

Complete Summary

GUIDELINE TITLE

Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based clinical practice guidelines.

BIBLIOGRAPHIC SOURCE(S)

Ries AL, Bauldoff GS, Carlin BW, Casaburi R, Emery CF, Mahler DA, Make B, Rochester CL, Zuwallack R, Herrerias C. Pulmonary Rehabilitation: Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest 2007 May;131(5 Suppl):4S-42S. [211 references] [PubMed](#)

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based guidelines. ACCP/AACVPR Pulmonary Rehabilitation Guidelines Panel. American College of Chest Physicians. American Association of Cardiovascular and Pulmonary Rehabilitation. Chest 1997 Nov 5;112(5):1363-96.

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SCOPE

DISEASE/CONDITION(S)

Chronic lung disease, including:

- Chronic obstructive pulmonary disease (COPD, including chronic bronchitis and emphysema)

- Other chronic lung conditions such as asthma, bronchiectasis, cystic fibrosis, interstitial disease and restrictive chest wall disease, pulmonary hypertension, obesity-related respiratory disease, and lung cancer

GUIDELINE CATEGORY

Rehabilitation

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Physical Medicine and Rehabilitation
Pulmonary Medicine

INTENDED USERS

Advanced Practice Nurses
Dietitians
Nurses
Occupational Therapists
Physical Therapists
Physician Assistants
Physicians
Respiratory Care Practitioners
Social Workers

GUIDELINE OBJECTIVE(S)

To update the 1997 guidelines published by the American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) and to examine new areas of research relevant to pulmonary rehabilitation based on a comprehensive literature review

TARGET POPULATION

Any stable patient with a chronic lung disease who is disabled by respiratory symptoms

INTERVENTIONS AND PRACTICES CONSIDERED

1. Comprehensive pulmonary rehabilitation program, including exercise training (lower extremity, upper extremity, ventilatory muscle training [VMT], and strength training) and psychosocial/behavioral/education interventions (e.g., smoking cessation, patient education)
2. Longer term rehabilitation and maintenance strategies
3. Supplemental oxygen use during rehabilitative exercise training
4. Noninvasive ventilation during exercise training

The following interventions were considered but not recommended: anabolic agents, inspiratory muscle training, routine use of nutritional supplements

MAJOR OUTCOMES CONSIDERED

- Dyspnea
- Exercise tolerance
- Quality of life and activities of daily life
- Health-care utilization

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The literature search was conducted through a comprehensive MEDLINE search from 1996 through 2004, and was supplemented by articles supplied by the guideline panel as well as by a review of bibliographies and reference lists from review articles and other existing systematic reviews. The literature search was limited to articles published in peer-reviewed journals only in the English language, and on human subjects. Inclusion criteria primarily included a population of persons with a diagnosis of chronic obstructive pulmonary disease (COPD) determined either by physical examination or by existing diagnostic criteria; however, those with other pulmonary conditions (e.g., asthma or interstitial lung disease) were also included. The search included randomized controlled trials (RCTs), metaanalyses, systematic reviews, and observational studies. The search strategy linked pulmonary rehabilitation or a pulmonary rehabilitation program with each key subcomponent, as listed in section on "Scope of Work" (see the original guideline document). To locate studies other than RCTs, such as systematic reviews and metaanalyses, those key words were used in searching MEDLINE and the Cochrane databases. Informal review articles were included only for hand searching additional references. For the purpose of this review, *pulmonary rehabilitation* was defined operationally as studies involving exercise training plus at least one additional component. Associated outcomes across all components were dyspnea, exercise tolerance, quality of life and activities of daily life, and health-care utilization. An initial review of 928 abstracts was conducted by the American College of Chest Physicians (ACCP) Clinical Research Analyst and the Research Specialist. Full articles (a total of 202) were formally reviewed and abstracted by the Clinical Research Analyst, and a total of 81 clinical trials were included in all evidence tables.

Given the length of time required to prepare the final manuscript after the conclusion of the systematic literature review in December 2004, from which the tables were constructed, the committee was allowed to include reference to selected articles published in 2005 and 2006 in the text if the additional information provided by the newer publications was felt to be important.

