3-year scoping report

Topic: cardiac rehabilitation

Literature published 2016-2021

Date of search: 4-7 Oct 2021

Searched by: Dawn Mahal & Jenny Harbour

Key concepts: Cardiac rehabilitation

Summary of findings

The purpose of this 3-year scoping is to establish what evidence has been published since publication of SIGN 150, and whether any sections of the guideline require updating. A rapid search of the literature was conducted; sources and references are detailed in the box below.

Relevant evidence and implications for SIGN recommendations

SIGN 150 section 3.2: engagement

Reference	**Details**	**How does this potentially change current recommendations?**
Cochrane systematic review. Santiago de Araújo Pio C, et al. Interventions to promote patient utilisation of cardiac rehabilitation. Cochrane Database of Systematic Reviews, 2019 issue 2.	Objectives 1. To assess interventions provided to increase patient enrolment in, adherence to, and completion of cardiac rehabilitation. 2. To assess intervention costs and associated harms, as well as interventions intended to promote equitable CR utilisation in vulnerable patient subpopulations.	This Cochrane review is an update of the one by Karmali et al (2014) that is currently referenced in the guideline. Additional interventions to support improved patient uptake and engagement with cardiac rehabilitation are evidenced in the review. SIGN could update the text in section 3.2 with this material.

	<u>Results</u> Included 26 studies with 5,299 participants (29 comparisons). Participants were primarily male (64.2%). Most studies having low or unclear risk of bias. 16 studies (n=3,164) reported interventions to improve enrolment in cardiac rehabilitation, 11 studies (n=2,319) reported interventions to improve adherence to cardiac rehabilitation, and 7 studies (n=1,567) reported interventions to increase programme completion. Meta-regression revealed that the intervention deliverer (nurse or allied healthcare provider, p=0.02) and the delivery format (face-to-face, p=0.01) were influential in increasing enrolment. Low-quality evidence shows interventions to increase adherence were effective (nine comparisons; standardised mean difference (SMD) 0.38, 95% CI 0.20 to 0.55), particularly when they were delivered remotely, such as in home-based programs (SMD 0.56, 95% CI 0.37 to 0.76). Moderate-quality evidence shows interventions to increase programme completion were also effective (eight comparisons; RR 1.13, 95% CI 1.02 to 1.25), but those applied in multicentre studies were less effective than those given in single-centre studies, leading to questions regarding generalisability.	

	No studies reported on harms associated with the interventions. Trialists tested interventions designed to improve utilisation among women and older patients. Evidence is insufficient for quantitative assessment of whether women-tailored programmes were associated with increased utilisation. For older participants peer navigation may improve enrolment.	
Systematic review [Medline] Supervia M, et al. Cardiac rehabilitation for women: a systematic review of barriers and solutions. Mayo Clin Proc. 2017:S0025-6196(17)30026-5.	A literature search was carried out using PubMed, EMBASE, Cochrane, OVID/Medline, and CINAHL. 31 studies that assessed the impact of various interventions to improve cardiac rehabilitation referral, enrollment, and/or completion in women were included. There was support for the use of automatic referral and assisted enrollment to improve participation. A small number of studies suggest that incentive-based strategies, as well as home-based programmes, may contribute to improving cardiac rehabilitation attendance and completion rates.	The current version of guideline 150 notes a lack of high-quality evidence on improving cardiac rehabilitation among hard to reach or under-served groups, including older women. This systematic review provides some suggested interventions that may improve uptake among women. The text in section 3.2.1 could be updated to include this.

