CR Setting: Mode of Delivery and Environment</strong></td>
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<td>3. After safety is assessed/discussed, women should be provided the choice of participating in a centre-based (clinical or community) or home-based setting (+/- technology using mode as per women’s preferences as well as device availability), or a hybrid model, where available and reimbursed.</td>
<td>☑️ ☑️ ☑️ Moderate</td>
<td>Strong</td>
<td>26,62,84,13, 5,141,144–150</td>
</tr>
<tr>
<td>4. The CR environment should be optimized to meet women’s preferences, values and goals, including consideration of: ensuring privacy (e.g., change room facilities, body composition assessment), as well as avoiding crowding and rushing. A safe space should be fostered, such that inclusion of male support persons in some elements of women-only programs may not be appropriate.</td>
<td>☑️ ☑️ ☑️ Moderate</td>
<td>Strong</td>
<td>25,80,141, 63,37</td>
</tr>
</tbody>
</table>
5. It is conditionally recommended that interprofessional staff, ideally with sociodemographic characteristics mirroring those of the women they serve, should have the sensitivities and approaches to effectively work with patients who identify as women and to develop a therapeutic relationship with them. They should have a depth of knowledge on women (sex/gender) and CVD.

| 5. | It is conditionally recommended that interprofessional staff, ideally with sociodemographic characteristics mirroring those of the women they serve, should have the sensitivities and approaches to effectively work with patients who identify as women and to develop a therapeutic relationship with them. They should have a depth of knowledge on women (sex/gender) and CVD. | ☉ ☉ ☉ ☉ | Weak | 151,152 |

6. Whether CR is delivered one-on-one or in groups, we suggest that providers aim to individually-tailor care provision to women’s needs and preferences, with consideration of intersectionality, including gender identity, ethnocultural background and/or religion. A qualified recommendation is that women receiving one-on-one models be offered the opportunity to connect with other women in the program (e.g., synchronous or asynchronous, virtual or in-person, depending on feasibility and patient preference).

| 6. | Whether CR is delivered one-on-one or in groups, we suggest that providers aim to individually-tailor care provision to women’s needs and preferences, with consideration of intersectionality, including gender identity, ethnocultural background and/or religion. A qualified recommendation is that women receiving one-on-one models be offered the opportunity to connect with other women in the program (e.g., synchronous or asynchronous, virtual or in-person, depending on feasibility and patient preference). | ☉ ☉ ☉ ☉ | Weak | 153,154,155 |

### Women-Focused CR Delivery

7. As women are the most populous under-represented group in CR, it is suggested that all programs should offer women-focused programming, comprising as many of the definitional elements of women-focused CR as possible. Where resources are limited, this could include offering for example some women-only virtual education or exercise sessions, or peer support programs. We suggest all women participate in programs with at least some form of sex and/or gender tailoring.

| 7. | As women are the most populous under-represented group in CR, it is suggested that all programs should offer women-focused programming, comprising as many of the definitional elements of women-focused CR as possible. Where resources are limited, this could include offering for example some women-only virtual education or exercise sessions, or peer support programs. We suggest all women participate in programs with at least some form of sex and/or gender tailoring. | ☉ ☉ ☉ ☉ | Strong | 24,153,51 |

8. It is conditionally recommended that women be offered as much choice as possible in CR session timing (whether women-only or traditional models).

| 8. | It is conditionally recommended that women be offered as much choice as possible in CR session timing (whether women-only or traditional models). | ☉ ☉ ☉ ☉ | Weak | 80,26,141,156 |

9. Women’s context, clinical history, and comorbidities should be considered fulsomely at the initial assessment in developing their individual CR treatment plan. Particular considerations include mental health and psychosocial issues, menopausal status, frailty, cancer history, and concerns about urinary incontinence, falls risk / osteoporosis, as well as autoimmune conditions.

| 9. | Women’s context, clinical history, and comorbidities should be considered fulsomely at the initial assessment in developing their individual CR treatment plan. Particular considerations include mental health and psychosocial issues, menopausal status, frailty, cancer history, and concerns about urinary incontinence, falls risk / osteoporosis, as well as autoimmune conditions. | ☉ ☉ ☉ ☉ | Strong | 1,157,158,159 |

10. CR programs should endeavor to provide preferred forms of aerobic exercise for women (e.g., alternatives to treadmill/stationary cycling such as overground exercise [walking and/or jogging, including outdoors], evidence-based forms of aerobic dance, and aerobics). If this is not possible, CR programs should endeavor to provide preferred forms of aerobic exercise for women (e.g., alternatives to treadmill/stationary cycling such as overground exercise [walking and/or jogging, including outdoors], evidence-based forms of aerobic dance, and aerobics). If this is not possible, | ☉ ☉ ☉ ☉ | Strong | 25,82–84,160–162 |
places to engage in forms of exercise preferred by women should be identified in the community
as an adjunct (e.g., swimming/aquatics, yoga, tai chi).

