

# Pulmonary Rehabilitation: Summary of an Evidence-Based Guideline

Andrew L Ries MD MPH

## Introduction

## Definition of Pulmonary Rehabilitation

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## Summary

Pulmonary rehabilitation has emerged as a standard of care for patients with chronic lung disease, based on a growing body of scientific evidence. Over recent decades, several organizations have championed pulmonary rehabilitation and developed comprehensive statements, practice guidelines, and evidence-based guidelines. Documenting the scientific evidence underlying clinical practice has been important in overcoming skepticism and convincing health professionals, health-care institutions, third-party payers, and regulatory agencies to support pulmonary rehabilitation programs. The literature on pulmonary rehabilitation has increased substantially and provided justification for including pulmonary rehabilitation in practice guidelines for chronic obstructive pulmonary disease and other chronic lung diseases. Therefore, the American College of Chest Physicians and the American Association of Cardiovascular and Pulmonary Rehabilitation decided to update their 1997 guidelines with a systematic, evidence-based review of the literature since the previous review. The panel updated prior topics and recommendations and reviewed new topics. Recommendations were given for outcomes of comprehensive pulmonary rehabilitation programs, including lower-extremity exercise training, dyspnea, health-related quality of life, health-care utilization, survival, psychosocial outcomes, and long-term benefits. Additional topics include the duration of pulmonary rehabilitation, post-rehabilitation maintenance strategies, intensity of aerobic exercise training, strength training, anabolic drugs, upper-extremity training, inspiratory-muscle training, education, psychological and behavioral components, oxygen supplementation, noninvasive ventilation, nutrition supplementation, rehabilitation for patients with disorders other than chronic obstructive pulmonary disease, and future pulmonary rehabilitation research. These guidelines provide an excellent summary of the recent literature and further strengthen the scientific basis of pulmonary rehabilitation. *Key words: pulmonary rehabilitation, guidelines, chronic obstructive pulmonary disease, COPD, chronic lung disease, exercise, dyspnea, health-related quality of life, health-care utilization, inspiratory muscles, supplemental oxygen, noninvasive ventilation, nutrition.* [Respir Care 2008;53(9):1203–1207. © 2008 Daedalus Enterprises]

## Introduction

Pulmonary rehabilitation has emerged as a recommended standard of care for patients with chronic lung disease, based on a growing body of scientific evidence. Over the past several decades, several organizations championed

pulmonary rehabilitation and developed comprehensive statements and evidence-based practice guidelines. Documenting the scientific evidence underlying clinical practice has been important in overcoming skepticism and con-

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Andrew L Ries MD MPH is affiliated with the Departments of Medicine and Family and Preventive Medicine, University of California, San Diego, La Jolla, California.

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Correspondence: Andrew L Ries MD MPH, School of Medicine, University of California, San Diego, 9500 Gilman Drive, La Jolla CA 92093-0602. E-mail: aries@ucsd.edu.

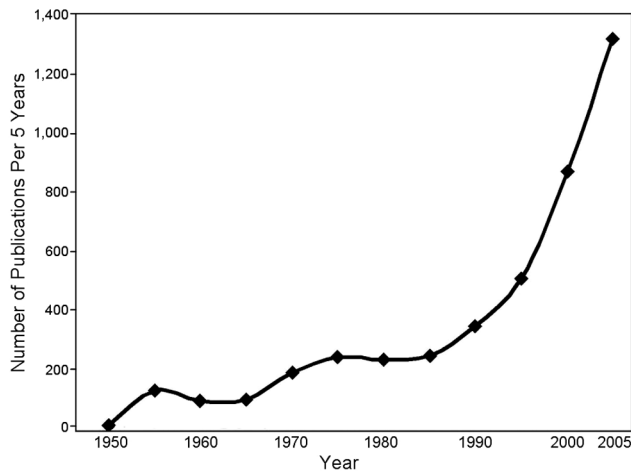


Fig. 1. Number of pulmonary rehabilitation references in PubMed from 1950 to 2005, in 5 year intervals.

vincing health professionals, health-care institutions, third-party payers, and regulatory agencies to support pulmonary rehabilitation programs. The American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), American Association for Respiratory Care, American College of Chest Physicians (ACCP), American Thoracic Society, and European Respiratory Society have contributed to and actively supported these efforts.