Section 5.3: Physical activity and reducing sedentary behaviour

Reference	**Details**	**How does this potentially change current recommendations?**
Guidance Dept Health & Social Care. Physical activity guidelines: UK Chief Medical Officers' report. 2019	Latest UK CMO report published which replaces reference 38 in 2017 revision of guideline 150. States they feel that the 2011 report (ref 38) did not give the recommendations on strengthening activities the merit they deserved. This report reinforces the importance of strengthening activities for all age groups.	Reference needs updating. New guidance places more emphasis on the importance of strength training. Strengthens the information contained within the guidelines at section 5.3
Meta-analysis [Medline] Goncalves C, et al. Exercise intensity in patients with cardiovascular diseases: systematic review with meta-analysis. Int J Environ Res Public Health. 2021;18(7):83574.	This study aimed to identify the optimal exercise intensity and programme length to improve VO_2peak in patients with cardiovascular diseases (CVDs) following cardiac rehabilitation. 16 RCTs were considered. The main finding was that moderate-to-vigorous and vigorous-intensity interventions, conducted for 6–12 weeks, were more effective at improving CVD patients' cardiorespiratory fitness .	The main use of this review would be to provide information on frequency and duration of the exercise component of cardiac rehabilitation (key question 6). Potentially the recommendations could be amended to include a preferred frequency and duration of exercise.
Systematic review [Medline] Seo YG, et al. What is the optimal exercise prescription for patients with dilated cardiomyopathy in	The purpose of this literature review was to identify optimal exercise training programming for patients with dilated cardiomyopathy. 4 studies were included in the systematic review. The exercise frequency of the reviewed studies ranged	The main use of this review would be to provide information on frequency and duration of the exercise component of cardiac rehabilitation (key question 6). Potentially the recommendations could be amended to

cardiac rehabilitation? a systematic review. J Mol Signal. 2019;39(4):235-40.	from 3 to 5 times/wk, and exercise intensity was prescribed within a range from 50% to 80% of oxygen uptake reserve. Exercise time was as high as 45 min by the final month of the exercise prescription. Exercise type was mainly aerobic exercise and resistance training. The average improvement of exercise capacity was 19.5% in reviewed articles. Quality of life also improved after intervention.	include a preferred frequency and duration of exercise.
Meta-analysis [Medline] Santiago de Araujo Pio C, et al. Effect of cardiac rehabilitation dose on mortality and morbidity: a systematic review and meta-regression analysis. Mayo Clin Proc. 2017;92(11):1644-59.	Objective: To ascertain the effect of cardiac rehabilitation dose (ie duration × frequency/wk; categorized as low [<12 sessions], medium [12–35 sessions], or high [≥36 sessions]) on mortality and morbidity. 33 trials were included comparing CR to usual care (.e no dose). In metaregression, greater dose was significantly related to lower all-cause mortality (high: -0.77; SE 0.22; p<0.001; medium: -0.80; SE 0.21; p<0.001) when compared with low dose. With regard to morbidity, dose was significantly associated with fewer percutaneous coronary interventions (high: RR 0.65; 95% CI 0.50 to 0.84; medium/low: RR 1.04; 95% CI 0.74- to 1.48; between subgroup difference p=0.03). No dose-response association was found for cardiovascular mortality, all-cause hospitalisation, coronary artery bypass graft surgery, or myocardial infarction.	The main use of this review would be to provide information on frequency and duration of the exercise component of cardiac rehabilitation (key question 6). Potentially the recommendations could be amended to include a preferred frequency and duration of exercise. Note that this review compares dose of cardiac rehabilitation and not specifically the exercise component.

