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## Quo vadis cardiac rehabilitation; the role of comprehensive cardiac rehabilitation in modern cardiology

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### Abstract

In accordance with the guidelines established by prominent European and global cardiology associations, comprehensive cardiac rehabilitation (CR) stands as an officially endorsed and highly recommended therapeutic approach (class I recommendations; level of evidence A) for a diverse spectrum of cardiac patients. Nevertheless, it is a cause for concern to observe that fewer than 50% of eligible patients are being effectively referred for CR, whether in an outpatient or inpatient setting. Concurrently, studies reveal that a substantial proportion of individuals with atherosclerotic cardiovascular disease maintain unhealthy lifestyles and exhibit suboptimal management of modifiable cardiovascular risk factors, including hypertension, lipid levels, and diabetes. Beyond the conventional patient profile encompassing those recovering from acute coronary syndrome with or without percutaneous coronary intervention, as well as patients who have undergone coronary or valvular surgery, contemporary CR now emphasizes specialized subgroups of patients. These include frail elderly patients, the female population with its unique considerations, individuals burdened by multiple cardiovascular comorbidities, those who have developed psychological consequences due to a cardiac illness and particularly those grappling with chronic heart failure. This editorial seeks to offer a state-of-the-art assessment of the significance and role of comprehensive CR within modern cardiology.

**Key Words:** Cardiac rehabilitation; Chronic heart failure; Treatment of heart failure; Cardiovascular disease; Psychological disorders; Posttraumatic stress disorder

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**Core Tip:** Comprehensive cardiac rehabilitation (CR) is an established and endorsed therapeutic approach for a broad spectrum of cardiac patients. Nevertheless, it is concerning that fewer than 50% of eligible patients are being effectively referred for CR, whether in an outpatient or inpatient setting. This editorial aims to offer a contemporary perspective on the significance and role of comprehensive CR in modern cardiology.

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## INTRODUCTION

Cardiac rehabilitation (CR) programs involve a comprehensive medical evaluation and optimization of the health status of diverse patient groups, including those recovering from acute coronary syndrome (ACS) with or without percutaneous coronary intervention (PCI), surgical myocardial revascularization coronary artery bypass grafting (CABG), valvular surgery, various endovascular procedures transcatheter aortic valve implantation, endovascular aneurysm repair (EVAR), thoracic EVAR, *etc.*, surgical management of congenital heart defects, peripheral arterial disease, and heart transplantation, among others[1].

## CONTENT AND POSITIVE EFFECTS OF CR

CR programs stand as the most cost-effective intervention to ensure favorable outcomes across a broad spectrum of cardiovascular conditions[2]. These programs encompass physical training and counseling on future physical activity, the identification, assessment, and mitigation of various cardiovascular risk factors, optimization of medication regimens, psychosocial support, education on nutrition, weight management, the sustained benefits of regular exercise, its purpose, potential side effects, and the promotion of medication adherence. The overarching, long-term objectives of the CR program are to promote consistent unsupervised exercise, the adoption of a “healthy lifestyle”, the reintegration of employed individuals into the workforce, and the enduring reduction of major adverse cardiac events (MACEs) as well as the deceleration of the cardiovascular continuum. Some of the well-documented short-term effects of CR encompass enhancements in lipid profiles, reductions in blood pressure, the management of type 2 diabetes, decreases in inflammation high-sensitivity C-reactive protein (hsCRP), heart rate normalization, improvements in ejection fraction, mitigation of adverse left ventricular remodeling, and the alleviation of emotional stress and depression, among others[2-4].

## SAFETY OF THE CR

The safety of the CR program has remained unquestionably solid. For instance, data from the French registry of complications during CR reveal an exceptionally low incidence of expected adverse events or complications, such as 1 MACE occurring in more than 8000 stress tests, 1 MACE in every 50000 h of patient exercise, and 1.3 cardiac arrests per million hours of exercise[5].

## INCONSISTENCY OF RECOMMENDATIONS VS CLINICAL PRACTICE RELATED TO CR

Considering all the information presented, the European Society of Cardiology and other prominent global cardiology associations have officially acknowledged CR as a highly effective and essential component in the comprehensive treatment of all categories of cardiology patients. They have included CR in their guidelines, assigning it class I recommendations and a level of evidence A[2,4,6,7]. Despite this, it remains a matter of concern that less than half of eligible patients are actually referred for CR, whether in an outpatient or inpatient setting [2,3,7,8].

