Journal of the Saudi Heart Association

Volume 35 | Issue 3 Article 2

2023

The Prevention and Cardiac Rehabilitation Group of the Saudi Heart Association recommendations regarding establishing a Cardiac Rehabilitation Service

Recommended Citation

Kinsara, Abdulhalim Jamal; Aljehani, Raghdah; Wolszakiewicz, Jadwiga; Staron, Adam; and Alsulaimy, Muteb A. (2023) "The Prevention and Cardiac Rehabilitation Group of the Saudi Heart Association recommendations regarding establishing a Cardiac Rehabilitation Service," *Journal of the Saudi Heart Association*: Vol. 35 : Iss. 3 , Article 2.
Available at: https://doi.org/10.37616/2212-5043.1346

The Prevention and Cardiac Rehabilitation Group of the Saudi Heart Association recommendations regarding establishing a Cardiac Rehabilitation Service

Cover Page Footnote

pls, see the correction on page 6. on other pages we noticed some typo or small/capital variations

GUIDELINE

The Prevention and Cardiac Rehabilitation Group of the Saudi Heart Association Recommendations Regarding Establishing a Cardiac Rehabilitation Service

Abdulhalim J. Kinsara [a,*], Raghdah Aljehani [b], Jadwiga Wolszakiewicz [c], Adam Staron [c], Muteb A. Alsulaimy [c]

[a] Ministry of National Guard-Health Affairs, King Abdullah International Medical Research Center, King Saud Bin Abdulaziz University for Health Sciences, COM-WR, Jeddah, Saudi Arabia
[b] King Abdullah Medical City, Mecca, Saudi Arabia
[c] Prince Sultan Cardiac Center, Riyadh, Saudi Arabia

Abstract

Cardiac rehabilitation (CR) is a cornerstone in the secondary prevention of cardiovascular disease (CVD). Comprehensive cardiac rehabilitation has obtained the highest class of recommendation and the level of evidence for the treatment of patients with ST-segment elevation myocardial infarction, after myocardial revascularization, with chronic coronary syndromes, and in patients with heart failure (HF). Comprehensive cardiac rehabilitation should be implemented as soon as possible, be multi-phasic, and adjusted to the individual needs of the patient. CR is still suboptimally used, and many cardiac centers do not have such services (2). The provision of CR services should be based on standards and key performance indicators, and guidelines containing a minimum standard of cardiac rehabilitation utilization should be published to improve the quality of the CR program. This document presents an expert opinion that summarizes the current medical knowledge concerning the goals, target population, organization, clinical indications, and implementation methods of the CR program in the Kingdom of Saudi Arabia.

Keywords: Cardiac rehabilitation, Cardiovascular disease, Exercise training, Secondary prevention of cardiovascular disease, Saudi Arabia, Guidelines

1. Epidemiology

In Saudi Arabia, cardiovascular disease (CVD) accounts for more than 45% of all deaths as a consequence of lifestyle changes, rapid urbanization, an increase in unhealthy diets and the prevalence of a sedentary lifestyle. Consequently, the rate of cardiovascular risk factors remains high. The results of the Prospective Urban Rural Epidemiology Study (PURE-Saudi) revealed a high prevalence of unhealthy lifestyles and CVD risk factors in the adult Saudi population, with an overall rate of low physical activity (69.4%), obesity (49.6%), an unhealthy diet (34.4%), dyslipidemia (32.1%), hypertension (30.3%), and diabetes (25.1%). In addition, 12.2% of the study participants were current smokers, and 16.9% had a history of stress [1].

The importance of cardiac rehabilitation (CR) is increasing because of the growing number of patients after acute cardiac events with subsequent

Received 11 May 2023; revised 11 August 2023; accepted 11 August 2023.
Available online 4 September 2023

* Corresponding author.
E-mail address: akinsara@yahoo.com (A.J. Kinsara).

https://doi.org/10.37616/2212-5043.1346

complications and progression into a chronic state. To promote CR utilization, which is still limited in the Kingdom of Saudi Arabia, the Saudi Group for Cardiovascular Prevention and Rehabilitation (SGCVPR) proposed the standards for the implementation of CR, considering the specific local features and including minimum standard of CR use, including the goals, target population, program organization, clinical indications, and methods of implementation of CR in the Kingdom of Saudi Arabia.