Section 5.3.1: Technology based exercise

Reference	Details	How does this potentially change current recommendations?
Meta-analysis [Medline] Kaihara T, et al. Impact of activity trackers on secondary prevention in patients with coronary artery disease: a systematic review and meta-analysis. Eur J Prev Cardiolog. 2021.	Objective: To review the literature on impact of activity trackers on CVD risk and outcomes. 11 articles were included in the review. Compared to control groups, intervention groups with activity trackers significantly increased peak VO_2 [MD 1.54; 95% CI 0.50 to 2.57; p = 0.004] and decreased major adverse cardiovascular events [RR 0.51; 95% CI 0.31 to 0.86; p=0.01]. Intervention with an activity tracker also has positive impact on quality of life.	The text in section 5.3.1 could be updated to include effects of activity monitors/tackers. The recommendation in this section could also be amended or added to based on this review.
Meta-analysis [Medline] Ashur C, et al. Do wearable activity trackers increase physical activity among cardiac rehabilitation participants? a systematic review and meta-analysis. J Mol Signal. 2021;41(4):249-56.	The objective of this study was to review RCTs, which included a wearable activity tracker in an intervention to promote physical activity among cardiac rehabilitation participants. Nineteen RCTs with 2,429 participants were included in the systematic review and 10 RCTs with 891 participants were included in the meta-analysis. Meta-analysis of three RCTs using a pedometer or accelerometer demonstrated a significant increase in daily step count compared with controls (n=211, 2,587 steps/d [95% CI 916 to 5257]; I^2 = 74.6% and p=0.002). Meta-analysis of three RCTs using a pedometer or accelerometer intervention demonstrated a significant increase in VO_2max	The text in section 5.3.1 could be updated to include effects of activity monitors/tackers. The recommendation in this section could also be amended or added to based on this review.

	compared with controls (n=260, 2.6 mL/min/kg [95% CI 1.6 to 3.6]; I^2 = 0.0% and p<0.0001). Meta-analysis of four RCTs using a heart rate monitor demonstrated a significant increase in Vo2max compared with controls (n=420, 1.4 mL/min/kg [95% CI 0.4 to 2.3]; I^2 = 0.0% and p=0.006).	
Meta-analysis [Medline] Hannan AL, et al. Impact of wearable physical activity monitoring devices with exercise prescription or advice in the maintenance phase of cardiac rehabilitation: systematic review and meta-analysis. BMC Sports Sci Med Rehabil]. 2019;11:14.	Objectives: 1. Assess the effect of wearable physical activity monitor through the maintenance phase of cardiac rehabilitation. 2. Collate outcome measures reported, reasons for drop out, adverse events, and psychological impact from utilising a wearable physical activity monitor (WPAM). Nine studies involving 1,352 participants were included. Cardiorespiratory fitness improved to a greater extent in participants using WPAM with exercise prescription or advice compared with controls (MD 1.65 mL/kg/min; 95% CI 0.64 to 2.66]; p=0.001; I^2 = 0%). There was no significant difference between groups in six-minute walk test distance. In 70% of studies, step count was greater in participants using a WPAM with exercise prescription or advice, however the overall effect was not significant (SMD 0.45; 95% CI −0.17 to 1.07] p=0.15; I^2 = 81%). A sensitivity analysis resulted in significantly greater step counts in participants using a WPAM with	This review also has potential to also affect section 5.5 on long-term maintenance of behaviour change. The text in section 5.3.1 could be updated to include effects of wearable physical activity monitors and exercise prescriptions or advice. The recommendation and text in section 5.5 could be updated to include effect of wearable physical activity monitors plus exercise prescription or advice on maintenance of physical activity.

	exercise prescription or advice and reduced the heterogeneity from 81% to 0% (SMD 0.78;95% [CI 0.54–1.02]; $p < 0.001$; $I^2 = 0\%$). Three of six studies reported improved psychological benefits. No cardiac adverse events related to physical activity were reported and 62% of non-cardiac adverse events were primarily musculoskeletal injuries.	

Section 5.5: Long-term maintenance of behaviour change

Reference	**Details**	**How does this potentially change current recommendations?**
Systematic review [Medline] Graham H, et al. Systematic review of interventions designed to maintain or increase physical activity post-cardiac rehabilitation phase II. Rehabil. Process Outcome. 2020;9:1179572720941833.	The purpose of this review was to evaluate current literature for interventions designed to assist individuals to maintain or increase physical activity post cardiac rehabilitation phase II. 19 randomized control trials retained for descriptive analysis. The intervention designs varied widely in terms of duration of the intervention and the length of time to outcome measurement. Most interventions were short term with only 2 studies offering a long-term intervention of greater than 1 year. Interventions using a theoretical approach most often included a cognitive-behavioral model.	The recommendation and text in section 5.5 could be amended or strengthened based on this review.