| 11. | Individually-tailored aerobic and resistance exercise prescriptions should consider
musculoskeletal issues (e.g., arthritis), body mass index / obesity, exercise history, pain and
fatigue. |
| --- | --- |
| | 12. | The psychosocial needs of women should be assessed and addressed in an evidence-based
manner (e.g., social support, relationship health, depression, anxiety, stress, socioeconomic
issues, informal caregiving activities). Where issues are identified and the program lacks
expertise on the team, referral to a specialist may be warranted. Re-assessment should be
undertaken, and communication be made to the woman’s primary care provider with consent to
ensure on-going monitoring and follow-up. |
| 13. | If sex/gender-specific education cannot be delivered directly within CR, women might be
directed to education resources on matters specific to women and cardiovascular diseases, in
multiple media where possible (see implementation tools in Supplemental Appendix S1). |
| 14. | It is conditionally recommended that from the outset of CR, staff should support women in the
self-management of their heart health as well as promote their heart-health behaviours in the
program and beyond, through encouraging their resilience and autonomy. This might involve for
example exploring means of exercise maintenance without the use of equipment only available at
the program (e.g., access to community centres). This may also involve promotion of continued
peer support post-program, as well as ensuring women are confident working with their primary
and specialty care providers to optimize secondary CVD prevention and associated health
conditions long-term. |
| 15. | Program evaluation should involve assessing women’s satisfaction with delivery (particularly
women-focused aspects), as well as analysis of sex differences in CR satisfaction and outcomes.
Corresponding quality improvement activities should be instituted where possible. |
CR, cardiovascular rehabilitation; GRADE, grading of recommendations assessment, development, and evaluation; MSK, musculoskeletal management
# Figures

## Figure 1: Summary of methods and recommendations

**Women-Focused Cardiovascular Rehab: Practice Guideline**

<table>
<thead>
<tr>
<th>Methods</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Recommendations</strong>&lt;br&gt;Based on the results of the first systematic review with meta-analysis on women-focused CR. Rated using GRADE.</td>
<td>Recommendations relate to:&lt;br&gt;- <strong>referral</strong> (i.e., automatic and encouragement),&lt;br&gt;- <strong>setting</strong> (e.g., choice of mode, environment, tailoring, staff training) and&lt;br&gt;- <strong>delivery</strong> (e.g., session timing options, preferred forms of exercise, psychosocial assessment and care, education on women and heart disease).</td>
</tr>
<tr>
<td><strong>Writing Panel Composed</strong>&lt;br&gt;Comprised of experts with diverse geographic representation, including multidisciplinary healthcare providers, a policy-maker to support recommendation implementation, and patient partners.</td>
<td><strong>GRADE</strong>&lt;br&gt;Overall, certainty of evidence for the final recommendations was <strong>low to moderate</strong>, and strength mostly <strong>strong</strong>.</td>
</tr>
<tr>
<td><strong>Delphi Panel – Survey and Call</strong>&lt;br&gt;Comprised of corresponding authors from articles included in the review and of programs delivering women-focused CR; asked to rate each recommendation on a 7-point Likert scale in terms of positive impact and implementation feasibility.</td>
<td></td>
</tr>
<tr>
<td><strong>External Review</strong>&lt;br&gt;The draft underwent external review from CR societies internationally and was posted for public comment.</td>
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</tr>
</tbody>
</table>

**Figure legends:** CR, cardiac rehabilitation
Supplemental Methods

The focus of this guideline is delivery of secondary prevention and rehabilitation of CVD in women. By CR program, we are referring to phase II (post-acute) programs, however these recommendations may also be suitable for inpatient and maintenance programs. The CR setting to which this guideline is applicable includes supervised programs in clinical (e.g., hospital to primary care) or community settings, as well as home-based programs, which may involve technology. Home-based CR delivered 1-1 would be considered “women-focused” where elements of items b and/or d in the introduction are applied. As per the mission of the ICCPR, this guideline takes into consideration the context of programs in low-resource settings.

The target population is adult women (using this term to encompass sex and gender, and including those assigned female sex at birth as well as individuals who identify as women or non-binary), with a CVD indicated for CR (i.e., evidence of benefit from randomized trials for reductions in mortality or morbidity when compared to usual care). Specifically, this guideline focuses on delivery of CR to women with stable coronary artery disease, a history of acute coronary syndrome +/- revascularization (percutaneous or surgical), heart failure (including with preserved ejection fraction), or ambulatory patients with stroke or PAD.

The target end-users of this guideline are chiefly CR providers of any discipline and administrators. The recommendations provided herein are also directed to healthcare practitioners providing inpatient acute cardiac care (e.g., nurses, physiotherapists, pharmacists), any referring providers (e.g., cardiac specialist, physiatrist, internist, family physicians) as tailored promotion of CR to women should be initiated in the inpatient setting. Broader healthcare administrators and policy-makers from the institutional, regional, national and international levels are other potential users of the guideline. Female CVD patients and their
family may also be interested in this guideline, to be informed about what type of CR could be available to them, or to work with programs to implement the recommendations herein.