2. Definition and goals

Despite evidence demonstrating that exercise-based CR, prescribed by a medical professional, has a positive impact on the fundamental pathophysiology of coronary artery disease, improves exercise capacity, quality of life, and psychological well-being, in addition to reducing mortality, morbidity, and hospital readmissions, CR remains underutilized globally, with less than 30% of the eligible patients participating in a CR program after a CVD event [2]. Comprehensive CR is defined as an individualized multidisciplinary intervention that entails clinical evaluation, management and modification of the CVD risk factors, physical activity counselling, prescription of exercise training, dietary counselling as well as psychological, social, and vocational support [3]. Comprehensive CR should be implemented as soon as possible, and should consist of multiple stages.

3. Indications

The patient groups that should be offered a cardiac rehabilitation program are presented in Table 1 [4]. All patients should enter the cardiac rehabilitation program through a referral from the physician responsible for the patient's care. Patients can attend the supervised exercise training program approximately two weeks after the myocardial infarction (MI), one-to-two weeks after elective percutaneous coronary intervention, four weeks after cardiac surgery or implantation of the electrical cardiac devices, and after clinical stabilization and optimal GDMT in patients with heart failure (CCF), following individual review during the in-patient phase [5]. Medical consent for patients to attend the exercise component of the second and the maintenance CR phases are required in accordance with the exclusion criteria.

4. Contraindications

The exclusion criteria for a structured exercise training program are listed in Table 2 [6]. Patients who do not meet the referral criteria for a structured exercise program should be offered an educational component and obtain sufficient information about physical activity at home.

Table 1. Clinical indications for comprehensive cardiac rehabilitation.

• Post-acute coronary syndromes
•Post-myocardial revascularization
•Chronic coronary syndromes
•Heart failure
•Following implantation of cardiac implantable electronic devices, pacemakers, resynchronization devices, or implantable cardioverter defibrillators
•Following heart valve repair/replacement
•Following heart transplantation
•Following implantation of ventricular assist devices
•Peripheral arterial disease
•Following cerebrovascular events
•Individuals with cardiovascular risk factors, i.e., with diagnosis of diabetes, dyslipidemia, and arterial hypertension
•Pulmonary hypertension

5. Phases of cardiac rehabilitation

Patients hospitalized for a cardiac event or procedure and discharged to a transitional setting on the basis of a physician referral or an ongoing order should receive CR services, which include (a) initial and daily clinical status assessments; (b) early progressive mobilization; (c) identification of and information regarding the modification of cardiovascular risk factors; (d) self-care; and (e) a complete discharge plan with options for traditional center-based or hybrid outpatient CR. Three phases are organized, starting with inpatient, continuation as outpatient and finally in the community, Table 3 [5,7].

6. Admission assessment

The CR program should commence with a comprehensive entry assessment (Fig. 1). Admission

Table 2. Exclusion criteria for the structured exercise program.

•Unstable angina
•Acute heart failure
•Severe aortic stenosis
•Uncontrolled atrial or ventricular arrhythmias
•Complete atrioventricular block without pacemaker
•Acute pericarditis or myocarditis
•Recent pulmonary embolism
•Acute thrombophlebitis
•Aortic aneurysm with diameter greater than 4 cm
•Resting systolic blood pressure greater than 200 mmHg or resting diastolic blood
•Pressure greater than 110 mmHg
•Uncontrolled diabetes mellitus
•Acute systemic illness or fever
•Severe orthopedic conditions that would prohibit exercise
•Left ventricular thrombus (less than 6 months)
•Uncontrolled asthma

assessment allows for the identification of the individual needs of patients referred to CR and facilitates personalized goals and the plan of care [8], which includes:

(1) Medical History (Clinical History, Comorbidities, medical therapy, evaluation of atherosclerotic risk factors, and symptoms (NYHA class, CCS angina class, Fontaine and Rutherford classification for lower extremity peripheral artery disease) Review of lifestyle modifications (diet, smoking, weight control, BP self-monitoring, glucose control, and Physical activity level).
(2) Physical examination (heart failure symptoms, arrhythmia, HR and BP control, extracardiac atherosclerotic manifestations, frailty syndrome, musculoskeletal disorders, and neurologic symptoms);
(3) Psychosocial assessment (stress, social support, depression, anxiety, cognitive function assessment); and
(4) Functional capacity assessment, Symptom-limited exercise test (preferably CPET, 6-MWT). If the patient is not able to undertake a standard exercise test on a treadmill or cycle leg ergometer, a functional test like the 6-min walk test or the incremental shuttle walk test should be performed.

