Review article

Pulmonary Rehabilitation

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Abstract:

Over recent years pulmonary rehabilitation (PR) is recognized as the standard and comprehensive treatment option to minimize disability and handicap in patients suffering from chronic lung disease. The first definition of PR was developed in 1974, at American College of Chest Physicians (ACCP) annual meeting, and and the first comprehensive statement was published by the American Thoracic Society in 1981, and adapted in 1999. In 1997 ACCP in conjunction with American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) published first evidence-based guidelines on pulmonary rehabilitation (PR). The rehabilitation process incorporates a program of physical training, disease education, and nutritional, psychological, social, and behavioral intervention. It is provided by multidisciplinary team with involvement of the patient's family and attention to individual needs. The outcomes of rehabilitation for individuals and programs should be continually observed with the appropriate measures of impairment, disability, and handicap. In our part of world there is an ever strong need to develop widespread pulmonary rehabilitation services, as the prevalence of disability due to chronic lung disease is increasing. The need for such services is evident, and its demand is substantial, while the capacity to provide such services is poor. To improve the situation, action from consumers, health professionals, and even commissioner of health care both in private and government sector needs to be stimulated.

Key words: *pulmonary rehabilitation, chronic lung disease, exercise, guidelines, quality of life, supplemental oxygen, exercise, nutrition, noninvasive ventilation, chronic obstructive pulmonary diseases.*

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Introduction

Pulmonary diseases are considered as one of the major causes of morbidity and mortality in the modern world. Chronic obstructive pulmonary disease (COPD) is on the course to be the third most common cause of death worldwide by 2020[1]. Over recent decades, growing body of scientific evidence has shown that pulmonary rehabilitation has emerged as a most accepted method of non-pharmacological treatment for patients with COPD, bronchial asthma, bronchiectasis, cystic fibrosis, interstitial lung diseases, neuromuscular degenerative diseases and post tuberculosis lung sequelae[2].

The first definition of pulmonary rehabilitation was developed in 1974, at American College of Chest Physicians (ACCP) annual meeting, and the first comprehensive statement was published by the American Thoracic Society in 1981[3], and adapted in 1999[4]. In 1997 ACCP in conjunction with American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) published first evidence-based guidelines on pulmonary rehabilitation (PR) [5, 6]. Since then there has been a substantial increase in the literature on pulmonary rehabilitation (Fig 1), providing evidence for including PR in practice guidelines for COPD and other chronic lung disease[7, 8, 9].

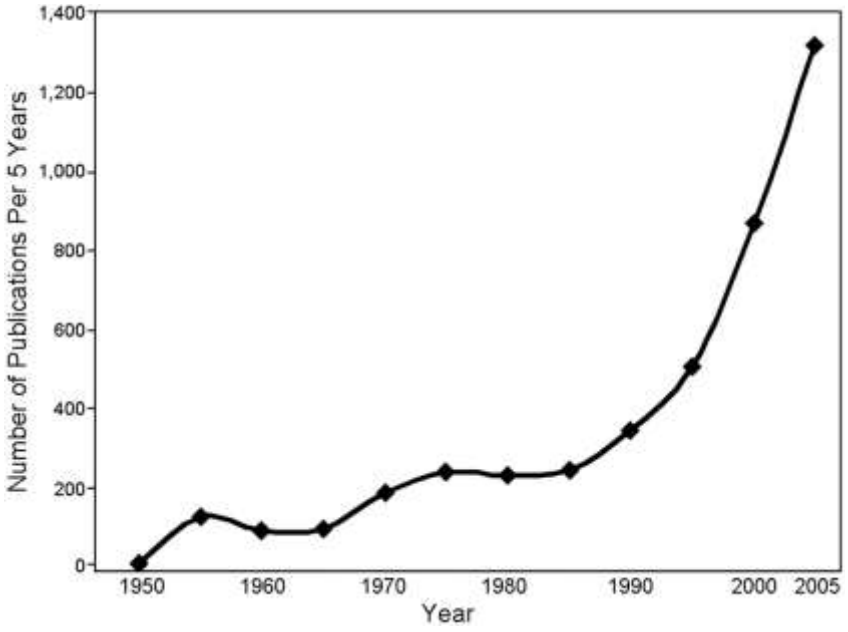

Fig. 1. Number of pulmonary rehabilitation references in Pubmed from 1950 to 2005, in 5 year intervals.

