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Prevention (K Aragam, Section Editor)

Cardiac Rehabilitation for Secondary Prevention of Cardiovascular Disease: 2019 Update

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Abstract

Purpose of review To provide updated information on the science and practice of cardiac rehabilitation (CR).
Recent findings Evidence continues to mount that supports the many benefits of CR as well as the important gap in delivering CR to all eligible patients. Recent studies have identified center-based and home-based strategies to improve the reach and impact of CR.
Summary Cardiac rehabilitation is a systematic, evidence-based approach to deliver effective secondary CVD preventive therapies to individuals with cardiovascular conditions. Because of a number of benefits that have been associated with CR, clinical practice guidelines strongly endorse CR services for eligible patients. Research supports CR as a high value service, with evidence of favorable clinical outcomes and costs. Unfortunately, a significant gap exists in CR participation due to a number of patient-, provider-, and system-level barriers. Solutions to most of these barriers have been identified and involve systematic approaches to CR delivery. The future is bright for CR as new strategies, new policies, and new methods of delivery continue to develop to help provide CR services to all eligible patients.

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Introduction

Cardiac rehabilitation (CR) is a systematic, evidence-based, multidisciplinary approach to delivering secondary cardiovascular (CVD) prevention therapies of known efficacy. Initial development of CR in the 1950s and 1960s was focused on providing low intensity physical activity and physical therapy to help patients recover during and after prolonged admission to hospital (and prolonged bedrest) after myocardial infarction (MI) or coronary artery bypass graft surgery (CABG) [1]. With advances in secondary prevention therapies, and with reductions in hospital stays for most patients after a cardiovascular event, CR has evolved and expanded over the past several decades to be focused on early outpatient delivery of secondary prevention therapies, including the multifaceted key components of outpatient CR, including patient assessments, CVD risk factor management, exercise training, nutrition and physical activity counseling, optimization of psychosocial health, medication adjustments/adherence, weight management, and screening/management of comorbid conditions (see Fig. 1) [2].

A robust and expanding evidence base has identified a number of benefits from CR for participating patients, including reduced hospital readmission rates [3], reduced CVD events [4, 5], reduced mortality rates [5–9], and improvements in functional capacity [10], CVD risk factor control [11], psychosocial health [12, 13], and medication adherence [14]. A limited number of studies have reported favorable cost-benefit and financial impact of CR [15, 16].

Because of the numerous benefits of CR, clinical practice guidelines strongly recommend CR for patients with one or more the following diagnoses/conditions: myocardial infarction (MI), percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG) surgery, and heart failure with reduced ejection fraction (HFrEF) [17–21].

Gaps in cardiac rehabilitation delivery

Despite the significant benefits associated with CR participation, only about 20–30% of patients who are eligible for CR are actually referred to and enroll in CR [22]. While referral rates may be improving over the past decade [23], a recent study suggests that participation rates among Medicare patients continues to be low in recent years [24•]. In addition, of those who enroll in CR, less than 50% of patients complete a full course of therapy (typically 36 sessions over a 12 week period) [25]. A number of patient-, provider-, and health system-level barriers to CR referral, enrollment, and completion have been identified, including time, geographic, and resource barriers, as well as lack of insurance coverage and adequate clinical systems for referral to and enrollment in CR [26]. The Million Hearts Cardiac Rehabilitation Collaborative has published a roadmap to help move CR participation from 20 to 70% [27••], and has made available a "Cardiac Rehabilitation Change Package" (https://millionhearts.hhs.gov/tools-protocols/action-guides/cardiac-change-package/index.html, accessed February 11, 2019) that includes system-based tools to help health systems, providers, and patients overcome barriers to CR participation. The Agency for Healthcare Research and Quality is currently funding an implementation project to test the feasibility and impact of system-based strategies from the Cardiac Rehabilitation Change Package on CR participation in hospitals throughout the USA. Such systematic strategies have been shown to improve referral, enrollment, and participation in CR, including such strategies as an automatic inpatient CR referral system for all eligible patients, early