Cardiac risk stratification is the next step and identifies patients at risk for a cardiac event recurrence. The exercise risk stratification process is mandatory and determines the exercise training intensity and duration, exercise facility, and level of supervision [9]. The five common components of CR—exercise training, lifestyle changes (diet and nutritional counselling, tobacco cessation), risk factor management (lipid and blood pressure control), heart health education, psychological support, and return to work—should be provided in more practical and affordable ways [10,11].

7. Exercise training program

Exercise training parameters should adhere to the FITT-VP principle, i.e., frequency, intensity, time, type, volume, and progression. Each exercise sessions should entail warm up, main phase, and a cool down component [3]. Patients are observed for 15 min at the end of the cool down. The type of exercise depends on the functional capacity of the patient and the equipment available. Exercise sessions should include aerobic, resistance, flexibility, and neuromotor components. Endurance aerobic exercise involving large muscle groups is the standard form of training, and walking program represents the most basic, and effective form of aerobic exercise, with an interval or a continuous approach applied. The ventilatory or lactate thresholds will determine the exercise intensity.

However, due to the limited availability of cardiopulmonary exercise testing, alternative methods can be applied, based on the rating of perceived exertion, or on the training heart rate [11]. A useful measure of exercise intensity in a low-resource

Table 3. Phases of cardiac rehabilitation.

Phase I	Phase II	phase III
In-patient during hospitalization for a cardiovascular event	Early outpatient or residential supervised structured program	Home or community-based maintenance phase
4–14 days	8–12 weeks	Delivered in ambulatory or community-settings and should be lifelong as part of healthy lifestyle intervention
As the patient's clinical status is stabilized or after an elective procedure	Should start as soon as possible, optimally within two weeks after discharge	
	24 CR and optimally 36 sessions	
At the coronary care unit, intensive care unit, postoperative ward, or cardiac rehabilitation ward	Can be offered to patients after discharge from hospital, can be delivered remotely as in patient, outpatient or home exercise program using data transmission technology (hybrid cardiac telerehabilitation).	Delivered in ambulatory, home or community-settings
Continued until the patient can be discharged from hospital	The form of structured, multidisciplinary program. Exercise Training depends on exercise capacity and the risk of complications.	
The main goal of phase I for the patient is to achieve independence, self-care and prevent complications of immobility.	Improve exercise tolerance, maintain treatment outcomes, and reduce the risk of disease recurrence.	Improve exercise tolerance, maintain treatment outcomes, and reduce the risk of disease recurrence.
ECG monitoring is recommended.	ECG monitoring for at least 6–12 sessions.	ECG monitoring in high-risk patients for at least 6–12 sessions