On the other hand, findings from extensive studies like Euroaspire indicate that a substantial portion of patients with established atherosclerotic cardiovascular disease (CVD) continue to maintain unhealthy lifestyles and struggle with inadequate control of modifiable cardiovascular risk factors, including elevated blood pressure, unfavorable lipid profiles, and diabetes. For instance, 55% of these patients were persistent smokers, 38% were categorized as obese (with a body mass index of  $\geq 30$  kg/m<sup>2</sup>), 66% engaged in physical activity for less than 30 min five times a week, 42% had blood pressure equal to or exceeding 140/90 mmHg, and 71% exhibited low-density lipoprotein cholesterol levels of 1.8 mmol/L or higher. The authors rightly emphasize that “cardiovascular prevention requires modern preventive cardiology programs delivered by interdisciplinary teams of healthcare professionals addressing all aspects of lifestyle and risk factor management, in order to reduce the risk of recurrent cardiovascular events”[9].

## CENTER-BASED VS HOME-BASED CR

According to the new systematic review[10], home-based CR (HBCR) could offer a secure and practical alternative to traditional center-based CR (CBCR). Research suggests that the HBCR model may serve as an equitable intervention approach for stable patients with CVD across all risk levels for exercise-related cardiovascular complications, particularly for those who are unable to access CBCR services. Moreover, the integration of artificial intelligence, with its robust data mining and interpretation capabilities, holds substantial future promise for HBCR. Tailored HBCR programs can be implemented by harnessing artificial intelligence through wearable monitoring and personalized coaching[10].

## HYBRID CR

In the current medical setting, the duration of hospital stays for patients with conditions like ACS or acute HF has notably shortened, often leaving insufficient time for comprehensive patient education regarding their medical condition. Hence, CR programs, whether in outpatient, inpatient, or hybrid formats, have become essential and ideal for ensuring the complete and long-term effectiveness of interventional, surgical, or medical treatments[11]. Particularly during the challenging period of the coronavirus disease 2019 pandemic[12], hybrid CR has gained prominence, proving to be a safe and efficient alternative to traditional rehabilitation care, offering numerous benefits for CVD patients[13,14]. Research have demonstrated the safety and effectiveness of hybrid CR exercise programs, which not only reduce the cost of delivery but also enhance patient participation[15,16]. In the latest review[16], it was revealed that hybrid CR provided similar short-term outcomes to traditional CR for patients with coronary artery disease. A recent systematic review[17] demonstrated that telerehabilitation, centered on exercise, is equally cost-effective when compared to traditional CBCR interventions. European Association of Preventive Cardiology strongly encourages the development and seamless integration of alternative digital modalities, like telerehabilitation, to offer comprehensive CR in a more refined and effective manner[12].

## PATIENTS OUTCOMES AFTER CR

In a meta-analysis comprising 85 randomized controlled trials involving 23430 individuals with coronary heart disease, exercise-based CR demonstrated improved outcomes across short-term (6 to 12 mo), medium-term (> 12 to 36 mo), and long-term (> 3 years) follow-up periods. Short-term effects included reductions in myocardial infarction rates and all-cause hospitalizations, while medium and long-term effects were associated with decreased cardiovascular mortality[18]. Additionally, a recent study by Bauer *et al*[19] has affirmed that CR leads to a reduction in 2-year mortality following CABG.