Writing Panel Composition & Stakeholder Engagement

The writing panel co-chairs (GG, SLG) were approved by the ICCPR Executive Committee. The co-chairs then developed an outline and set out to populate the writing panel so that the sections could be drafted by experts in each area, and this was considered by the Executive; the corresponding authors of studies which were included in the reviews which form the evidentiary basis for this clinical practice guideline were considered,\(^2,10\) with the aim also of ensuring that the panel had diverse geographic representation, and included the CR-delivering healthcare provider types that would be implementing the recommendations (e.g., nurses, physiotherapist).

Two female cardiac patient partners from a low-resource setting were solicited to serve (one age 74 and the other 82, and one of lower education level and the other higher), as well as a policy-maker with international experience (AN) to promote implementability and uptake of the recommendations. The World Health Organization and World Heart Federation (of which ICCPR is an Associate member) were informed about the initiative.

All members were required to disclose conflicts of interest, financial relationships or personal interests from 12 months before initiation of the writing effort that could impact their contributions to this guideline. All authors declared none (available from corresponding author upon request).

Evidence collection, Grading criteria and Synthesis

This clinical guideline is based on the results of the first systematic review with meta-analysis on women-focused CR undertaken by several of the authors (TM, GG, SLG),\(^2,10\) In
brief, comprehensive literature searches were performed of 8 databases, from inception. The search strategy was based on the following parameters: inclusion of female adults (≥18 years) with any cardiac condition, where the study could be of any design (primary research only) and with any outcome, although we focused in particular on access, utilization, satisfaction, cost, as well as psychosocial (e.g., depression, anxiety, quality of life), heart-health behaviour and clinical (i.e., risk factors, functional capacity, morbidity and mortality) outcomes. Randomized trials were considered separately to undertake meta-analyses where it was possible based on availability of evidence, with separate consideration of usual care versus active comparison arms. Again, the intervention had to comprise women-focused CR as defined previously.

Quality of each study was rated using the Mixed-Methods Assessment Tool. Risk of bias in trials was also assessed using Cochrane’s tool (v1). Following meta-analysis where possible, evidence for each outcome was evaluated according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system. Where meta-analysis could not be performed, results were analyzed in accordance with the Synthesis Without Meta-analysis (SWiM) reporting guideline.

The first-ever reviews of women-focused CR revealed the diversity of what is considered women-focused CR, and it is unclear with what elements women are most satisfied. Given the limited availability of this model of CR, accessibility is very limited, and whether availability results in greater CR utilization in women cannot be established. In terms of impact, while there are few studies available, women-focused CR appears to be equivalent in effect to traditional CR in terms of functional capacity improvements, but results in significantly better quality of life. One study reported favorable economic impact and another reduced sick days, but the cost-effectiveness of traditional CR is well-established across many contexts and from many
perspectives.\textsuperscript{18,19,20} No harms were identified, and it is known that traditional and home-based CR are safe.\textsuperscript{6,21,22}

\textit{Development and Consensus Process}

The guideline was developed in accordance with the Appraisal of Guidelines for Research and Evaluation (AGREE)-II,\textsuperscript{23} the Institute of Medicine’s Trustworthiness Standards\textsuperscript{24} and the Reporting Items for practice Guidelines in HealTh care (RIGHT).\textsuperscript{25} Recommendations were initially developed by the panel co-chairs, with strength of recommendations based on GRADE.\textsuperscript{13,26} Articles included in the review were used as a basis for ratings,\textsuperscript{2,10} but in many cases additional evidence was also considered, using publications that were part of author’s personal databases. The 14 drafted recommendations were circulated to all other authors and ICCPR executive for initial input (Supplemental Table S1).

An online survey was created in Qualtrics to solicit ratings of each recommendation. Delphi panelists, described below, were first asked to specify whether or not the recommendation should be included (yes/no). Next, on a scale from 1-7, they rated each recommendation in terms of (a) potential positive impact for women’s CR adherence and/or outcomes, and (b) feasibility of implementation (including in low-resource settings). The anchors were from “no impact” to “major impact” and “not feasible” to highly feasible”, respectively (higher scores more positive). For each recommendation there was also a free-text box where panelists were invited to make suggestions about revision to wording or other considerations that could be addressed. Finally, panelists were asked to specify recommendations that should be added.

Delphi panelists comprised corresponding authors from each of the 28 studies included in the women-focused CR review,\textsuperscript{2,10} as well as CR providers who participated in ICCPR’s 2016/17
global CR audit who denoted offering at least some women-focused sessions at their program and provided their email to be contacted;\textsuperscript{15} there were 74 (67.3\%) respondents who provided contact information, but another 36 programs that reported offering some women-focused CR did not. These parties were emailed an invitation with details of the initiative (including proposed definition of women-focused CR) and survey link in December 2021, including a call for any women-focused CR implementation tools they would be willing to share.