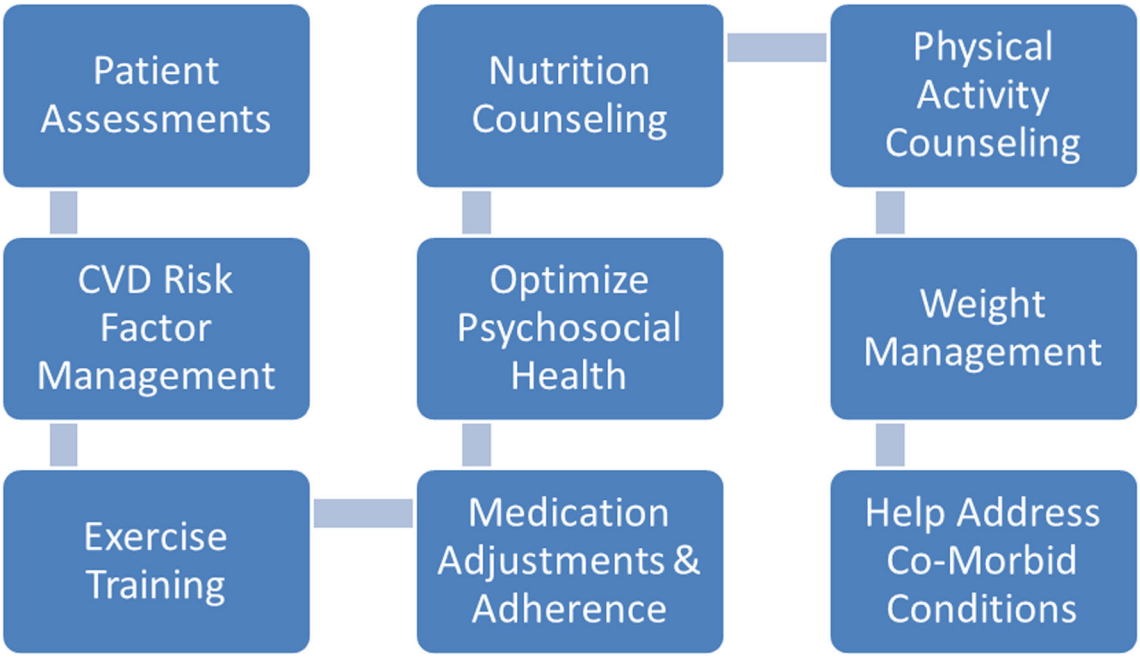

Fig. 1. Components of cardiac rehabilitation.

CR enrollment soon after hospital discharge, individualized communications and reminders, and participation incentives (see Table 1).

Recent directions in cardiac rehabilitation

Research studies

Recent research studies in CR have focused on 3 main areas: (1) impact of CR on patient outcomes, (2) new methods for CR interventions, and (3) new models for delivering CR services. Given the known benefits of CR, new research studies

Table 1. System-based steps to overcome patient-, provider-, and system-oriented barriers to CR referral, enrollment, and participation

Steps to improve referral of patients to cardiac rehabilitation	Steps to improve enrollment of patients in cardiac rehabilitation	Steps to improve adherence of patients to cardiac rehabilitation sessions
Automatic Referral System	CR Staff liaison/navigator	Set "full dose" of 36 sessions as a goal for all CR patients
CR staff liaison/navigator to assist patient enrollment in CR	Early enrollment in CR	Flexible CR center hours
CR referral as a performance measure	CR enrollment as a CR performance measure	Minimize out-of-pocket expenses for CR patients
	Minimize out-of-pocket expenses for patients	Develop home-based and other alternative CR options

aimed at comparing a "CR" intervention group to a "No CR" control group would be considered to be unethical. Therefore, many outcomes studies in CR have relied largely on analyses of observational datasets [6, 8, 9, 28]. However, some recent research studies have been randomized studies of various CR interventions and/or CR delivery methods [10, 29]. Such studies are likely to be more and more common in the future.

Several observational studies have reported favorable association between CR participation and important patient outcomes. Suaya and colleagues showed significantly lower mortality rates among Medicare CR participants as compared to non-participants, a finding that held true for all age, gender, and racial/ethnic groups [9]. Other community-based studies have found that CR participation is associated with lower mortality rates after MI [3, 30], PCI [6], CABG surgery [8], and CABG-Valve surgery [7]. Community-based studies have also found that CR participation is associated with lower hospital re-admission rates [3] and with higher medication adherence [14]. One study from Canada found that patient care costs were significantly lower among CR participants than among those patients who did not participate in CR [16].