Definition of Pulmonary Rehabilitation

The American Thoracic Society and the European Respiratory Society recently (2006) adapted the following definition of pulmonary rehabilitation:
Pulmonary rehabilitation is an evidence –based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory disease who are symptomatic and often have decreased daily life activities. Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health-care costs by stabilizing or reversing systemic manifestation of the diseae[10].
The above mentioned definition of PR focuses on three aspects of successful rehabilitation:
Multidisciplinary: Program is designed to provide comprehensive and cohesive treatment to patients tailored according to their needs by utilizing expertise from various health care disciplines.
Individual: PR program focuses to meet individual realistic goals.
Attention to Physical and Social Function: To be successful and effective, pulmonary rehabilitation pays attention to psychological, emotional, and social needs of individual patient as well as their physical disability.

Objectives and Goals:

Over recent years it's being recognized as the standard and comprehensive treatment option to minimize disability and handicap in patients suffering from chronic lung disease. The primary goal is to restore the patient to the highest possible level of independent functioning and to reduce repeated hospitalization. The fundaments principles and goals of rehabilitation is shown in a box below (Box 1)[11].

- The goals of rehabilitation are to reduce the symptoms, disability, and handicap and to improve functional independence in people with lung disease
- It is assumed that optimum medical management has been achieved or continues alongside the rehabilitation process
- The rehabilitation process incorporates a program of physical training, disease education, nutritional, psychological, social, and behavioral intervention
- Pulmonary rehabilitation is provided by multidisciplinary team with involvement of the patient's family and attention to individual needs
- The outcomes of rehabilitation for individuals and programs should be

continually observed with the appropriate measures of impairment, disability, and handicap

Box. 1: General Principles and Goals of Rehabilitation

The process of pulmonary Rehabilitation

Site and Personal

In the light of the most recent definition, success of the rehabilitation program is attributed to the multidisciplinary approach. The interdisciplinary team of health-care professionals in pulmonary rehabilitation may include physicians; nurses; respiratory, physical, and occupational therapists; psychologists; exercise specialists; social worker; pharmacist; and/or others with appropriate expertise. The specific team make-up depends on the resources and expertise available, but usually includes at least one full-time staff member.

Cost comparison suggests that hospital outpatient rehabilitation is currently the most efficient form of delivery.

Format, Content and Benefits:

Outpatient program should ideally contain a minimum of 6-12 weeks of physical exercise with two to three directly supervised sessions each lasting for 3 to 4 hours, and additional instructions to train at home on daily basis[12].

Before the patient is enrolled in the program thorough clinical assessment is carried out both by the physician and rehabilitation coordinator. The main goal is to get information on the severity of exercise intolerance, identify any cardiovascular or other contraindications to rigorous exercise program, identify the need for supplemental oxygen and to make a guideline for the intensity of the exercise prescribed. Revaluations are carried out at regular intervals to assess patient's progress toward individualized exercise and education goals[13].

Pulmonary rehabilitation program is contraindicated for patients who are unable to walk (because of orthopedic or neurologic disorders) or those with unstable cardiac disease (unstable angina or recent myocardial infarction). Other relative contraindications include cognitive or psychiatric problems that would prevent the patient from comprehending or cooperating with the treatment plan. Some programs exclude active smokers, although there are no convincing data that support this decision[14].

The core content of the program comprises of aerobic physical exercise training and educating the patient on disease. Limb strength and upper limb training, psychological intervention, smoking cessation, oxygen therapy and nutritional intervention are the additional components of the rehabilitation program.

Evidence cited in the literature shows that such a comprehensive and individually tailored program of rehabilitation will improve the functional exercise capacity, reduce exertional dyspnoea, and improve health status (Box 2)[11]. The program also reduces hospital admission frequency, duration of stay, exacerbation rate, general practitioner home visit and bronchodilator usage[15-18].

Evidence exists that a multiprofessional individually tailored program of rehabilitation including prescribed endurance exercise training should:

- Improve functional exercise capacity
- Improve health status
- Reduce dyspnoea
- Have some health economic advantages

Box 2: The benefits of pulmonary rehabilitation base on present evidence

Components of Rehabilitation:

Physical Training: It is a centre piece of pulmonary rehabilitation program; it does not directly improve lung mechanics or gas exchange. The exercise program is designed to optimize the function of other body systems so that the effect of lung dysfunction is minimized (Fig 2)[19]

Endurance (Aerobic) Training: Endurance (or aerobic) exercise of the leg muscles is the main focus of such training. Patients are mostly trained to perform treadmill exercises, stationary cycling and walking. Another component of this training is resistance-exercise. Resistance-training usually involves the upper arm muscles, as they serve as auxiliary muscles of respiration[20].

