# Pulmonary Rehabilitation
## Timing, Location, and Duration

Thierry Troosters, PT, PhD[a,b,*], Miek Hornikx, MSc, PT[a,b], Heleen Demeyer, MSc, PT[a,b], Carlos A. Camillo, MSc, PT[b], Wim Janssens, MD, PhD[a]

**KEYWORDS**

• Pulmonary rehabilitation • Timing • Duration • Location • Muscle dysfunction • Exacerbation

**KEY POINTS**

- From a group perspective, pulmonary rehabilitation has produced positive and clinically meaningful effects across multiple outcome areas in patients with chronic respiratory diseases.
- Although enthusiasm has been increased among clinicians and third party payers, and pulmonary rehabilitation is advised as a therapy for COPD in international guidelines, reimbursement remains a challenge in many regions leading to large variability in program design, duration and patient selection.
- There are several risk factors for lack of uptake and nonadherence to rehabilitation programs and logistical aspects (transportation) seem to be an important barrier.

## INTRODUCTION

This issue of *Clinics in Chest Medicine* elaborates on the benefits of pulmonary rehabilitation. The effects of following a rehabilitation program cannot be stressed enough. Patients typically experience benefits in exercise capacity, functional performance, symptoms, disease mastery, and health-related quality of life. Promising, although less consistent, results are observed in increased physical activity levels of patients with chronic obstructive pulmonary disease (COPD).[1,2] The mechanisms underlying these improvements across multiple outcome areas are various[3] and are complementary to the mechanisms through which pharmacotherapy enhances lung function and patient-centered outcomes. As a consequence, pharmacotherapy and pulmonary rehabilitation exert additive or even synergistic effects.

The improvements in outcomes realized by rehabilitation can be categorized by the World Health Organization (WHO) model into areas of bodily function, activity, and participation. Not only do the interventions and beneficial effects differ considerably among various pulmonary rehabilitation programs but the importance that individual patients attribute to a particular improvement also varies considerably. The content of a program should ideally be tailored to maximize the chances that a patient's individual goals and the therapeutic goals of the rehabilitation interdisciplinary team should be met. Both patient-individual and team goals are based on a comprehensive baseline assessment at the beginning of pulmonary rehabilitation.[4]

In this article, 3 practical and related questions are discussed: (1) who should be referred for pulmonary rehabilitation? (2) Where should rehabilitation take place? (3) How long should rehabilitation last? Across the globe there is a large heterogeneity in these organizational components of rehabilitation.[5] Although seemingly simple, there is no

Supported by grant Flemish Research Foundation (gs1) FWO G.0871.13.

[a] Respiratory Rehabilitation and Respiratory Division, University Hospital Leuven, Leuven, Belgium; [b] KU Leuven, Department of Rehabilitation Sciences, Faculty of Kinesiology and Rehabilitation Sciences, 3000 Leuven, Belgium

* Corresponding author. Respiratory Division, University Hospital Gasthuisberg, Herestraat 49, 3000 Leuven, Belgium.

*E-mail address:* thierry.troosters@med.kuleuven.be

Clin Chest Med 35 (2014) 303–311
http://dx.doi.org/10.1016/j.ccm.2014.02.002

straightforward and fully evidence-based answer available to these questions. Several options are available for each. Based on the phenotype of an individual patient and on the characteristics of the rehabilitation team, the patient should be referred to the most suitable program. However, in practice decisions are often influenced by limited availability of programs and limited reimbursement options.

### *Who Should Be Referred?*

Most research on the effects of pulmonary rehabilitation is performed in patients known to respiratory specialists and studies have consistently shown wide variability in outcomes of rehabilitation in virtually all outcome measures studied. Only a few studies have attempted to identify the best responders to rehabilitation programs. All these studies have defined responders in a particular dimension of outcome, and being a responder in that particular dimension does not automatically imply being a responder on other dimensions. Because rehabilitation requires substantial effort and investment on both the patient and the rehabilitation team, the targeted outcome or outcomes of the program need to be identified and there should be reasonable expectation that the patient can significantly improve in these outcomes. Adherence with programs is crucial if they are to result in benefits,[6] and several factors have been (weakly) associated with nonadherence to pulmonary rehabilitation. These include lower levels of social support,[7] active smoking,[7–9] extremes of age,[8,9] long-term oxygen use,[8] forced expiratory volume in 1 second,[8] a lower health-related quality of life score,[8,9] and longer traveling distance to the rehabilitation center.[8] A systematic review identified travel and transport issues and a lack of perceived benefit as barriers to both uptake and completion of programs. The only demographic features that consistently predicted noncompletion were being a current smoker and depression.[10] Apart from these quantifiable factors there are several personal and system factors that influence uptake and adherence. Qualitative studies identified that the service that is introduced and the capacity of the service to meet the patient's lifestyle needs are determinants of the willingness of patients to undertake the treatment. Themes that determined the decision not to start rehabilitation or to interrupt a program were difficulties with accessing the program (geography and timing); difficulties in prioritizing the treatment; contrary beliefs about the role and safety of exercise, and fears about criticism (being unable to cope with exercise, or smoking status). These factors are only seldom recognized when the lack of uptake of rehabilitation is discussed. A patient who does not start a rehabilitation program clearly cannot become a responder.

A few studies have attempted to identify the best responders to exercise training. Prediction models are generally poor, but may give insight into the benefits that can be expected in individual patients. Patients with poor functional exercise capacity, more muscle dysfunction,[11,12] and better preserved ventilatory capacity[13] seem to respond slightly better to exercise training. Two studies found that patients with skeletal muscle fatigue after exercise[14] or an exercise training program[15] are more likely to experience physiologic benefits of a training program. Thus, those patients with poor skeletal muscle function at the beginning of pulmonary rehabilitation are more likely to benefit from the exercise stimulus. Although one study suggested that younger patients are more likely to respond favorably to exercise training,[16] age is generally not though to be an important discriminator between responders and nonresponders.[17–19] Gender and lung function also do not predict success of rehabilitation.

Responders are typically defined in just 1 dimension, such as exercise capacity or quality of life. However, as shown in **Fig. 1**, improvement in one outcome area, such as exercise capacity, is not necessarily related to improvement in another area, such as quality of life. Furthermore, for most end points, benefits can only be expected if there is a baseline abnormality. This rule also applies for less conventional end points, such as maintenance of postural control and balance or psychological abnormalities: benefits can only be attained if deficiencies in these dimensions are present at baseline, which reiterates the importance of comprehensive baseline screening and the identification of patient-specific goals for the rehabilitation program.

For people outside pulmonary rehabilitation (chest physicians, internal medicine, or general practitioners), there is no clear guidance on which patients should be referred for pulmonary rehabilitation. The most recent Global Initiative for Obstructive Lung Disease (GOLD) strategy document advocates pulmonary rehabilitation of GOLD category B, which means that virtually any symptomatic patient with COPD should be considered for this intervention.[20] A pragmatic approach is to refer any patient with persistent respiratory symptoms (dyspnea, fatigue) and/or functional status limitations despite otherwise optimal therapy.[4] The British Thoracic Society guidelines give more practical guidance as to who should be referred to rehabilitation, based on the Medical