The first definition of pulmonary rehabilitation was developed in 1974, at the ACCP annual meeting, and the first comprehensive statement was published by the American Thoracic Society in 1981,<sup>1</sup> and updated in 1999,<sup>2</sup> and again in 2006, in conjunction with the European Respiratory Society.<sup>3</sup> The first systematic review of the scientific basis of pulmonary rehabilitation was published by AACVPR in 1990.<sup>4</sup> In conjunction with ACCP, in 1997, AACVPR published the first evidence-based guidelines on pulmonary re-

habilitation.<sup>5,6</sup> Since then the literature on pulmonary rehabilitation has increased substantially (Fig. 1) and provided justification for recommending pulmonary rehabilitation as a standard of care for the management of patients with chronic obstructive pulmonary disease (COPD) and other chronic lung diseases.<sup>3,7,8</sup> Therefore, ACCP and AACVPR decided to update the 1997 guidelines with a systematic, evidence-based review of the literature. In this paper I will summarize the main findings of the new guidelines.<sup>9</sup>

In the United States, COPD accounted for more than 119,000 deaths in 2000, ranking it the 4th leading cause of death and the only major disease among the top 10 that continues to increase.<sup>10-13</sup> Mortality data tend to underestimate the impact of COPD because it is more likely to be listed as a contributory cause rather than the underlying cause of death, and is often not listed at all.<sup>14,15</sup> Between 1980 and 2000, deaths from COPD increased 282% among women and 13% among men. Also in 2000 the number of women who died from COPD exceeded the number of men.<sup>10</sup>

COPD develops insidiously over decades, and, because of the large reserve in lung function, there is a long pre-clinical period. Affected individuals have few symptoms and are undiagnosed until a relatively advanced stage of disease. In a population survey, Burrows reported that only 34% of persons with COPD had ever consulted a physician, 36% denied having any respiratory symptoms, and 30% denied dyspnea on exertion, which is the primary symptom of COPD.<sup>16</sup> The National Health and Nutrition Examination Survey III indicated that 24 million United States adults have impaired lung function but only 10 million reported a physician diagnosis of COPD.<sup>10</sup> Worldwide the burden of COPD is projected to increase substantially, paralleling the rise in tobacco use, particularly in developing countries. An analysis by the World Bank and World Health Organization ranked COPD 12th in 1990

Table 1. Grading System Based on Strength of Supporting Evidence and Balance of Benefits to Risks and Burdens

		Balance of Benefits to Risks and Burdens			Uncertain§
		Benefits Outweigh Risks/Burdens*	Risks/Burdens Outweigh Benefits†	Risks/Burdens and Benefits Balanced‡	
Strength of Evidence	High	1A: Strong recommendation	1A: Strong recommendation	2A: Weak recommendation	
	Moderate	1B: Strong recommendation	1B: Strong recommendation	2B: Weak recommendation	
	Low	1C: Strong recommendation	1C: Strong recommendation	2C: Weak recommendation	2C: Weak recommendation

\* Benefits clearly outweigh the risks and burdens (certainty of imbalance)  
† Risks and burdens clearly outweigh the benefits (certainty of imbalance)  
‡ Risks/burdens and benefits are closely balanced (less certainty)  
§ Balance of benefits to risks and burdens is uncertain (uncertainty)  
(Adapted from Reference 19.)

# PULMONARY REHABILITATION: SUMMARY OF AN EVIDENCE-BASED GUIDELINE

Table 2. Recommendations, Statements, and Grades in the Evidence-Based Guidelines on Pulmonary Rehabilitation

Recommendation or Statement	Strength of Evidence/ Recommendation Grade
1. A program of exercise training of the ambulation muscles is a mandatory component of pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD).	1A
2. Pulmonary rehabilitation improves dyspnea in patients with COPD.	1A
3. Pulmonary rehabilitation improves health-related quality of life in patients with COPD.	1A
4. Pulmonary rehabilitation reduces the number of hospital days and other measures of health-care utilization in patients with COPD.	2B
5. Pulmonary rehabilitation is cost-effective in patients with COPD.	2C
6. There is insufficient evidence to determine if pulmonary rehabilitation improves survival in patients with COPD.	None
7. There are psychosocial benefits from comprehensive pulmonary rehabilitation programs in patients with COPD.	2B
8A. Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes, but these benefits decline gradually over 12–18 months.	1A
8B. Some benefits, such as health-related quality of life, remain above control at 12–18 months.	1C
9. Longer (> 12 weeks) pulmonary rehabilitation programs produce greater sustained benefits than do shorter programs.	2C
10. Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes.	2C
11. Lower-extremity exercise training at a higher exercise intensity produces greater physiologic benefits than lower-intensity training in patients with COPD.	1B
12. Both low-intensity and high-intensity exercise training produce clinical benefits for patients with COPD.	1A
13. Addition of a strength training component to pulmonary rehabilitation increases muscle strength and muscle mass.	1A
14. Current evidence does not support the routine use of anabolic agents in pulmonary rehabilitation for patients with COPD.	2C
15. Unsupported endurance training of the upper extremities benefits patients with COPD and should be included.	1A
16. The evidence does not support the routine use of inspiratory muscle training as an essential component.	1B
17. Education is an integral component of pulmonary rehabilitation and should include information on collaborative self-management and prevention and treatment of exacerbations.	1B
18. Minimal evidence supports the benefits of psychosocial interventions as a single therapeutic modality.	2C
19. Though evidence is lacking, current practice and expert opinion support the inclusion of psychosocial interventions for patients with COPD.	None
20. Use supplemental oxygen rehabilitation exercise training in patients with severe exercise-induced hypoxemia.	1C
21. In patients without exercise-induced hypoxemia, supplemental oxygen during a high-intensity exercise program may improve gains in exercise endurance.	2C
22. In selected patients with severe COPD, noninvasive ventilatory support from a mechanical ventilator may modestly improve exercise performance.	2B
23. There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD.	None
24. Pulmonary rehabilitation benefits some patients with chronic respiratory diseases other than COPD.	1B
25. Though evidence is lacking, current practice and expert opinion suggest that pulmonary rehabilitation for patients with chronic respiratory diseases other than COPD should be modified to include treatment strategies specific to individual diseases and patients, in addition to the treatments used with patients with COPD.	None

