



Editorial

Exercise Modalities and Intensity to Improve Functional Capacity and Psychological/Mental Health in Cardiac Rehabilitation: A Role for Nordic Walking?

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See article by Terada et al., pages 1235–1243 of this issue.

Cardiac rehabilitation (CR) and exercise training programs are guideline-recommended therapy after major cardiovascular disease (CVD) events, and these programs are associated with considerable improvements in functional capacity and measured levels of cardiorespiratory fitness (CRF), major CVD risk factors, psychologic factors, and quality of life (QoL), as well as major CVD morbidity and mortality and all-cause mortality.^{1–4} Although CR involves more than just exercise, improvements in functional capacity/CRF, whether measured by the criterion standard of cardiopulmonary gas exchange and peak oxygen consumption (VO₂) or estimated by speed and incline on the treadmill (estimated metabolic equivalents [METs]), or by 6-minute walk tests (6MWT) or shuttle tests, explain most of the improvements in CVD and all-cause mortality.^{5–9}

There is extensive work comparing the exercise modalities of high-intensity interval training (HIIT) and moderate to vigorous intensity continuous training (MICT) on physical health and CRF as peak VO₂ in patients with coronary artery disease (CAD) undergoing supervised CR programs (16 studies; n = 748).^{10,11} This work consistently shows a superior effect of HIIT for improving VO₂ peak in the short term. In the longer term, HIIT and MICT have shown similar sustained improvements on peak VO₂, moderate to vigorous physical activity, and QoL over 12 months,^{12,13} and 1 study found that HIIT maintained peak VO₂ to a higher level than usual-care exercise at 6 months¹⁴ and 30 months,¹⁵ but with similar maintenance effects on QoL. In contrast, few

studies have investigated the effects of Nordic walking (NW) on physical health in this population, particularly on the maintenance of improvements following supervised CR. NW is an enhanced form of walking exercise that uses specifically designed poles to further engage both upper and lower body muscles. A meta-analysis by Cugusi et al.¹⁶ compared NW programs with conventional CR programs for patients with CAD (2 studies; n = 110) and found that NW provided superior improvements in exercise capacity (METs achieved during a treadmill stress test) and dynamic balance (up and go test), but not functional capacity (6MWT), strength (arm curl test; chair sit to stand test), or flexibility (back scratch test; chair sit and reach test). Following this meta-analysis, Girold et al.¹⁷ compared NW with traditional walking in 46 patients and found that NW provided superior improvement in 6MWT distance but not treadmill stress test distance or power output. Prince et al.¹⁸ found that NW and standard exercise therapy had similar improvements in 6MWT distance during and after supervised CR at 26 weeks, but the study was underpowered and in a heart failure population.

The study by Terada et al.¹⁹ reported in this issue of the *Canadian Journal of Cardiology* extends the previous work by comparing NW with different exercise modalities (HIIT and MICT groups) during and after supervised CR. The HIIT and MICT groups performed various types of aerobic exercise, including, but not limited to, walking. The investigators randomly assigned patients with CAD to 1 of the 3 exercise groups (NW, HIIT, or MICT) during a 12-week CR program and then reassessed patients after a 14-week observation phase. The study design was pragmatic using clinically relevant, accessible, and validated measurements for functional capacity (6MWT), QoL (HeartQoL questionnaire, Short Form–36 questionnaire), and depression (Beck Depression Inventory II). The authors recently published their primary outcome findings during the 12-week supervised CR program.²⁰ The present article reports secondary outcomes

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assessing the prolonged effects (improvements from baseline to 26 weeks) and sustained effects (end of supervised CR to week 26) on physical and mental health. The main finding was that NW showed a superior “prolonged effect” on functional capacity (6MWT) compared with HIIT and MICT. This was due to the greater improvement in functional capacity with NW during the 12-week supervised CR phase, rather than a superior “sustained effect” during the observation phase. Overall functional capacity showed further improvement after supervised CR, but this improvement was not different between HIIT, MICT, and NW. After supervised CR, participants were encouraged to continue an active lifestyle and were provided with self-management exercise tools. Accelerometry was used to assess prolonged and sustained effects on light and moderate to vigorous physical activity, which was not different between groups at any time point, and no further increases occurred during the observation phase. The study did not report any descriptive results on home-based exercise or activity (eg, type, frequency, duration) during the observation phase. Therefore, whether patients would continue and adhere to home-based NW after supervised CR remains unclear.