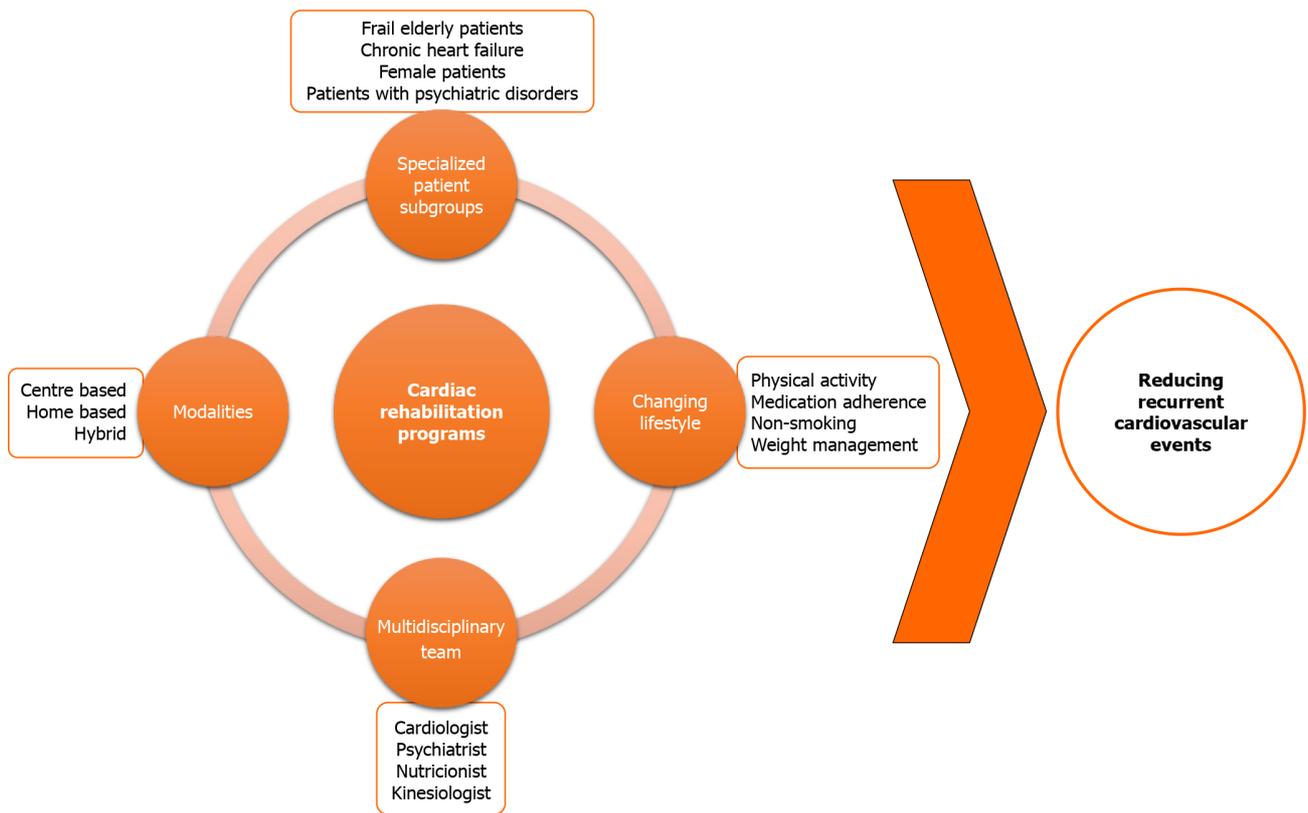
## SPECIALIZED PATIENT SUBGROUPS

In addition to the conventional patient profile (comprising individuals post-ACS with or without PCI, coronary or valvular surgery), contemporary CR now places emphasis on specialized patient subgroups. These include frail elderly patients[20], the female population, with consideration for its unique characteristics (as women are less frequently referred to CR!)[21], individuals with multiple cardiovascular comorbidities, those who have undergone transcatheter implantation or valve repair, and particularly patients with chronic heart failure (HF) (CHF)[7,22,23].

Results from global survey on barriers to CR based on gender indicate that barriers to CR differ significantly between men and women across various regions, underscoring the need for region-specific, customized approaches to overcome these challenges[24]. For women, the primary barriers to enrollment encompass a lack of awareness, cost considerations, and concerns about experiencing fatigue or pain during exercise. When it comes to program adherence, women's main difficulties involve distance, transportation, and family responsibilities. Notably, non-working women experience more pronounced CR challenges. While personalized strategies aimed at addressing these challenges were highly beneficial to patients, there is a need for the implementation of automatic referral and the provision of a choice of reimbursed CR models with elements tailored to women to effectively address the primary barriers identified[24].

## PATIENTS WITH CHF AND CR

Patients with CHF exhibit a significant degree of heterogeneity, forming an increasingly diverse population with a wide array of characteristics, including comorbidities, symptoms, clinical stability or instability, with preserved or varying degrees of reduced ejection fraction of the left ventricle. In patients with compensated HF with reduced ejection fraction, regular exercise has been shown to reduce both total hospitalizations and those related to HF, enhance exercise tolerance, and improve overall quality of life, including a reduction in depressive symptoms[7,22]. Taylor *et al*[7] aptly underscores in their recent publication that CR should be regarded as an essential, the fifth pillar in the treatment of HF patients, alongside pharmacological interventions such as beta-blockers, angiotensin-converting enzyme inhibitors, angiotensin



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Figure 1 Comprehensive cardiac rehabilitation in modern cardiology.

receptor-neprilysin inhibitors, sodium-glucose co-transporter 2 inhibitors, and medical devices.

## ADDITIONAL ADVANTAGES OF THE CR PROGRAMS

An emerging concern in recent years has been the early recognition and intervention in a wide spectrum of psychological disorders following ACS or cardiac surgery, potentially leading to post-traumatic stress disorder. These patients often go unnoticed and are known to experience a lower quality of life, an increased incidence of MACEs, and an overall poorer prognosis compared to those without such disorders[11]. Comprehensive CR, with individualized patient assessments, provides an opportune moment for recognizing and treating these psychological disorders. A multidisciplinary team approach, which actively involves psychologists and psychiatrists, is essential for comprehensive management[11,25].

## CONCLUSION

Taking all the above into account, it is evident that CR programs are effective, safe, cost-effective for society, and an indispensable component of the treatment for a broad spectrum of cardiac patients. Instead of providing a traditional conclusion, we would like to conclude this editorial with a message we consistently impart to our patients: “CR cannot change a patient’s past, but it unquestionably holds the potential to enhance the future of the patient’s heart, with a high-quality life without MACEs” (Figure 1).

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