Based on best practice,\textsuperscript{27} it was established a priori to consider recommendations where \(\geq 75\%\) of respondents agreed it should be included, as well as impact and implementability average scores \(\geq 5/7\) to have consensus for inclusion. Those recommendations with \(< 50\%\) agreement for inclusion, as well as impact and implementability average scores \(< 4/7\) were considered to have consensus for exclusion. All other recommendations were considered to have “unclear consensus”, and with consideration of open-ended comments, would be discussed on the consensus call.

Open-ended feedback was incorporated into the recommendations using tracked changes. The co-chairs discussed suggestions for additional recommendations, and drafted them for consideration by the panelists as well where it was deemed warranted. This was then shared with all respondents who provided their name to review.

A web call was convened in February 2022 to confirm recommendation inclusion/exclusion decisions, discuss recommendations where consensus was lacking, discuss potential revision of recommendations with consensus for inclusion based on comments provided, and consider new recommendations until consensus was achieved. The senior author chaired the call, ensuring all perspectives were voiced. The recommendations were revised accordingly, with strength of recommendations / certainty of evidence finalized for each based
on GRADE after the call. The final recommendations and GRADE ratings were then shared with panelists and patient partners for confirmation.

The guideline outline was discussed by the author team on a call before the consensus process. Benefits and harms of the recommendations were considered, as well as costs and implementability. Section authors provided their sections after the process, which were collated by the senior author; the full draft was then circulated to the writing panel for input. Feedback was incorporated by the co-chairs. Where there were significant outstanding questions, a webcall of authors was planned, but ultimately not necessary.

The drafted guideline was then shared with all those invited to the Delphi panel, who were considered an independent external review panel of experts (see acknowledgments). The draft was also posted on ICCPR’s website for a 14-day period to enable interested public stakeholders to provide input. It was also shared with all 42 member societies of ICCPR and 16 “friends” from countries where CR is emerging. Input received from associations and stakeholders was documented and considered, and integrated where appropriate. The document was then submitted to the ICCPR Executive Committee for quality assurance, and ultimate approval.

The writing panel will consider updating this guideline if substantive new evidence is available that may change practice in recommendation areas where there is uncertainty, new studies become available with ample power, and/or there is a reason to incorporate new methods, as per best practices.
Supplemental Results

Women-Focused CR Recommendation Development Process

Of those 94 unique women-focused CR experts globally invited to serve as Delphi panelists including co-authors, 18 (19.1%) email addresses were confirmed as no longer valid, and 19 (25.0%) responded (one anonymously); respondents were from all World Health Organization regions except Africa.

Based on the rating scheme, results suggested consensus to include 10/14 recommendations, and unclear consensus for recommendation five, as well as three, eight and 14 (issues of feasibility only for latter three). Based on comments, some edits were made to these four recommendations. Then comments for all other recommendations were considered; recommendation 11 regarding exercise was separated into 2 recommendations. Ultimately, revisions were made to every recommendation, with some of the suggestions for additional recommendations which pertained to existing recommendations incorporated therein (e.g., fostering a safe space, considering intersectionality, community settings).

The consensus call was attended by all seven co-authors plus eight other panelists from diverse regions. First, the definition of women-focused CR was discussed, and following some edits, consensus achieved on the four elements.

Next, the four recommendations with unclear consensus were discussed. There was a decision to re-frame recommendation five on staff not to specify sex, but instead to focus on characteristics, training and approach. Panelists then decided that related recommendation nine was not necessary, considering also that patient-centered care is relevant for men and women, and thus out of scope. Recommendations three and eight were discussed with the revisions from the comments, and the decisions were to include them given specification that these only be applied where feasible. Discussion about recommendation 14 centered around the scope of post-
CR care being more in the domain of the health system, although the audience for this guideline includes policy-makers. Given the importance of continuity of care for optimal secondary prevention, it was decided to re-frame the recommendation to focus on what should be done within CR to support women to achieve optimal secondary prevention and quality of life post-program given their unique challenges.

Half of respondents had forwarded additional recommendations in their survey responses. They were considered in terms of scope, and relevance to women-focused CR specifically; some of the suggestions were set aside accordingly by the panel. Some were included as directions for future research (e.g., seldom-heard women). There was agreement on incorporating some of the points into existing recommendations, as had been circulated prior to the meeting. Inclusion of family was discussed; it was agreed that women patients are more often unpartnered and hence use of more inclusive terminology was needed (e.g., support persons). It was agreed these parties should be engaged at the stage of CR referral to support women’s enrolment, but that inclusion of husbands in women-only exercise sessions may be problematic for some group class participants. Rather than adding a recommendation, this was added to recommendations two and four, respectively. Ultimately, one new recommendation was added, regarding evaluation (#15).