SIGN section 7.2: Vocational rehabilitation - interventions

Reference	Details	How does this potentially change current recommendations?
Cochrane systematic review Hegewald J, et al. Interventions to support return to work for people with coronary heart disease. Cochrane Database of Systematic Reviews, 2019 issue 3.	To assess the effects of person- and work-directed interventions aimed at enhancing return to work in patients with coronary heart disease compared to usual care or no intervention. 39 RCTs (including one cluster- and four three-armed RCTs); 34 studies were included in the meta-analyses. Person-directed interventions included psychological counselling, work-direcedt counselling, physical conditioning interventions, and combined interventions. No work-directed interventions were identified in the literature. The only statistically significant results were for combined interventions (13 studies). Combined cardiac rehabilitation programmes may have increased return to work up to six months (RR 1.56, 95% CI 1.23 to 1.98; number needed to treat for an additional beneficial outcome (NNTB) 5; four studies; low-certainty evidence), and may have little to no difference on return-to-work rates at six to 12 months' follow-up (RR 1.06, 95% CI 1.00 to 1.13; 10 studies; low-certainty evidence). Combined interventions probably shortened the time needed	Although the Cochrane review mainly found non-significant results for interventions aimed at getting people with coronary heart disease back to work, it could improve the evidence levels/quality in section 7.2 and the resulting recommendation could be amended to include 'combined interventions'.

	until return to work (MD −40.77, 95% CI −67.19 to −14.35; two studies; moderate-certainty evidence).	

Recommendations for research – *note any evidence that addresses evidence gaps highlighted in the original guideline under the Recommendations for research section*

Reference	Details	What area for further research does this address?
Meta-analysis [Medline] Scott-Sheldon LA, et al. Mindfulness-based interventions for adults with cardiovascular disease: a systematic review and meta-analysis. Ann Behav Med. 2020;54(1):67-73.	Objective: To examine the effects of mindfulness-based interventions on psychological and physiological measures in adults with CVD using meta-analysis. 16 studies met inclusion criteria (n=1,476; mean age=56 years; 40% women). Compared to controls, participants who received a mindfulness-based intervention reported greater improvements in psychological outcomes (ie anxiety, depression, distress, and perceived stress). Mindfulness recipients also reduced their systolic but not diastolic blood pressure relative to controls.	The current guideline does not make a recommendation on mindfulness due to a lack of research on this intervention. This review could support a new recommendation in section 6.4.3 on mindfulness.

Potentially important new evidence – *note any new important evidence in the field that may be relevant for the update but that hasn't been mentioned in the original guideline*

Reference	Details	Why might this be important to include in the guideline?

Meta-analysis [Dynamed] Gomes Neto et al. Combined exercise and inspiratory muscle training in patients with heart failure: a systematic review and meta-analysis. J Cardiopulm Rehabil Prev. 2016;36(6):395-401.	The objective of this study was to determine whether combined exercise and inspiratory muscle training was more effective than conventional exercise in patients with heart failure. Three studies met the inclusion criteria. Combined exercise/inspiratory muscle training resulted in improvement in maximal inspiratory pressure weighted mean differences (20.89 cm H_2O; 95% CI 14.0 to 27.78) and Minnesota Living with Heart Failure Questionnaire weighted mean differences (4.43; 95% CI 0.72 to 8.14). Non-significant difference was observed in peak O_2 for participants in the combined exercise/inspiratory muscle training group compared with the conventional exercise group. No serious adverse events were reported.	This meta-analysis could support addition of inspiratory muscle training to the exercise component of cardiac rehabilitation programmes. There is currently no recommendation or text on this combined intervention in the guideline.
Economic analysis [Medline] Melbostad et al. Financial analysis of cardiac rehabilitation and the impact of COVID-19. J Mol Signal. 2021;41(5):308-14.	The aim of this study was to compare the costs and reimbursements of cardiac rehabilitation between two periods: (1) pre-COVID-19 and (2) during the COVID-19 pandemic. The mean number of cardiac rehabilitation participants enrolled/month declined during the pandemic (-10%; 33.8 ± 2.0 vs 30.5 ± 3.2, p=0.39), the mean cost/participant increased marginally (+13%; $2,897 ± $131 vs $3,265 ± $149, p=0.09), and the mean reimbursement/participant decreased slightly (-4%; $2,959 ± $224 vs $2,844 ± $181, p=0.70). These differences did not reach statistical significance. The pre-COVID mean operating surplus/participant ($62 ± $140) eroded into a deficit of -$421 ± $170/participant during the pandemic. No known COVID-19	A US-based study, this paper provides some insight into the financial impact of the COVID pandemic on cardiac rehabilitation provision.