One recent randomized controlled trial from the UK compared outcomes in patients from hospitals that were willing to randomize their patients to a "CR intervention" or "no CR intervention" [31]. It found no impact of CR participation on mortality, but the study has been criticized for a number of shortcomings [32, 33]. The study may have suffered from "spill over" of the intervention into the control group, or may have simply lacked an effective CR intervention, suggested by the fact there were no significant differences in functional capacity between the intervention and control groups at the end of the study, a problem that has been noted previously in CR programs in the UK [34]. Previous randomized controlled trials of traditional, effective CR models have been found to have significant impact on mortality rates, recurrent cardiovascular event rates, functional capacity, and psychosocial health [5]. While a few studies have assessed the "dose" of CR sessions on outcomes [9], future outcome studies that assess the impact of CR on mortality and morbidity outcomes will need greater clarity as to the "dose" and "quality" of CR delivered (frequency, duration, and intensity of exercise training, nutritional therapy, counseling sessions, etc.), factors that have generally been underreported in previous studies [35].

Recent studies have compared traditional exercise training strategies (i.e., continuous intensity training) with other strategies, such as high intensity interval training, or HIIT [36]. In HIIT, patients exercise with high intensity bursts of exercise lasting 30–120 s, alternating with lower intensity cool-down periods. Outcomes for HIIT are comparable or better than for continuous intensity training, and safety appears to be similar, even in patients with heart failure [37].

Other studies have explored the impact of alternative training methods, such as Tai Chi and yoga, suggesting that alternative modalities may be reasonable adjuncts to traditional forms of cardiovascular exercise training (e.g., walking, jogging, biking) [38–40]. However, these studies are generally small in scale, short in duration, and lacking in morbidity and mortality outcomes, compared with studies involving more traditional forms of exercise training.

New models of CR delivery have been tested in the USA and around the world, including home-based approaches that utilize smartphone and other technology tools. One study by Varnfield and colleagues in Australia looked at

the impact of a smartphone based CR program on patient outcomes, compared with a traditional center-based CR comparison group. Intervention patients received intervention communications and educational offerings on a regular basis from CR professionals via smartphone communications, and exercised at home or in a local community health center. The study's investigators found that patients in both groups had similar improvements in functional capacity, risk factor control, and psychological health [29]. A recent AACVPR/ACC/AHA scientific statement on home-based CR highlights the evidence base for using home-based CR as an adjunct to or alternative to center-based CR [41]. The statement underscores the need for additional studies on the safety and outcomes of home-based CR, but at the same time helps to identify standards, models, and components that can be considered for home-based CR, at least in lower-risk individuals who do not have center-based CR available to them. As wearable technologies and new communications strategies evolve, CR services will most certainly expand to include tools and strategies that will help oversee a patient's recovery and prevention efforts 24 h a day, 7 days a week [42, 43••].

As more and more supportive CR outcome studies have been published in recent years, policy changes have consequently occurred that are supportive of CR services, including the expansion of covered diagnoses to include HFrEF and PAD patients in supervised CR/exercise programs. These groups, when added to the previously covered diagnoses (MI, PCI, CABG, Valve, Transplant, stable angina), bring to 8 the total number of diagnoses that Medicare and other insurance carriers cover for CR and/or supervised exercise training. Legislation has been passed recently that will go into effect in January 2024 that will allow non-physician providers (i.e., nurse practitioners, physician assistants, and clinical nurse specialists) to provide the supervision that is required by Medicare during center-based CR sessions. The growing trend toward shared risk models of healthcare funding (such as bundled payment models) that is tied to high quality care, will highlight the importance of CR for eligible patients, since CR is considered a high value service (i.e., strong evidence for improving healthcare quality and outcomes, with a favorable impact on patient care costs). Delivery models that include incentives, either monetary or non-monetary, appear to be promising ways to promote CR and other preventive therapies, although ethical concerns exist for such strategies [44–46].

Research, practice, and policy changes will continue to emerge that will be geared toward closing the CR participation gap. While the future looks bright in this regard, only time will tell if these efforts are successful.

Compliance with Ethical Standards

Conflict of Interest
The authors declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent
This article does not contain any studies with human or animal subjects performed by any of the authors.

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- •• Of major importance

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