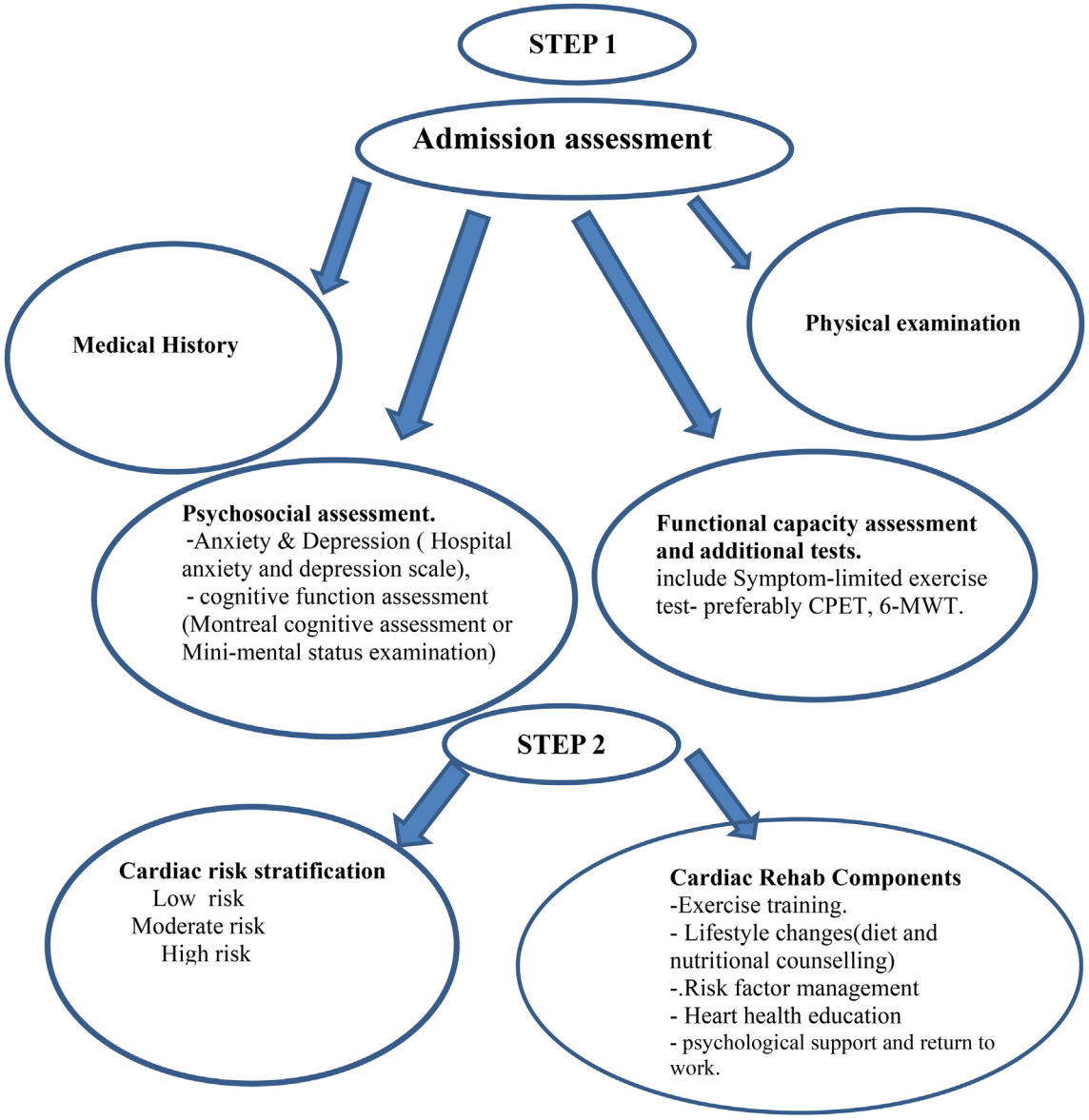

Fig. 1. Cardiac rehabilitation step-up approach.

environment is a rating of perceived exertion using the 20-point Borg scale, with exercise typically performed at an intensity of 11–14 on this scale [12]. The exercise training progression should be based on the individual's clinical response, and program goals. Resistance training is recommended after at least 1 week of supervised endurance training and can be performed with elastic bands, small weights, or using the patients' own body weight [13]. In addition to aerobic and resistance training flexibility and neuromotor exercises should be applied 2–3 times weekly [14,15].

8. Staffing

All CR team members should be competent in basic life support (BLS) and in using the automated external defibrillator (AED), and at least one team member involved in the direct supervision of exercise must be competent in advanced cardiac life support (ACLS) (Table 4).

9. Facility

All areas should provide temperature and humidity control. A source of water should be immediately

available in all exercise area. A regularly tested emergency call system should be available in all exercise areas. Participants with disabilities should have full access to all CR facilities (Table 5).

10. Equipment

CR equipment should optimally include equipment for a functional capacity assessment and provided with exercise equipment (Table 5). In a low-setting environment, equipment for exercise provision and monitoring may be a challenge; therefore, non-equipment exercise program (e.g., walking or cycling if the patient has their own bicycle) can be recommended as a minimal option [16].

Table 4. Staffing.

Staff	Role & Responsibilty
Cardiologist, Physiatrist	CR director, responsible for establishing all medical protocols, policies, and procedures, ensuring that CR program is safe and comprehensive. It should be a physician who is a board-certified cardiologist or physiatrist with a strong background in clinical cardiology, exercise testing and cardiac rehabilitation experience or education in the organization and administration of a CR program
Nurses	Advanced knowledge of exercise physiology, nutrition, and CVD risk factor management.
Physiotherapists and/or Exercise physiologist	Responsible for implementing the exercise component of the program and participating in the patient education program services
Psychologist	Responsible for developing strategies for stress management.
Dietitian	Provide and supervise nutritional counseling services to the patients

11. Safety of exercise program

Appropriately conducted exercise training is safe; the risk of major adverse events during exercise sessions is very low, with the reported occurrence of cardiac arrest, myocardial infarction, and fatal events 1 per 116,906, 1 per 219,970, and 1 per 752,365 patient-hours of training, respectively [17,18].

Pre-screening prior to each physical exercise session should include changes in symptoms, signs, and ECG. Medical supervision is suggested for the high-risk patients mentioned in Table 6 [19]. Patients at lower risk or who have completed supervised exercise sessions can exercise safely at home or in community settings. To monitor the exercise intensity, a "talk test" can be used when a heart rate measurement is not possible.