	infections occurred among the 183 participants and 14 on-site staff members during the pandemic period.	

Chair's comments *Include any comments or suggestions on updates the Chair has provided*

Comment

Evidence sources

Resource	Results
Previous HIS projects on this topic	0
Dynamed	Multiple Dynamed summaries have a section on cardiac rehabilitation, with a lot of overlap in content and references between summaries. The summaries cover: acute coronary syndromes, ST elevation MI, secondary prevention of coronary artery disease, heart failure with reduced ejection fraction, CABG, management of stable angina, and acute heart failure. Secondary evidence cited in Dynamed summaries for cardiac rehab: 2016 European Guidelines on cardiovascular disease prevention in clinical practice Recommends cardiac rehabilitation and engagement in alignment with current SIGN 150 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation Cardiac rehabilitation recommended after MI

	Pengelly et al. Exercise parameters and outcome measures used in cardiac rehabilitation programs following median sternotomy in the elderly: a systematic review and meta-analysis. Heart Lung Circ. 2019;28(10):1560-70. Adds nothing new to current recommendations Taylor et al. Impact of exercise rehabilitation on exercise capacity and quality-of-life in heart failure: individual participant meta-analysis. J Am Coll Cardiol. 2019;73(12):1430-43. Adds nothing new to current recommendations Palmer et al. Chronic heart failure and exercise rehabilitation: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2018;99(12):2570-82. Adds nothing new to current recommendations
TRIP	Nothing identified
Guidelines and guidance	
NICE	Chronic heart failure guidance updated in 2018. Section 1.9 on cardiac rehabilitation but does not add anything to current SIGN 150. Acute coronary syndromes guidance published 2020 but all recommendations on cardiac rehabilitation are carried forward from 2007 and 2013 updates.
Guidelines International Network (GIN)	The UK Chief Medical Officers physical activity guidelines report 2019.
BMJ Best Practice	Nothing identified
Secondary literature	
Cochrane library	Long L, Mordi IR, Bridges C, Sagar VA, Davies EJ, Coats AJS, *et al.* Exercise-based cardiac rehabilitation for adults with heart failure. Cochrane Database of Systematic Reviews. 2019(1). Older version used in last update – no significant changes to findings. Richards SH, Anderson L, Jenkinson CE, Whalley B, Rees K, Davies P, *et al.* Psychological interventions for

	coronary heart disease. Cochrane Database of Systematic Reviews. 2017(4). Older version used in last update – no significant changes to findings. Anderson L, Sharp GA, Norton RJ, Dalal H, Dean SG, Jolly K*, et al.* Home-based versus centre-based cardiac rehabilitation. Cochrane Database of Systematic Reviews. 2017(6). Older version used in last update – 6 new studies – no significant changes to findings. Anderson L, Brown JPR, Clark AM, Dalal H, Rossau HKK, Bridges C*, et al.* Patient education in the management of coronary heart disease. Cochrane Database of Systematic Reviews. 2017(6). No significant effect on recommendations. Yamamoto et al. Exercise-based cardiac rehabilitation for people with implantable ventricular assist devices. 2018. Only two small RCTs (cumulative n=40) of very poor quality so no conclusions reached in the review. Five Cochrane reviews on exercise-based cardiac rehabilitation in new patient populations (below). None focus on duration or frequency of exercise intervention and do not add to the current guideline content. Risom SS, Zwisler AD, Johansen PP, Sibilitz KL, Lindschou J, Gluud C*, et al.* Exercise-based cardiac rehabilitation for adults with atrial fibrillation. Cochrane Database of Systematic Reviews. 2017(2). Anderson L, Nguyen TT, Dall CH, Burgess L, Bridges C, Taylor RS. Exercise-based cardiac rehabilitation in heart transplant recipients. Cochrane Database of Systematic Reviews. 2017(4). Long L, Anderson L, Dewhirst AM, He J, Bridges C, Gandhi M*, et al.* Exercise-based cardiac rehabilitation for adults with stable angina. Cochrane Database of Systematic Reviews. 2018(2). Abraham et al. Exercise-based cardiac rehabilitation for adults after heart valve surgery. 2021.