The inclusion of all recommendations was confirmed, and finally revisions to included recommendations based on open-ended feedback was discussed. Some further wording changes were made for clarity (e.g., “weighing” in recommendation 4 changed to “body composition assessment”). Means to provide support to women in one-on-one models was discussed in relation to recommendation seven. For recommendation 10, panelists discussed the lack of evidence for some alternative forms of exercise, and thus specified “evidence-based” to qualify
delivery of aerobic forms of dance. Final decisions on each recommendation are shown in Supplemental Table S1.

A written record of feedback received from the external review and public comment period as well as corresponding edits has been archived. Input did not result in alteration to the recommendations, but some sections of the text were clarified and some additional considerations added along with supporting references (e.g., early and surgical menopause assessment at intake, Indigenous considerations). Note that considerations for delivery of CR to women more broadly (i.e., not specific to women-focused CR) are well-reviewed elsewhere, including all components such as diet.\textsuperscript{29}
Other Considerations for Women-Focused CR Recommendation

Women-focused CR could be offered in clinical, community, hybrid or home-based (including incorporation of digital technologies) settings. Offering it only in a clinical setting raises the common barriers among women of distance, time conflicts, lack of transportation, and/or transportation cost. Location and ease of access are key for women.

Recent research suggests that alternatively offering programming hybrid or in the community, and in the case of this guideline we hope women-focused programming specifically, may facilitate greater women’s engagement. Features of community-based CR appealing to women have been elucidated. How to best leverage digital technologies for women-focused CR requires further investigation; however, where women have the technology and digital literacy, exploiting commonly-used apps to facilitate women’s education in CR, health behaviour change (e.g., tracking exercise intensity) as well as peer support and psychosocial well-being appears prudent. However, few trials of mobile phone-based CR involve women, and none provide sex-specific analyses.

Previous research has elucidated women’s needs and preferences for CR as well as for delivery models specifically. Many of these, as well as other preference and value considerations are addressed in the recommendation elucidation. However, this work is quite dated; women’s needs and preferences should be established in the current context, particularly given CR is now often delivered using new technology. Moreover, investigation of the CR preferences and needs of women with the following characteristics is necessary: those of lower socioeconomic status, of various sexualities and gender identities, ethnocultural backgrounds (including Indigenous), occupying various societal roles (e.g., informal caregiving, in abusive relationships), young and old, with women’s more common yet only recently-investigated and
hence less understood cardiac conditions (e.g., ischemia with non-obstructive coronary arteries) and multimorbidity (including mental health and cognitive conditions), in low-resource and non-Western (including less gender-egalitarian) cultures. Then these needs and preferences can be met.

Until these are well-known, program staff could assess women’s preferences individually by, for example, administering the CR Preferences Form at time of intake assessment, and then using the results to inform the treatment plan. Programs may also benefit from recommending women patients complete the CR barriers scale (CRBS) and Information Needs in CR (INCR) scales at intake. These validated scales are available in self-report form in various languages online (https://globalcardiacrehab.com/For-Patients), with mitigation strategies suggested in lay language for their biggest barriers as well as patient information sources provided where gaps exist; the means to share results with CR programs directly are also provided.

People with PAD and those with stroke are severely under-represented in CR; this disparity is even greater for women. With regard to the former, in 5 retrospective CR studies, <36% (12%-35%) of all PAD participants were women, despite the fact that women represent ~52% of people with PAD worldwide. This under-representation extends to stroke, where among 116 consecutively-enrolled stroke outpatients eligible for CR, only 24% of those that enrolled were women, despite the higher point estimate of incident and prevalent strokes in women than in men globally. It is therefore not surprising that there is little to no research on tailoring CR to women with stroke or PAD.

The under-representation and under-investigation is of concern because women with these conditions have greater depressive symptoms, pain, fatigue, poorer cardiorespiratory fitness, quality of life and functional mobility than their male counterparts, which are parameters
that can improve with CR/exercise participation.\textsuperscript{63,64–73} Regarding mobility, eligibility criteria for CR entry are based on level, where a progressively greater proportion of people with PAD and stroke are excluded from CR as their mobility deficits increase.\textsuperscript{48,49} This would disproportionately restrict entry of women with stroke or PAD, given their greater functional impairment than men. Therefore, having less restrictive inclusion criteria where feasible may mitigate sex differences in access, and ensure exercise engagement among those who most need it. Other strategies are to have stroke-specific and PAD-specific referral brochures for patients and families that target women (i.e., pictures of older and younger women exercising with and without mobility aids, or using arm ergometry), including how the program can help, who can join, and what happens during the program (including pain management).

