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**INVITED EDITORIAL**

# Computerized decision support for exercise prescription in cardiovascular rehabilitation: high hopes. . .but still a long way to go

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**This editorial refers to 'A computerized decision support system did not improve personalization of exercise based cardiac rehabilitation according to the latest recommendations', by T. Vromen *et al.*, pp. 572–580.**

## How to personalize exercise prescription in cardiovascular rehabilitation: a major issue

Multidisciplinary cardiovascular rehabilitation (CR) is a Class 1A intervention in the secondary prevention of cardiovascular disease (CVD) because of its significant impact on mortality, hospitalization rates, and incidence of major adverse cardiovascular events.[1,2] Notwithstanding these favourable outcomes, it seems that there is still room for improvement in CR. Next to how to increase the uptake and adherence rates of CR, how to personalize CR remains a major issue. In particular how to prescribe exercise to patients with different CVD risk factors and diseases seems difficult to many clinicians. Between centres and clinicians, disagreement occurs on what exercise intensity, volume and type should be prescribed to patients with CVD (risk),[3–7] despite the availability of clinical guidelines.[1,2] This finding is worrisome, as it has been shown that the selection of these different exercise modalities significantly modulate the clinical benefits of CR (e.g. changes in fat mass, blood pressure, lipid profile, glycaemic control and physical fitness).[1] As a result, different groups of investigators came up with the idea to develop digital decision support systems for exercise prescription to patients with CVD.[8,9] In this issue of the Journal, one of those systems has been assessed for its effect on exercise prescription skills and habits in clinicians involved in CR.[10]

## A decision support system for exercise prescription put to the test

Among clinicians working in 10 Dutch CR centres (comprising 2258 patients), Vromen *et al.* tested whether a computerized decision support (CDS) system, based on CR guidelines, can improve the personalization of exercise prescriptions.[10] The CDS is a web-based, interactive system that provides a personalized exercise training prescription for CVD patients, after the following information is provided to the system: referral reason (e.g. diagnosis, intervention), age, left ventricular function, body weight, rehabilitation goals, and exercise test parameters (e.g. peak power output, maximal and resting heart rate, peak oxygen uptake). The training prescription includes the training frequency, duration, and intensity, as well as the evaluation instruments. If a patient has multiple rehabilitation goals, a prioritization between the goals is made, resulting in multiple phases of the training programme.

In the study, the CR programme characteristics of consecutive patients were recorded during one year, and data on the prescribed exercise intensity, session and programme duration, weekly frequency, and characteristics of the strength training were collected. Next, the CDS was used during a randomly assigned 4-month period within this year. The study thus consisted of three phases. Phase 1 referred to the period from the start of the study to the beginning of the intervention, Phase 2 referred to the 4-month intervention period and Phase 3 referred to the period from the end of the intervention to the end of the study period. They assessed the concordance of the prescriptions to the recommendations in the three phases for 12 CR programme characteristics (including exercise prescriptions).

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The overall concordance of actual CR prescription to the personalized training prescription, according to the recommendations, was 60% in Phase 1, 62% in Phase 2 ($P = 0.82$ vs. Phase 1) and 60% in Phase 3 ($P = 0.56$ vs. Phase 1). As a result, the introduction of the CDS into these CR centres did not affect the agreement between exercise prescriptions in clinical practice vs. the guideline-directed exercise prescriptions. Moreover, although the application of aerobic exercise training and baseline exercise testing was nearly always in concordance with the recommendations, the goal-specific evaluation of individual progress was virtually never applied, and this was not influenced by the introduction of CDS either. For the total aerobic training volume even a decline was observed throughout the study. On the other hand, the concordance with recommendations for the application of functional training improved with the use of CDS. The authors therefore concluded that the introduction of a CDS into CR does not affect exercise training prescriptions to CVD patients, so a greater personalization of CR was, unfortunately, not achieved.

## What hampers the effect of digital decision support systems on our exercise prescription habits?

At first sight, these findings seem to be in stark contrast with the results of a study of Goud *et al.*,[11] who, 11 years earlier, observed significantly better agreement between the therapeutic decisions of Dutch multidisciplinary CR teams and the recommendations, after the introduction of a CDS. However, a qualitative follow-up study revealed that a CDS is not effective when organizational or procedural changes are required that clinicians consider to be beyond their tasks and responsibilities.[12] These studies thus demonstrated the complexity of introducing a CDS system in CR.

The more recent study by Vromen *et al.* gives some hints of what they believe are the barriers that hampered the adoption of their system, as well as its limited positive effect on the concordance of prescribed CR programmes to the recommendations. However, the study had at least a couple of limitations that, as discussed by the authors, did not let them figure out the actual cause of the negative results. In this regard, a formal interview with the clinicians to find out their motivation behind the treatment decisions could have delivered key insights. Moreover, little is mentioned about the way clinicians in the study were encouraged to fine-tune the CDS-proposed prescription.

Behind the positive or negative effects of a CDS there are certainly a number of internal and external barriers related to the execution of the medical profession, for example: familiarity with the guidelines, reluctance of medical professionals to modify their daily practice, lack of infrastructure in the training centre, or lack of a proper reimbursement policy, among others.

Moreover, the adoption and positive contribution of a CDS can be strongly influenced by its design and usability. One practical example is mentioned by Vromen *et al.*: the lack of integration of the CDS system in the different electronic health records in the participating centres. Practitioners should be able to seamlessly integrate the CDS into their daily practice, without having to worry about double data management and the validation of the patient data (e.g. having to verify that the patient's risk profile is up-to-date).

An effective CDS should also offer enough flexibility and control to the clinicians in order to adapt the treatment to the specific condition of the patients. Personalization can go beyond the traditional consultation where the patient has to follow all instructions given by the clinician, to an interactive consultation where the needs and preferences of the patient are also considered.[13]

Five years have passed since Vromen *et al.* performed the study: the technological and information management landscape in healthcare has however changed considerably [e.g. common use of mobile devices and wearable devices, increase in privacy awareness and requirements to treat personal data (GDPR)]. It is necessary, in our opinion, to perform an updated evaluation of the barriers and benefits of CDS systems for CR. A thorough assessment of internal, external, and patient-related barriers should then be included, as well as the actual benefit of the system in improving the concordance of actual CR prescription skills of those medical professionals in the field.

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