Respiratory Muscle Training: For the present respiratory muscle training is not an essential component of the pulmonary rehabilitation program as it is now known that even with improvement of respiratory-muscle strength, functional capacity of patient usually does not improve.

There is some evidence in literature that respiratory muscle support by non-invasive ventilation may have a role in rehabilitation e.g. nocturnal domiciliary non-invasive ventilation (NIPPV) can augment the effects of pulmonary rehabilitation program in patients with severe COPD[21-22].

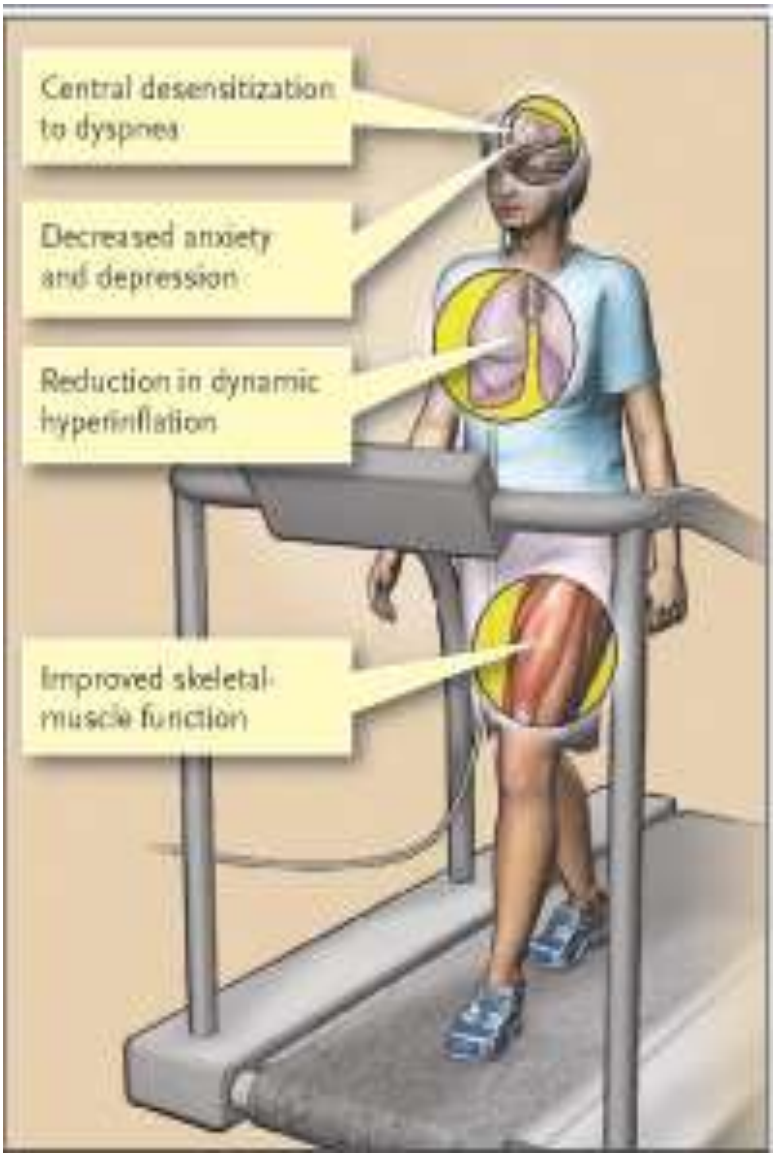

Fig. 2. Targets of Exercise Training as Part of a Pulmonary Rehabilitation Program for patients with chronic lung disease

Use of Oxygen during Exercise Training: Ancillary measures have been added to the program to improve and increase the intensity of exercise. The use of supplemental oxygen during training sessions, even in patients without substantial exercised induced desaturation, improves and reduces ventilatory demand. Other ancillary interventions include use of noninvasive ventilatory support, heliox (an inhaled mixture of helium and oxygen), ventilatory-pattern feedback, and anabolic steroids[23-25].