Another sex difference is that women, including those with cardiac diseases, are more likely to have asymptomatic PAD or have atypical symptoms of PAD than men.\textsuperscript{74} This may be in part why PAD is under-diagnosed and under-treated in women worldwide (particularly in low- and middle-income countries), leading to delayed treatment and worse outcomes.\textsuperscript{75,74} It is important for the CR practitioner to be aware that difficulty walking because of PAD can be mistaken for hip or knee arthritis or spinal stenosis.\textsuperscript{76} This presents a challenge as these are more common or more disabling issues for women in general than men.\textsuperscript{77} However, CR provides an opportunity for identifying these women with or at high risk for PAD, by targeted use of the ankle-brachial index for timely diagnosis and treatment.\textsuperscript{75,74}

Women with stroke may be significantly more likely to decline to be referred to CR than men; fatigue being the only reason for declining that differed from men in one study.\textsuperscript{58} Women may have more musculoskeletal issues and poorer adherence to outpatient stroke rehabilitation than men.\textsuperscript{47}
For the exercise practitioner, ways to overcome barriers reported more frequently by women with stroke and PAD are to re-assure them that exercise will not make the condition worse, help plan exercise where there is opportunity to sit when fatigued or if leg pain occurs, and to prescribe a modality of exercise that minimizes the risk of falls. Strategies to manage fatigue, musculoskeletal issues, pain and psychosocial issues can be found in other sections. Nevertheless, once stroke and PAD patients enroll, there seems to be no sex difference in CR completion.\textsuperscript{51,58,79}

**Low-Resource Settings and Consideration of Equity, Feasibility**

Implementation of women-focused CR in low-resource settings\textsuperscript{3} will represent an even greater challenge, not only for socioeconomic reasons but also gender-related societal ones. Chief among barriers to implementation in these settings is the lower availability of CR, which results in no programs to tailor to women or greater geographic barriers.\textsuperscript{80} Interestingly, much of the women-focused CR available globally is offered in lower-resource settings in the Eastern Mediterranean Region.\textsuperscript{15} Indeed, in these contexts, CR is often single-sex for cultural and/or religious reasons; hence there is experience and knowledge that could be transferred for the benefit of higher-resource contexts. Guidance on augmenting CR capacity in low-resource settings is offered elsewhere.\textsuperscript{81,1}

In many lower-resource regions of the world, gender inequality is greater,\textsuperscript{82} which likely leads to the lower use of CR in women in these regions than in more equitable societies, such as Sweden for example.\textsuperscript{83} Women may be less likely to work outside the home, especially older women, and additionally often have less control over, and access to, the family’s financial resources; this would be exacerbated in families of lower socioeconomic status. This could impede payment for CR services (which must be paid out-of-pocket more often in low-resource
settings\textsuperscript{20} as well as needed funds to access CR (e.g., appropriate footwear, transportation). Family sizes are often larger,\textsuperscript{84} so women are shouldering greater family responsibility, including caretaking responsibility that extends to parents and grandchildren. This represents a major time commitment for women, limiting time for their own cardiac care, which is also often not prioritized. Women may more often experience interpersonal violence,\textsuperscript{85} and have subsequent psychosocial issues. Women may require their husband’s consent to participate, and may not be able to participate if programs are not women-only.\textsuperscript{86} Finally, many specialty physicians are male, and sexism exists in care;\textsuperscript{4} but regardless women should be encouraged to attend CR like men.

There are other important factors to consider in low-resource contexts. Chagas disease, rheumatic heart disease and congenital conditions are more common,\textsuperscript{87,88} so women will present with these CR indications. When recommending women exercise on non-CR days, there may be additional barriers to consider both within and outside the home. In the home, there may be less space for exercise, and there may be less money for any needed equipment. Outside the home, temperature extremes raise health concerns and there may be fewer green spaces for exercise. With regard to safety, road traffic injury,\textsuperscript{89} air pollution,\textsuperscript{90} as well as potential for assault in the evening may represent risks for women exercising outside in these contexts (although these issues can also be at play in all contexts).

Within CR programs themselves, there are additional considerations. Programs in low-resource settings can be shorter\textsuperscript{91} or women might not have funds to pay for sufficient sessions, despite their likely greater need for comprehensive programming. Education levels and literacy may be lower,\textsuperscript{92} so more time in patient education, using materials tailored to women’s needs would be imperative in supporting women to understand and implement needed self-
management practices. Often, there is stigma and under-identification of psychosocial issues, despite higher burden in these settings;\textsuperscript{93} CR programs should aim to identify such issues and ensure women have access to evidence-based treatments, given the hazards of depression and anxiety for example for mortality and morbidity in CVD patients.\textsuperscript{94} Domestic labour may be leveraged as lifestyle activity, but women may have less experience with higher-intensity aerobic as well as resistance exercise and it may not be understood as important. Where women cannot come on-site, the potential of offering CR and peer support via commonly-used apps such as WhatsApp or WeChat could be explored (i.e., internet connection, devices, power available, data plans), to support women in their secondary preventive lifestyle changes and promote their psychosocial well-being.
Supplemental Discussion

Directions for Future Research

In addition to some directions raised herein, in the reviews underpinning this guideline, directions for future research are forwarded, and a recent review also presents a good overview. Considerations around incorporating women with less-studied cardiac conditions that are more common in women (e.g., heart failure with preserved ejection fraction, ischemia with non-obstructive coronary arteries, stress cardiomyopathy, spontaneous coronary artery dissection) in CR are also recently reviewed elsewhere, and we bolster that call for research in relation to these populations specifically in women-focused CR.

