Cardiac rehabilitation: why is it an underused therapy?

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This editorial refers to ‘Cardiac rehabilitation and survival in a large representative community cohort of Dutch patients’†, by H. de Vries et al. on page 1519.

During the last decades, cardiac rehabilitation (CR) has evolved from a simple patient monitoring system for the safe return to normal physical activities to a multidisciplinary approach that focuses on patient education, individually tailored exercise training, modification of the risk factors, and the overall well-being of cardiac patients. The benefits of CR include reduction in mortality, symptom relief, smoking cessation, improved physical fitness, risk factor modification, and improved overall psychosocial well-being. Unfortunately, CR still remains underutilized among patients with cardiovascular diseases mainly because of referral problems, poor enrolment and support, and various local reasons due to limited resources.

A problem that healthcare systems are facing in all developed countries is the increase of the ageing population with various cardiovascular diseases and frailty. Coronary heart disease (CHD) is the most common type of heart disease, and it manifests as chest pain and myocardial infarction. Patients with cardiovascular diseases are a great challenge for secondary prevention measures, and recent research developments in CR have demonstrated that tremendous benefits can be derived from the optimal use of CR in patients recovering from an acute CHD event or heart failure (HF), as well as after cardiac surgery. A crucial point is to consider CR not as exercise training only, but also as a programme based on the individual’s requirements, aiming at the improvement of the quantity and quality of life by means of: reduction of the risk factors, such as smoking and cholesterol levels, modification of dietary habits, increase and maintenance of exercise training and its intensity, psychological support, and guidance on returning to work. The scope of contemporary CR could be shifted from exercise interventions to more comprehensive secondary prevention programmes (Table 1). Multidisciplinary CR programmes should normally be started as soon as possible after a recent cardiac event during the hospitalization phase, continuing as a long-term treatment option with all necessary drugs and interventions.

Despite its proven benefits, CR referral and participation rates have been very low compared with other evidence-based treatments. Earlier studies from multiple countries reported an average referral rate of ~30% in Canada, the USA, and the UK, and a little higher at ~50% in the rest of Europe. Differences in healthcare policies and delivery systems between countries and across hospitals may explain, at least in part, this variability. There are still differences in referral rates between European countries, and the exact reasons for underuse of CR in different EU countries and hospitals are not widely known. Although many patients do not receive CR currently, new home-based and individualized CR programmes have been increasingly introduced to widen access and participation in device-guided rehabilitation. In addition to recruitment problems, maintaining long-term adherence to CR is a key challenge, and therefore, interventions aimed at improving patient uptake and long-term adherence to CR programmes should be monitored and assessed. Indeed, exercise-based lifestyle modifications should be part of normal daily life.

There are very few papers on comprehensive CR across the entire spectrum of indications for CR using a nationwide database. de Vries et al. have now assessed the effects of CR on survival in a large population of patients with an acute coronary syndrome (ACS) and patients that underwent coronary revascularization and/or heart valve surgery. Their new findings showed that receiving multidisciplinary CR in The Netherlands was associated with a substantial survival benefit in the first 4 years following an ACS or cardiac intervention. The survival benefit associated with CR was present regardless of age, type of diagnosis, type of intervention, and follow-up duration. In females, CR uptake was associated with a significant survival benefit at 2 years of follow-up only.

Patients included in CR programmes in The Netherlands are offered a comprehensive multidisciplinary rehabilitation with a typical duration of 6–12 weeks, consisting of one or more group-based therapies (education, exercise training, relaxation therapy, and lifestyle modification therapy) supplemented by individual counselling when indicated (e.g. by a psychologist, dietitian, or social worker). Reimbursement for outpatient CR after an ACS or cardiac intervention was provided by insurance companies on the condition that a patient is referred by a...
cardiologist. In general, 85% of the patients receive exercise training, 75% receive education, 39% receive relaxation therapy, and 17% receive lifestyle modification therapy. Although the amount, intensity, and duration of exercise training may have varied, exercise training consists of aerobic and strength training in the vast majority of the centres, with a mean frequency of 2.3 times per week and a session duration of 30 min, in post-ACS patients based on data from the Dutch CR centres. The mean intensity of aerobic training was \( \sim 65\% \) of maximal heart rate.

This recent study could not control for confounders not observable in the study data, including some cardiovascular risk factors. This may cause bias while estimating the value of CR on survival using a Cox proportional hazards model and propensity score matching, despite the fact that matching attempts to mimic randomization by creating a sample of units that received the treatment that is comparable on all observed covariates with a sample of units that did not receive the treatment. However, the propensity score matching only accounts for observed covariates.

From the interesting methodological point of view, the authors also used the lasso method in their further analyses which included many other previously collected variables that were selected by the automated method. The lasso method can be understood as a regression model, in which the sum of the absolute values of the regression coefficients is less than a constant. Its aim is similar to traditional automated variable selection methods, such as subset selection (e.g. forward stepwise), but improves on these methods by yielding more stable models, and greater predictive accuracy. The constraint on the absolute values of the regression coefficients is a tuning factor, which regulates the amount of shrinkage, with lower values leading to more parsimonious models, i.e. models in which many coefficients are zero. As in all observation studies, changes in cardiovascular medication or common lifestyle factors might have occurred after the study baseline as well as during the CR programme, possibly confounding the effect estimate of CR.

Although cardiorespiratory fitness (CRF) is recognized as an important marker of both functional ability and cardiovascular health, it is currently the major risk factor that is not routinely and regularly assessed in the clinical setting. The value of environmental modulators including improvement in CRF level would be important in the all stages of cardiovascular diseases. Additionally, over the past decades, a considerable amount of data has been published demonstrating the importance of CRF in predicting risk for adverse health outcomes. We have also shown that CRF, assessed directly from respiratory gases, is a strong predictor of major cardiovascular outcomes.

Among patients with suspected or diagnosed cardiac disease, the exercise test is a useful tool to evaluate patient CRF capacity and exertional symptoms using objective measures. This test can offer numerous physiological parameters including ventilatory, haemodynamic, and metabolic responses to exercise, which may reflect on underlying mechanisms of exertional dyspnoea, angina pectoris, and fatigue in patients with cardiovascular disorders. However, the implementation of multidisciplinary CR should not be restricted due to the limited availability of clinical exercise testing with ECG monitoring because a progressive CR rehabilitation programme can usually be started without the information that can be achieved only from exercise testing.

The importance of comprehensive CR should be strengthened in the future, because of the continuous changes in the population, the increasingly favourable effects obtainable by strict secondary prevention follow-up, and the increasing demand for a better quality of life in modern society. CR should be easily attainable in most cases. In order to monitor the indications for CR, to assess and compare the populations chosen and the methods used, to follow the type and quality of care, the use of resources, and the clinical outcome, the implementation of multinational databases seems a desirable tool, in addition to planning larger controlled clinical trials based on more effective CR interventions including even higher intensity physical exercise and strength training.

The development of alternative approaches and the use of mobile phone applications and other means of monitoring and surveillance will help expand the utilization of CR. Finally, the benefits of CR should be tested in the era of modern and contemporary medical therapy for CHD and HF with evidence-based drugs and interventions so that CR could be adopted as an additional tool in the modern era of cardiovascular therapy.

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### References

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