12. Psychoeducational program

Education related to physical activity, risk factor control, smoking cessation, and dietary counselling should be provided. Psychoeducational sessions should be held for patients and include dietary counselling and an introduction to the psychological and emotional aspects of recovery form a cardiac event [17]. The Hospital Anxiety and Depression Scale (HADS) should be administered on admission and after completion of CR program (HADS- Arabic version available) [20].

If more detail is required, then separate instruments for depression and anxiety may be considered. For example, depression can be measured with the Patient Health Questionnaire 9 (PHQ9) for detecting Major Depressive Disorder based on a structured clinical interview [21].

Anxiety could be measured with the Generalised Anxiety Disorder Instrument (GAD-7) and has been validated in cardiac populations [22].

The Quality of life (QoL) may be measured using the Short Form Health Survey (SF-12) or similar

Table 5. Facility & equipment.

Space for patient reception and waiting	
Consultation area	
Space for education	
Area for assessment of functional capacity (with treadmill and/or leg cycle ergometer for standard exercise testing and appropriate place for conduction 6-min walk test i.e., 20 m long hallway with markers in the corners) floor space required for aerobic exercise per individual of 3.0 −4.0 m2	Treadmill or/and supine leg cycle ergometer with software for continuous ECG monitoring cardiac monitoring clinical assessment equipment, chart of rate of rating of perceived exertion preferable cardiorespiratory exercise testing equipment, life support equipment, medical alert signals system
Gym/exercise area	Equipment for an aerobic and strength training hand weights, resistance bands, multi-weight machines, medical alert signals system
Documentation storage area	
Rest rooms with showering	
Minimal option	Non-equipment exercise program e.g. walking or cycling if the patient has own bicycle)

Table 6. Risk stratification by the American association of cardiovascular prevention and rehabilitation.

Parameter	Low risk	Moderate risk	High risk
Left ventricular ejection fraction	LVEF 50% or more	LVEF 35–49%	
Complex ventricular dysrhythmia	Absent at rest or during exercise testing and recovery		Present at rest or during exercise testing and recovery
Angina or other symptoms (unusual shortness of breath, lightheadedness or dizziness)	Absent during exercise testing and recovery	Present only at high level of exertion (7METS or more)	Present at low levels of exertion (<5 METS) or during recovery
Hemodynamics during exercise testing and recovery	Normal Hemodynamics		Abnormal hemodynamics during exercise testing (i.e chronotropic incompetence or flat or decreasing systolic BP with increasing workload) or during recovery (severe post-exercise hypotension)
Ischemic ECG changes	None	ST-segment depression <2 mm	ST-segment depression >2 mm
Functional capacity	7 METS or more 100 Wats or more	5–6.9 METS 75-100 Watts	<5 METS <75 Watts
Clinical data	Uncomplicated MI or revascularization procedure Absence of CHF Presence of signs or symptoms of post- event/post- procedure ischemia		History of cardiac arrest Complicated MI or revascularization procedure Presence of signs and symptoms of post-event/post −procedure ischemia Presence of CHF
Clinical depression	**Absent**		**Present**
	All characteristics Listed must be absent for patients to remain low risk.	Those who do not fit into any classification classified as moderate risk	One or more of these findings places the patient at high risk.

Table 7. FITT-VP aerobic training formula.

Training parameter	Description
Frequency (F)	Number of exercises or sessions during a day or week Recommendations: 4–7 days per week
Intensity (I)	Direct (METS, oxygen uptake, Watts), indirect (training heart rate, Borg scale)/ Recommendations: 40%–80% of maximal heart rate or oxygen uptake reserve or Borg scale 11–16, 10 beats per minute below event-heart rate (heart rate at start of angina or ECG ischemic changes)
Time (T)	Time of training or total time during a week Recommendations: 20–60 min per session
Type (T)	Exercise type Recommendations: Rhythmic, involving large muscle groups (biking, walking, swimming)
Volume (V)	Total energy expenditure in time V=F x I x T Recommendations: 500–1000 MET-min per week, 1500 kcal per week
Progression (P)	Load increase rate Recommendations: 5–10 min over 1–2 weeks

tools [23]. Both (Montreal cognitive assessment, or Mini-mental status examination–2 and Mini-cog) are valid and good screening tools for cognitive impairment in Arabic-speaking patients [24,25].