Most imperative is getting women into CR, and then facilitating their adherence. With regard to the former, research is needed on how to address the gender gap in physician CR encouragement. We would argue that where women-focused CR is available, inpatient cardiac care providers be informed, and encouraged to communicated it to patients and their family. Also scripts supporting referral discussions with women patients, as available in the implementation tools in the Appendix, need to be tested and revised based on findings. Whether knowledge of the availability of women-focused CR increases women’s enrolment should be investigated. Standardized triage algorithms need to be developed and tested to support patient allocation to program model; but specifically in relation to this work, consideration of factors more common in female CVD patients and that are related to decisions to allocation to a women-focused model (e.g., session timing availability, safety, psychosocial well-being) must be incorporated in that assessment.

With regard to programming itself, as outlined in the reviews, features of women-focused CR that most engage women through to program completion must be identified. With regard to setting or models, research on how one-on-one CR (i.e., often home-based) should be
tailored to women to optimize utilization and outcomes also must be established; we identified no work in this area. Also needed is research into how hybrid models, as well as more-recently applied asynchronous and synchronous group online programming can meet women’s needs, including how this affects outcomes. On a related note, data do suggest that exercise intensity is equivalent in unsupervised versus supervised programs, but more research on this in women specifically is needed given their well-known barriers. It is encouraging that research attention has recently turned to sex differences in cardiorespiratory fitness in CR, but more work to understand optimizing initial exercise prescriptions and progressing it for women is needed, to maximize outcomes without leading to dropout. Finally, where they are shown to be beneficial, the question of how CR programs can integrate women’s preferred forms of exercise (e.g., Zumba) and how this affects outcomes needs investigation.

**Limitations**

The limitations of the evidence review are reported elsewhere. With regard to this guideline, we did not have representation on the writing panel from all global regions; for instance Africa was not represented, but there is limited CR and very limited women-focused CR there. There was good diversity in Delphi panelists, covering all regions but Africa. However, survey response rate was low. Finally, the authors are cautioned as while the additional literature from author’s personal databases used to support the recommendations was assessed for quality, all references cited in the text were not.
Supplemental Acknowledgements

We are grateful to our patient partners Tereza Rodrigues Pinto and Ana Maria da Silva. We recognize the contributions of Delphi panelists Sol Vidal Almela, Holly Wykes, Evangelia Kouidi, Mahdieh Ghanbari, Debbie Childerhose, Faith Delos-Reyes, Simonetta Scalvini, Lee Wan Ling, Michael D Kennedy, Masoumeh Sadeghi, Priya Chockalingam, Robert Zecchin, Lucia Filippucci, and Mireille Landry. We also recognize external reviewers, particularly Robyn Gallagher, but also including Mary Whooley, Danielle A. Gomes Pereira, Diann Gaalema, Jose Antonio Caldas Teixeira, Marta Supervia, Ardianna Meity, Won-Seok Kim, Jibril Mohammed, Jamal Uddin, Nidal Tourkmani, Carlos Alberto Cordeiro Hossri, Susan Dawkes, Nabila N. Soomro and Fakhr Al-Ayoubi.


19. Oldridge NB, Pakosh MT, Thomas RJ. Cardiac rehabilitation in low- and middle-income


29. Smith JR, Thomas RJ, Bonikowske AR, Hammer SM, Olson TP. Sex Differences in


46. Fernandez RS, Salamonson Y, Juergens C, Griffiths R, Davidson P. Validation of the


71. Breek JC, Hamming JF, De Vries J, van Berge Henegouwen DP, Van Heck GL. The


Supplemental Table S1: Initial Recommendations with Delphi Ratings and Panel Decisions