The authors acknowledge that the greater improvement in 6MWT distance by NW may be a reflection of the similarity between testing and training methods (ie, walking), and specific improvements in parameters related to walking, such as posture and gait.¹⁹ Nonetheless, NW was superior to HIIT and MICT for improving walking capacity during the 12-week CR program. The authors acknowledge the lack of cardiopulmonary exercise testing as a limitation of the study. The assessment of peak VO_2 and other functional capacity measures (eg, treadmill distance/workload, upper and lower body strength/endorance) would have provided a more comprehensive assessment of physical health. Although readily used in CR programs, the 6MWT has limitations, such as learning effects with familiarisation, ceiling effects (due to maximal walking speed), and variable intensity (due to self-paced nature), and it does not rigorously evaluate the cardiorespiratory system. To prevent learning effects, the investigators averaged the distance of 2 6MWTs at each time point. Furthermore, the randomised study design helped to ensure that the likelihood of potential ceiling effects was similar among the groups.

This study showed similar improvements in functional capacity between HIIT and MICT, which is in contrast to other studies that have shown a superior effect of HIIT compared with MICT on 6MWT distance²¹ and/or CRF (peak VO_2)¹⁰ in patients with CAD. In those previous studies, MICT is generally prescribed at a moderate intensity with a rating of perceived exertion (RPE) of 11-13 and/or 60%-75% of peak heart rate. In the present study, MICT was prescribed at a moderate to vigorous intensity (RPE 12-16), which is consistent with CR exercise prescription guidelines for Canada, the United States, and the majority of European countries. Therefore, the present study further highlights that continuous aerobic training prescribed at a moderate to vigorous intensity has similar effectiveness to HIIT for improving walking capacity during a 12-week CR program.

Very commendably, Terada et al.¹⁹ elaborate on the impact of CR not only on CRF but also on mental and emotional status. They present equally effective and positive

acute effects of CR on the mental component of QoL and depressive symptoms regardless of exercise modality. Their work emphasises the importance of CR on overall QoL of patients with CAD. Whereas depression as a consequence of CAD is well recognised, the role of impaired mental and emotional status in the development of CAD and increased mortality is underconsidered.²² Previous studies have demonstrated marked improvement of mental and emotional status following formal CR in a great majority of patients with CAD, and those positive responders exhibited 4-fold lower mortality, with strong links between overall CRF improvement, depression symptoms, and survival benefits after a CR program.^{22,23} Recently, CR programs have been addressing mental and emotional risk factors as a core component.

Nonetheless, Terada et al. demonstrate that, unlike functional capacity, achieved improvements in mental and emotional status do not persist, or even reverse, during a 14-week observation period.¹⁹ The authors speculate that this could be a consequence of increased physical activity level during the observation phase. However, there is still an unexplained incoherence between physical health and mental/emotional status during this phase. It seems that changes of the body (functional capacity/CRF) are longer lasting after structured CR, but improvements of the mind may require more targeted strategies for long-lasting changes. One of the approaches to addressing this issue may be enhanced CR (standard CR with stress-management training).²⁴ Further work is certainly needed to determine if there is a synergistic effect of combining physical and mental/cognitive strategies. Clearly, however, attendance and completion of formal CR programs is highly recommended for emotional and mental status-related risk reduction in patients with CAD.

Implications for Clinical Practice

The findings of this study promote enthusiasm for the inclusion of NW in CR programs. NW improved walking capacity more than HIIT, with a lower training heart rate and perceived exertion. The addition of NW to a CR program could therefore provide an ideal progression from standard MICT or traditional walking, especially for deconditioned patients who may not tolerate high-intensity exercise, or for patients in which HIIT may be contraindicated.²⁵⁻²⁷ The addition of Nordic poles to moderate to vigorous walking is a simple accessible option to enhance improvements in walking capacity, increase energy expenditure, engage upper body musculature, and improve other functional parameters such as posture, gait, and balance.^{28,29} This study highlights NW as an appropriate adjunct to MICT and HIIT during supervised CR programs. Providing a variety of exercise options enhances patient enjoyment and progression, which is important for adherence and maintenance. Exercise modalities should be prescribed with consideration of patient goals, preferences, and capabilities. Further research is warranted to investigate the efficacy and integration of NW into home-based exercise after supervised CR for maintenance of physical and mental health, and we congratulate Terada et al for their initial efforts in this direction.

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