Education: Patient education plays a central role for successful implementation of pulmonary rehabilitation program. It is usually delivered in the form of talks, group discussions, counseling, additional material in the form of leaflets and continuing education instructions. Areas covered by the education component are shown in the (Box 3)[11]. It is included in the PR to improve patient's understanding of the disease and its treatment and to promote self-management strategies. Development of self-management strategies, allows development of a partnership between patient and health care professional to systematically manage the disease. This approach of education also promotes adaptive behaviors, such as abstinence from smoking, better adherence to pharmacologic and exercise therapy, and earlier recognition and treatment of the disease exacerbation. It also reduces the use of health care services and costs among patients with moderate-to-sever chronic lung disease and a history of hospitalization[26-27].

- Anatomy, physiology, pathology and pharmacology (including oxygen therapy)
- Dyspnoea/symptom management, chest clearance techniques
- Energy conservation/pacing
- Nutritional advice
- Managing travel
- Anxiety management
- Relaxation
- Identifying and changing beliefs about exercise and health related behaviors
- Development of self management
- Exacerbation management (including coping with setbacks and relapses)
- The benefits of physical exercise

Box 3: Suggested Content of Education

Psychology and Behavioral Intervention: Anxiety and depression observed in the course of chronic lung disease benefits from rehabilitation program. Psychological and behavioral intervention is embedded in the PR program through the delivery of education, small group discussions, and relaxation therapy. Evidence shows no additional benefit of antidepressant or anxiolytic pharmacotherapy. One area where psychological assessment brings about maximum benefit is in the assessment of motivation and identification of readiness to start with the physical training and be complainant with program.

Respiratory Therapy, Relaxation exercises, and Energy conservation: The physiotherapist provides advice about relaxation and breathing retraining techniques such as pursed lip breathing, diaphragmatic breathing retraining, coughing technique, and postural drainage.

Nutrition: Chronic lung disease cachexia is characterized by involuntary weight loss and depletion of lean body mass, which has a very good prognosis. Patients are offered nutritional supplementation, but literature shows limited efficacy of such supplementation. The appetite stimulant megestrol acetate has been shown to increase body weight, typically gain in lean body fat mass. Obesity causes ventilatory limitation at lower exercise intensities because of increase in metabolic activity[28-29].

Conclusion:

In our part of world there is an ever strong need to develop widespread pulmonary rehabilitation services, as the prevalence of disability due to chronic lung disease is increasing. The need for such services is evident, and its demand is substantial, while the capacity to provide such services is poor. A roadblock to achieving widespread availability of pulmonary rehabilitation in our country is the lack of a uniform funding and planning policy to train the human resources to provide these services and poor infra-structure of health services to make these services easily available at the consumer end.

To improve the situation, action from consumers, health professionals, and even commissioner of health care both in private and government sector needs to be stimulated. Evidence exists to show that pulmonary rehabilitation is safe, effective, and inexpensive intervention which may reduce health service usage. This justifies immediate investing in PR services for patients with chronic lung diseases.

References:

1. Rabe KF, Hurd S, Anzueto A, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. Am J Respir Crit Care Med 2007; 176:532-55.

2. Pesut D, Ciobanu L, Nagorni-Obradovic L. Pulmonary rehabilitation in chronic respiratory diseases--from goals to outcomes. Pneumologia. 2008 Apr-Jun; 57(2):65-9.

3. American Thoracic Society; Medical Section of the American Lung Association. Pulmonary rehabilitation. Am Rev Respir Dis 1981; 124(5): 663-666

4. American Thoracic Society. Pulmonary rehabilitation - 1999. Am J Respir Crit Care Med 1999; 159(5 Pt 1):1666-1682.

5. American College of Chest Physicians; American Association of Cardiovascular Pulmonary Rehabilitation. Pulmonary rehabilitation: JointACCP/AACVPRevidence-based guidelines. Chest 1997; 112(5): 1363-1396.

6. ACCP-AACVPR Pulmonary Rehabilitation Guidelines Panel. Pulmonary rehabilitation: joint ACCP/AACVPR evidence based guidelines. J Cardiopulmonary Rehabil 1997; 17:371-405.

7. Nici L, Donner C, Wouters E, Zuwallack R, Ambrosino N, Bourbeau J, et al. American Thoracic Society; European Respiratory Society. ATS/ERS statement on pulmonary rehabilitation. Am J Respir Crit Care Med 2006; 173(12):1390-1413.