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Include? n (% yes)</th>
<th>Potential Positive Impact *</th>
<th>Feasibility of Implementation *</th>
<th>Panel Decision</th>
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<tr>
<td>Women’s Referral to CR</td>
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<tr>
<td>1 To facilitate referral of all CR-indicated women and reduce sex/gender bias, CR programs should work with referral sources to institute systematic referral</td>
<td>19 (100.0)</td>
<td>6.6±0.7</td>
<td>5.5±1.3</td>
<td>include</td>
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<tr>
<td>2 CR programs should educate providers at the referral sources regarding the importance of encouraging women’s attendance at the bedside, and tailoring that discussion to women’s more-common barriers and preferences</td>
<td>19 (100.0)</td>
<td>6.7±0.5</td>
<td>5.7±1.0</td>
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<tr>
<td>3 Women should be provided the choice of a supervised or unsupervised/home-based setting where safety is not an issue and there are no concerns about depression.</td>
<td>16 (94.1)</td>
<td>6.2±1.1</td>
<td>4.9±1.3</td>
<td>include</td>
</tr>
<tr>
<td>4 CR context should be optimized to meet women’s preferences with regard to: privacy (e.g., changeroom facilities, weighing), crowding, rushing</td>
<td>16 (88.9)</td>
<td>5.6±1.5</td>
<td>5.4±1.3</td>
<td>include</td>
</tr>
</tbody>
</table>
| 5 Where possible, female providers should deliver CR care to female patients    | 12 (66.7)          | 4.8±2.0                    | 4.7±2.1                       | Revise substan
tively |
| 6 Where unsupervised CR is delivered one-on-one, providers should attempt to tailor to women’s needs and preferences, as outlined in the delivery section below. | 17 (94.4)          | 6.2±1.1                    | 6.1±1.1                       | include        |
| Women-Focused CR Delivery                                                      |                    |                            |                                |                |
| 7 As women are the most populous under-represented group in CR, programs should offer some form of tailoring for women where possible. At the least a synchronous virtual session should be offered. | 16 (88.9)          | 6.2±1.5                    | 5.8±1.4                       | include        |
| 8 Women should be offered as much choice as possible in session timing           | 16 (88.9)          | 6.4±1.1                    | 4.9±1.4                       | Include        |
| 9 Care should be delivered in a patient-centered manner, specific to women.     | 18 (100.0)         | 6.4±0.9                    | 5.8±1.3                       | when discussi
ing changes |
<table>
<thead>
<tr>
<th>#</th>
<th>Text</th>
<th>Count (Percent)</th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Women’s comorbidities and gender-related symptoms should be considered in developing their individual treatment plan, including mental health and psychosocial issues, menopausal status, cancer history, and concerns about urinary incontinence, falls risk / osteoporosis, as well as autoimmune conditions / MSK in relation to exercise.</td>
<td>18 (100.0)</td>
<td>6.5±0.8</td>
<td>6.0±1.2</td>
<td>Include, but was broken into 2 recommendations</td>
</tr>
<tr>
<td>11</td>
<td>Programs should endeavour to provide preferred forms of aerobic exercise for women (e.g., walking not on a treadmill, swimming/aquabics, dance, aerobics/zumba). If this is not possible, individually-tailored exercise prescriptions must take musculoskeletal issues and exercise history into consideration (i.e., pain and fatigue), and/or other forms of exercise preferred by women should be made available in addition to traditional treadmill / cycle ergometers (e.g., yoga).</td>
<td>18 (100.0)</td>
<td>6.7±0.7</td>
<td>5.3±1.6</td>
<td>Include, but was broken into 2 recommendations</td>
</tr>
<tr>
<td>12</td>
<td>The psychosocial needs of women should be assessed and addressed in an evidence-based manner (e.g., social support, relationship health, depression, anxiety, stress, socioeconomic issues, informal caregiving activities). Where issues are identified, re-assessment should be undertaken, and communication be made to the woman’s primary care provider to ensure on-going monitoring and follow-up.</td>
<td>18 (100.0)</td>
<td>6.6±0.7</td>
<td>6.0±1.1</td>
<td>Include</td>
</tr>
<tr>
<td>13</td>
<td>if it cannot be delivered directly, women should be directed to education resources on</td>
<td>14 (77.8)</td>
<td>6.1±1.4</td>
<td>6.1±1.3</td>
<td>include</td>
</tr>
<tr>
<td></td>
<td>matters specific to women and cardiovascular diseases</td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>Women should be offered a means of continued support post-program.</td>
<td>16 (88.9)</td>
<td>6.4±0.9</td>
<td>4.8±2.0</td>
<td>revise substantially</td>
</tr>
</tbody>
</table>

CR, cardiovascular rehabilitation; MSK, musculoskeletal.
*mean and standard deviation of rating on scale from 1 to 7, with higher scores being more positive (e.g., major impact or highly feasible)
Supplemental Appendix S1

Appendix 1: Women-Focused Cardiovascular Rehabilitation Implementation Tools

Systematic Referral with Bedside Encouragement of Women Inpatients
Training in implementing: https://takeheart.ahrq.gov/
Resources to support, and provider talking points tailored to women:

Exercise Sessions
Recorded women-focused exercise sessions in English, by type (e.g., dance, yoga, resistance):
https://www.healtheuniversity.ca/EN/CardiacCollege/Pages/Women-Learn-Online.aspx

Patient Education
Recorded evidence-based women-focused education lectures in English, by topic (includes about heart diseases, medications, diet, psychosocial well-being etc.):
https://www.healtheuniversity.ca/EN/CardiacCollege/Pages/Women-Learn-Online.aspx
Online sources of information on women and CVD created for patients and evidence-based:
- Go Red for Women https://www.goredforwomen.org/ (English and Spanish)
- Centers for Disease Control USA https://www.cdc.gov/heartdisease/women.htm
- Heart and Stroke Foundation of Canada https://www.heartandstroke.ca/heart-disease/what-is-heart-disease/types-of-heart-disease/women-and-heart-disease (English, French)
- CardioSmart US https://www.cardiosmart.org/topics/women-and-heart-disease

Support Groups
- US Women’s Heart Foundation https://www.womenheart.org/