13. Physical activity recommendations

Aerobic capacity is a strong prognostic marker in healthy individuals. One metabolic equivalent of task (MET) in aerobic fitness corresponds with a 13% decrease in all-cause mortality and a 15% decrease in the incidence of cardiovascular events [26]. Long-term physical activity after completing a cardiac rehabilitation program is essential. Current guidelines on physical activity recommend that individuals with increased cardiovascular risk should perform at least 150 min of aerobic exercise at a moderate intensity or 75 min of high intensity exercise three to five days a week or a combination of moderate- and vigorous-intensity exercise, Table 7 [27]. The moderate-intensity activities (i.e., 3–5.9 MET) entail, e.g., brisk walking (5–6.5 km/h), or slow biking (15 km/h). Examples of vigorous activities (≥6 MET) include jogging, running, and bicycling (>15 km/h). In addition to an aerobic component, moderate-intensity resistance training involving large muscle groups is recommended twice a week, Table 8. Individuals who cannot perform 150 min of moderate-intensity physical activity each week should be as active as health condition allows. To maintain an adequate physical activity level, motivational interventions should be applied, e.g., self-monitoring utilizing wearable activity trackers [28].

14. Discharge and documentation

A discharge summary should include information regarding the patient's completed program, documented progress, goals achieved and planned. On discharge, the patients should be given both verbal and written advice regarding further goals. The referring cardiologist should be notified by a discharge summary of the patient's attendance on the CR program. Each patient attending the CR program should have a medical record with detailed information.

15. Outcome measurements

Evaluation of CR outcomes should include symptoms, changes in functional capacity, and cardiac function, risk factor control, quality of life, nutritional and psychosocial status. The quality of life may be assessed using the Short Form Health Survey (SF-12). The SF-12 includes one item that assesses self-rated health, which has been shown to predict survival. The instrument is regarded as a reliable and valid generic measure of health-related quality of life in cardiac populations [23].

Cardiac rehabilitation key performance indexes (KPI's) should include percent of eligible patients enrolled for phase II of cardiac rehabilitation, average waiting time from referral to start of the structured CR program, CR adherence, weight reduction in obese and overweight patients, improvement of functional capacity and quality of life [29].

Table 8. FITT-VP resistance training formula.

Training parameter	Description
Frequency (F)	Number of exercises or sessions during a day or week. Recommendations: 2-3 non-consecutive days per week
Intensity (I)	One-repetition maximum, Borg scale Recommendations: 40–70% of one repetition maximum, 8–15 repetitions for each major muscle group,1–3 sets, Borg scale 12–15
Time (T)	Time of training or total time during a week. Recommendations: No specific training duration has been identified for effectiveness
Type (T)	Exercise type Recommendations: Involving each major muscle groups
Volume (V)	Not specified
Progression (P)	Load increase rate Recommendations: Gradual progression of greater resistance and/or more repetitions per set

16. Telerehabilitation

CR provides a supervised rehabilitation program remotely through using advanced medical and telecommunication technology [2]. Phase II of telerehabilitation can be delivered at home following an exercise capacity assessment and a few supervised exercise training sessions at a cardiac rehabilitation facility. Home programs typically include up to 20 training sessions. The core components of an exercise session include permission for training based on a medical interview by phone, ECG recording, heart rate and body weight measurements, assessment for exercise contraindications, followed by exercise training guided by a telerehabilitation system with programmed recording and transmission of the electrocardiogram [30]. The type of home-based exercise training depends on the availability of exercise equipment, and if equipment is not available, walking is recommended[31].

17. Conclusion

CR is an important intervention which aim to improve CV outcome and can be implemented with minimal resources either at the hospital or in the community.

Authors' contribution

Conception and design of Study: AJK, JW, AS. Literature review: AJK, RA, JW, AS. Acquisition of data: AJK, RA, JW, AS, MAA. Analysis and interpretation of data: AJK, RA, JW, AS. Research investigation and analysis: AJK, RA, JW, AS. Data collection: AJK, RA, JW, AS, MAA. Drafting of manuscript: AJK, RA, JW, AS. Revising and editing the manuscript critically for important intellectual contents: AJK, RA, JW, AS. Data preparation and presentation: AJK, RA, JW, AS, MAA. Supervision of the research: AJK, JW, AS. Research coordination and management: AJK, JW, AS.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

None of the authors had conflict of interest.

Acknowledgments

We thank the Saudi Group of Cardiovascular Prevention and Rehabilitation (SGCVPR) board members: Dr Fakhr Alayoubi, Dr Gamal Hussein, Dr Rasha Albawardy, Dr Talal Alghamdi for their support of the work and endorsement of the task force recommendations.

The board of the SHA approved the final manuscript.