(Adapted from Reference 20.)

in disease burden, reflected in disability-adjusted years of life lost.<sup>14</sup>

## Definition of Pulmonary Rehabilitation

The American Thoracic Society and the European Respiratory Society recently adopted the following definition of pulmonary rehabilitation:

Pulmonary rehabilitation is an evidence-based, multidisciplinary, and comprehensive intervention for pa-

tients with chronic respiratory diseases 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 manifestations of the disease.<sup>3</sup>

That definition focuses on 3 aspects of successful rehabilitation: a multidisciplinary approach; an individualized

program tailored to the patient's needs; and attention to physical, psychological, and social functioning.

Pulmonary rehabilitation for patients with chronic lung disease is well established as a means of enhancing standard therapy, to control and alleviate symptoms and optimize functional capacity.<sup>3,5,6,8,17</sup> The primary goal is to restore the patient to the highest possible level of independent functioning, which is accomplished by helping patients learn more about their disease, treatments, and coping strategies.

Pulmonary rehabilitation is appropriate for any patient with stable chronic lung disease who is disabled by respiratory symptoms. A pulmonary rehabilitation program typically includes patient assessment, exercise training, education, nutritional intervention, and psychosocial support. These programs have been successfully applied to patients with diseases other than COPD, such as interstitial diseases, cystic fibrosis, bronchiectasis, and thoracic-cage abnormalities.<sup>18</sup>

### Summary of the 2008 Pulmonary Rehabilitation Guidelines

The guideline panel was selected to represent both ACCP and AACVPR and worked tirelessly to make sense of the literature reviews and develop the recommendations. In preparing the 2008 version of the guidelines the panel focused on studies published since the previous review, and again concentrated on patients with COPD. Because of the many advances and new subjects of investigation, the panel not only updated the subjects and recommendations in the previous guideline<sup>5,6</sup> but also reviewed new topics. The new guidelines include recommendations for several outcomes of comprehensive pulmonary rehabilitation programs, including lower-extremity exercise training, dyspnea, health-related quality of life, health-care utilization, survival, psychosocial outcomes, and long-term benefits. Additional topics reviewed include the duration of pulmonary rehabilitation, post-rehabilitation maintenance strategies, intensity of aerobic exercise training, strength training, anabolic drugs, upper-extremity training, inspiratory muscle training, education, psychological and behavioral components, oxygen supplementation, noninvasive ventilation, nutritional supplementation, rehabilitation for patients with disorders other than COPD, and recommendations for future pulmonary rehabilitation research.

An ACCP clinical research analyst systematically reviewed the literature from 1996 to 2004 and presented the review in tables to the panel, who developed and graded the guidelines' statements and recommendations, following the guidelines developed by ACCP (Table 1).<sup>19</sup> The grades evaluate both the strength of the evidence (A =

high, B = moderate, C = low) and the balance of benefits to risks and burdens:

Grade 1 = strong recommendation: certainty that the benefits do or do not outweigh the risks and burdens

Grade 2 = weak recommendation: evenly balanced or uncertainty regarding benefits versus risks and burdens

Table 2 lists the panel's recommendations, statements, and grades.<sup>20</sup>

For consistency throughout the guideline, the panel used the description of COPD severity as recommended by the Global Initiative for Chronic Obstructive Lung Disease<sup>7</sup> and the American Thoracic Society/European Respiratory Society guidelines,<sup>8</sup> based on forced expiratory volume in the first second (FEV<sub>1</sub>), as follows:

Stage I: Mild: FEV<sub>1</sub> ≥ 80% predicted

Stage II: Moderate: FEV<sub>1</sub> 50–80% predicted

Stage III: Severe: FEV<sub>1</sub> 30–50% predicted

Stage IV: Very severe: FEV<sub>1</sub> < 30% predicted

### Summary

Overall, this new guideline provides an excellent summary of the past decade's literature and further strengthens the justifications for including pulmonary rehabilitation as a standard of care for patients with chronic lung diseases. Everyone who works in this field owes a debt of gratitude to both ACCP and AACVPR for leading and supporting this effort. These new guidelines clearly represent a major step forward in advancing the practice of pulmonary rehabilitation and should provide more strength to those striving to serve our deserving patients with chronic lung disease.

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