	Nielsen et al. Exercise-based cardiac rehabilitation for adult patients with an implantable cardioverter defibrillator. 2019.
Medline	11 systematic reviews/meta-analyses 1 economic study

Consultation

This topic exploration was reviewed by some of the group responsible for developing SIGN 150: Cardiac rehabilitation, who were asked to comment primarily on the comprehensiveness and accuracy of the summary of findings and whether there is sufficient new evidence to warrant a refresh of the guideline. Guideline development group membership can be found in section 12 of the guideline.

Comments from scoping, October 2020:

Reviewer	Comments
Frances Divers Cardiology Nurse Consultant on behalf of Scottish Governments women's heart health plan working group	Comments received from Professor Lis Neubeck, Professor of Cardiovascular Health, Napier University. There have been important reviews on women's participation in cardiac rehabilitation which have not been included in this update: 1. Supervía, M., Medina-Inojosa, J. R., Yeung, C., Lopez-Jimenez, F., Squires, R. W., Pérez-Terzic, C. M. & Thomas, R. J. (2017, April). Cardiac rehabilitation for women: a systematic review of barriers and solutions. In Mayo Clinic Proceedings (Vol. 92, No. 4, pp. 565-577). Elsevier. 2. Resurreccion, D. M., Motrico, E., Rigabert, A., Rubio-Valera, M., Conejo-Ceron, S., Pastor, L., & Moreno-Peral, P. (2017). Barriers for nonparticipation and dropout of women in cardiac rehabilitation programs: A systematic review. Journal of women's health, 26(8), 849-859. 3. Oosenbrug, E., Marinho, R. P., Zhang, J., Marzolini, S., Colella, T. J., Pakosh, M., & Grace, S. L. (2016). Sex differences in cardiac rehabilitation adherence: a meta-analysis. Canadian Journal of Cardiology, 32(11), 1316-1324.

	There have also been a number of trials showing how uptake can be increased amongst women. Two small studies suggest CR is safe and improves psychological outcomes in spontaneous coronary artery dissection (SCAD) survivors. There is a statement in the guidelines about mindfulness needing further research. This point should be addressed as there has been a systematic review on this topic published in 2020. Scott-Sheldon, L. A., Gathright, E. C., Donahue, M. L., Balletto, B., Feulner, M. M., DeCosta, J. & Salmoirago-Blotcher, E. (2020). Mindfulness-based interventions for adults with cardiovascular disease: a systematic review and meta-analysis. Annals of Behavioral Medicine, 54(1), 67-73.
Brian Skinner, Patient representative	I agree that the recommendations are still very relevant and up to date. The only thing that is of concern is that since March and COVID 19 the cardiac rehab has been vastly affected with all centres being shut exercise has fallen off the edge. Most participants feel it is easier with others to attend classes. It also has been a great help psychology wise.

Concluding remarks

There is little new evidence that would change existing recommendations. There may be benefit in enhancing the guideline with further advice for women, and psychological interventions. However, given that rehabilitation services are currently adapting to the impact of COVID-19 and the new evidence does not have high impact on the existing recommendations, this update does not require urgent attention.

Decision

On 24 November 2021 the Work Programme Committee recommended:

This guideline would benefit from review and has been accepted onto the SIGN guideline programme.