References

[1] Alhabib KF, Batais MA, Almigbal TH, Alshamiri MQ, Altaradi H, Rangarajan S, et al. Demographic, behavioral, and cardiovascular disease risk factors in the Saudi population: results from the Prospective Urban Rural Epidemiology study (PURE-Saudi). BMC Public Health 2020 Aug 8;20(1): 1213. https://doi.org/10.1186/s12889-020-09298.

[2] Turk-Adawi K, Sarrafzadegan N, Grace SL. Global availability of cardiac rehabilitation. Nat Rev Cardiol 2014;11(10): 586–96. https://doi.org/10.1038/nrcardio.2014.98.

[3] Ambrosetti M, Abreu A, Corrà U, Davos CH, Hansen D, Frederix I, et al. Secondary prevention through comprehensive cardiovascular rehabilitation: from knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. Eur J Prev Cardiol 2020 Apr 7:2047487320913379.

[4] Cowie A, Buckley J, Doherty P, Furze G, Hayward J, Hinton S, et al. British Association for Cardiovascular Prevention and Rehabilitation (BACPR). Standards and core components for cardiovascular disease prevention and rehabilitation. Heart 2019;105(7):510–5. https://doi.org/10.1136/heartjnl-2018-314206.

[5] American Association of Cardiovascular and Pulmonary Rehabilitation. Guidelines for cardiac rehabilitation and secondary prevention programs. 6th ed. Champaign, IL, USA: Human Kinetics Publishers; 2019.

[6] Gielen S, Laughlin MH, O'Conner C, Duncker DJ. Exercise training in patients with heart disease: review of beneficial effects and clinical recommendations. Prog Cardiovasc Dis 2015;57(4):347–55. https://doi.org/10.1016/j.pcad.2014.10.001.

[7] Jegier A, Szalewska D, Mawlichanów A, Bednarczyk T, Eysymontt Z, Gałaszek M, et al. Comprehensive cardiac rehabilitation as the keystone in the secondary prevention of cardiovascular disease. Kardiol Pol 2021;79:901–16. https://doi.org/10.33963/KP.a2021.0066.

[8] Abreu A, Schmid JP, Piepoli MF. The ESC handbook of cardiovascular rehabilitation. Oxford, UK: Oxford University Press; 2020.

[9] Sandercock G, Hurtado V, Cardoso F. Changes in cardiorespiratory fitness in cardiac rehabilitation patients: a meta-analysis. Int J Cardiol 2013;167:894–902. https://doi.org/10.1016/j.ijcard.2011.11.068.

[10] American College of Sports Medicine. ACSM's guidelines for exercise testing and prescription. 11th ed. Philadelphia, PA, USA: Wolters Kluwer, Lippincott Williams & Wilkins; 2021.

[11] Ambrosetti M, Abreu A, Corrà U, Davos CH, Hansen D, Frederix I, et al. Secondary prevention through comprehensive cardiovascular rehabilitation: from knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. Eur J Prev Cardiol 2020. https://doi.org/10.1177/2047487320913379. Epub ahead of print]: 2047487320913379.

[12] Borg G. Borg's perceived exertion and pain scales. Champaign: Illinois Human Kinetics; 1998.

[13] Williams MA, Haskell WL, Ades PA, Amsterdam EA, Bittner V, Franklin BA, et al. American heart association council on clinical cardiology; American heart association council on nutrition, physical activity, and metabolism. Resistance exercise in individuals with and without cardiovascular disease: 2007 update: a scientific statement from the

American heart association council on clinical cardiology and council on nutrition, physical activity, and metabolism. Circulation 2007;116:572–84. https://doi.org/10.1161/CIRCULATIONAHA.107.185214.

[14] McHugh MP, Cosgrave CH. To stretch or not to stretch: the role of stretching in injury prevention and performance. Scand J Med Sci Sports 2010;20:169–81. https://doi.org/10.1111/j.1600-0838.2009.01058.x.

[15] Lesinski M, Hortobágyi T, Muehlbauer T, Gollhofer A, Granacher U. Effects of balance training on balance performance in healthy older adults: a systematic review and meta-analysis [published correction appears in sports med. 2016 Mar; 46, 457]. Sports Med 2015;45:1721–38. https://doi.org/10.1007/s40279-015-0375-y. Erratum in: Sports Med. 2016;46(3):457.

[16] Grace SL, Turk-Adawi KI, Contractor A, Atrey A, Campbell N, Derman W, et al. Cardiac rehabilitation delivery model for low-resource settings. Heart 2016 Sep 15;102(18):1449–55. https://doi.org/10.1136/heartjnl-2015-309209.