8. Global Initiative for Chronic Obstructive Lung Disease [GOLD] Executive Committee. Workshop report 2005 update: global strategy for diagnosis, management, and prevention of COPD. September 2005. Available at http://goldcopd.org/guidelineitem.asp?intid_1386 Accessed June 27, 2008.

9. American Thoracic Society; European Respiratory Society. Standards for the diagnosis and management of patients with COPD. 2005. Available at http://www.thoracic.org/sections/copd/resources Copddoc.pdf Accessed June 27, 2008.

10. Nici L, Donner C, Wouters E, Zuwallack R, Ambrosino N, Bourbeau J, et al. American Thoracic Society; European Respiratory Society. ATS/ERS statement on pulmonary rehabilitation. Am J Respir Crit Care Med 2006; 173(12):1390-1413.

11. British Thoracic Society Standards of Care Subcommittee of Pulmonary Rehabilitation. Pulmonary rehabilitation BTS Statement. Thorax 2001; 56: 827-834

12. Troosters T, Casaburi R, Gosselink R, Decramer M. Pulmonary rehabilitation in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2005; 172:19-38.

13. Wasserman K, Hansen JE, Sue DY, Stringer WW, Whipp BJ. Principles of exercise testing and interpretation: including pathophysiology and clinical applications 4th ed. Philadelphia: Lippincott Williams & Wilkins, 2004.

14. Lacasse Y, Maltais F, Goldstein RS. Smoking cessation in pulmonary rehabilitation: goal or prerequisite? J Cardiopulm Rehabil 2002; 22:148-. 53

15. Griffiths TL, Burr ML, Campbell IA, et al. Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: a randomized controlled trial. Lancet 2000; **355:362**–8.

16. Guell R, Casan P, Belda J, et al. Long-term effects of outpatient rehabilitation of COPD: a randomized trial. Chest 2000; **117:976**–83

17. Young P, Dewse M, Fergusson W, et al. Improvements in outcomes for chronic obstructive pulmonary disease (COPD) attributable to a hospital-based respiratory rehabilitation programme. Aust NZ J Med 1999; **29:59**–65.

18. Gallefoss F, Bakke PS. How does patient education and self management among asthmatics and patients with chronic obstructive pulmonary disease affect medication? Am J Respir Crit Care Med 1999; **160:2000**–5

19. Casaburi Richard, Wallack Zu Richard. Pulmonary Rehabilitation for management of chronic obstructive pulmonary disease. N Engl J Med 2009; 360: 1329-35

20 Celli BR, Rassulo J, Make BJ. Dyssynchronous breathing during arm but not leg exercise in patients with chronic airflow obstruction. N Engl J Med 1986; 314: 1485-90.

21. Garrod R, Mikelsons C, Paul EA, et al. Randomized controlled trial of domiciliary noninvasive positive pressure ventilation and physical training in severe chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2000; **162:1335**–41.

22. Polkey MI, Hawkins P, Kyroussis D, et al. Inspiratory pressure support prolongs exercise induced lactataemia in severe COPD. Thorax 2000; **55:547**–9.

23. Emtner M, Porszasz J, Burns M, Somfay A, Casaburi R. Benefits of supplemental oxygen in exercise training in nonhypoxemic chronic obstructive pulmonary disease patients. Am J Respir Crit Care Med 2003; 168:1034-42.

24. Casaburi R, Bhasin S, Cosentino L, et al. Effects of testosterone and resistance training in men with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2004; 170:870-8.

25. Casaburi R. Boosting the effectiveness of rehabilitative exercise training. Am J Respir Crit Care Med 2008; 177:805-6.

26. Bourbeau J, Julien M, Maltais F, et al. Reduction of hospital utilization in patients with chronic obstructive pulmonary disease: a disease specific self-management intervention. Arch Intern Med 2003; 163:585-91

27. Bourbeau J, Collet JP, Schwartzman K, Ducruet T, Nault D, Bradley C. Economic benefits of self-management education in COPD. Chest 2006; 130:1704-11.

28. Ferreira IM, Brooks D, Lacasse Y, Goldstein RS, White J. Nutritional supplementation for stable chronic obstructive pulmonary disease. Cochrane Database Syst Rev 2005; 2:CD000998.

29. Weisberg J, Wanger J, Olson J, et al. Megestrol acetate stimulates weight gain and ventilation in underweight COPD patients. Chest 2002; 121:1070-8