[17] Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano A, et al. European guidelines on cardiovascular disease prevention in clinical practice: the sixth joint task force of the European society of cardiology and other societies on cardiovascular disease prevention in clinical practice (constituted by representatives of 10 societies and by invited experts) developed with the special contribution of the European association for cardiovascular prevention & rehabilitation (EACPR). Eur Heart J 2016;37:2315–81. https://doi.org/10.1093/eurheartj/ehw106. Epub 2016 May 23.

[18] Van Camp SP, Peterson RA. Cardiovascular complications of outpatient cardiac rehabilitation programs. JAMA 1986;256: 1160–3.

[19] Abreu A, Mendes M, Dores H, Silveira C, Fontes P, Teixeira M, et al. Mandatory criteria for cardiac rehabilitation. Rev Port Cardiol 2018;37:36373. https://doi.org/10.1016/j.repc.2018.02.006.

[20] Terkawi AS, Tsang S, AlKahtani GJ, Al-Mousa SH, Al Musaed S, AlZoraigi US, et al. Development and validation of Arabic version of the hospital anxiety and depression scale. Saudi J Anaesth 2017 May;11(Suppl 1):S11–8. https://doi.org/10.4103/sja.SJA_43_17. PMID: 28616000; PMCID: PMC5463562.

[21] Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 2001; 16(9):606–13.

[22] Conway A, Sheridan J, Maddicks-Law J, Fulbrook P, Ski CF, Thompson DR, et al. Accuracy of anxiety and depression screening tools in heart transplant recipients. Appl Nurs Res 2016;32:177–81. https://doi.org/10.1016/j.apnr.2016.07.015.

[23] Le Grande M, Bunker S, Tucker G, Jackson AC. Validating the SF-12 and the development of disease specific norms in a cohort of Australian private health insurance members. Aust Jnl of Primary Health 2019. https://doi.org/10.1071/PY18069.

[24] Rahman Tomader Taha Abdel, Mohamed El Gaafary Maha. Montreal Cognitive Assessment Arabic version: reliability and validity prevalence of mild cognitive impairment among elderly attending geriatric clubs in Cairo. Geriatr Gerontol Int 2009;9(1):54–61.

[25] Albanna M, Yehya A, Khairi A, Dafeeah E, Elhadi A, Rezgui L, et al. Validation and cultural adaptation of the Arabic versions of the Mini–Mental status examination–2 and Mini-cog test. Neuropsychiatric Disease and Treatment; 2017. p. 793–801 [].

[26] Fletcher GF, Landolfo C, Niebauer J, Ozemek C, Arena R, Lavie CJ. Promoting physical activity and exercise: JACC health promotion series. J Am Coll Cardiol 2018 Oct 2;72(14):1622–39. https://doi.org/10.1016/j.jacc.2018.08.2141.

[27] Howlett N, Trivedi D, Troop NA, Chater AM. Are physical activity interventions for healthy inactive adults effective in promoting behavior change and maintenance, and which behavior change techniques are effective? A systematic review and meta-analysis. Transl. Behav. Med. 2019;9:147–57. https://doi.org/10.1093/tbm/iby010.

[28] Thomas RJ, Balady G, Banka G, Beckie TM, Chiu J, Gokak S, et al. ACC/AHA clinical performance and quality measures for cardiac rehabilitation: a report of the American college of cardiology/American heart association task force on performance measures. Circ Cardiovasc Qual Outcomes 2018 Apr; 11(4):e000037. https://doi.org/10.1161/HCQ.0000000000000037.

[29] Kodama S, Saito K, Tanaka S, Maki M, Yachi Y, Asumi M, et al. Cardiorespiratory fitness as a quantitative predictor of all-cause mortality and cardiovascular events in healthy men and women: a meta-analysis. JAMA 2009 May 20;301(19): 2024–35. https://doi.org/10.1001/jama.2009.681.

[30] Brouwers RWM, van Exel HJ, van Hal JMC, Jorstad HT, de Kluiver EP, Kraaijenhagen RA, et al. Cardiac telerehabilitation as an alternative to centre-based cardiac rehabilitation. Neth Heart J 2020;28:443–51. https://doi.org/10.1007/s12471-020-01432-y.

[31] Batalik L, Filakova K, Batalikova K, Dosbaba F. Remotely monitored telerehabilitation for cardiac patients: a review of the current situation. World J. Clin. Cases 2020;8:1818–31. https://doi.org/10.12998/wjcc.v8.i10.1818.