NUMBER OF SOURCE DOCUMENTS

A total of 81 clinical trials were included in all evidence tables.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

High (A) Evidence based on well designed randomized controlled trials (RCTs) yielding consistent and directly applicable results. In some circumstances, high-quality evidence can be the result of overwhelming evidence from observational studies.

Moderate (B) Evidence based on RCTs with limitations that may include methodological flaws or inconsistent results. Studies other than RCTs that may yield strong results are also included in the moderate-quality category.

Low (C) Evidence from other types of observational studies (the weakest type of evidence).

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Randomized controlled trials were scored using a simplified system that was based on methods of randomization, blinding, and documentation of withdrawals/loss to follow-up. This system follows a method that is based on a 3-point scale, which rates randomization (and appropriateness), blinding (and appropriateness), and tracking of withdrawals and loss to follow-up. Studies were graded on a scale of 0 to 5. No formal quantitative analysis was performed due to the wide variation in methodologies reported in studies.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The guideline panel was organized under the joint sponsorship of the American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR). Panel members were evenly distributed between and selected by the two organizations with a goal of making the panel multidisciplinary and geographically diverse.

In addition to several conference calls, the panel met for one 2-day meeting to review the evidence tables and become familiar with the process of grading recommendations. Writing assignments were determined by members' known expertise in specific areas of pulmonary rehabilitation. Each section of the

guideline was assigned to one primary author and at least one secondary author. Sections were reviewed by relevant panel members when topics overlapped.

The ACCP system for grading guideline recommendations is based on the relationship between the strength of the evidence and the balance of benefits to risk and burden (see "Rating Scheme for the Strength of the Recommendations"). Simply stated, recommendations can be grouped on the following two levels: strong (grade 1); and weak (grade 2). If there is certainty that the benefits do (or do not) outweigh risk, the recommendation is strong. If there is less certainty or the benefits and risks are more equally balanced, the recommendation is weaker. Several important issues must be considered when classifying recommendations. These include the quality of the evidence that supports estimates of benefit, risks, and costs; the importance of the outcomes of the intervention; the magnitude and the precision of estimate of the treatment effect; the risks and burdens of an intended therapy; the risk of the target event; and varying patient values.

Table 2 in the original guideline document describes the balance of benefits to risk and burden, and the level of certainty based on this balance. As stated above, the more certain the balance, or lack thereof, the stronger the recommendation. Patient and community values are important considerations in clinical decision making and are factored into the grading process. In situations in which the benefits clearly do or do not outweigh the risks, it is assumed that nearly all patients would have the same preferences. For weaker recommendations, however, there may not be consistency in patient preferences.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Strength of Recommendations

- 1A** Strong recommendation
- 1B** Strong recommendation
- 1C** Strong recommendation
- 2A** Weak recommendation
- 2B** Weak recommendation
- 2C** Weak recommendation

Relationship of Strength of the Supporting Evidence to the Balance of Benefits to Risks and Burdens

Strength of Evidence	Balance of Benefits to Risks and Burdens			
	Benefits Outweigh Risks/Burdens	Risks/Burdens Outweigh Benefits	Evenly Balanced	Uncertain
High	1A	1A	2A	
Moderate	1B	1B	2B	
Low or very low	1C	1C	2C	2C

COST ANALYSIS

Health-Care Utilization and Economic Analysis

Regarding changes in health-care utilization resulting from pulmonary rehabilitation, the previous panel concluded that there was B level strength of evidence supporting the recommendation that "pulmonary rehabilitation has reduced the number of hospitalizations and the number of days of hospitalization for patients with chronic obstructive pulmonary disease (COPD)."

In the current review, some additional information is available about changes in health-care utilization after pulmonary rehabilitation. In one study, over 1 year of follow-up the number of patients admitted to the hospital was similar in both the pulmonary rehabilitation group and the control group (40 of 99 vs 41 of 101 patients); however, the number of days spent in the hospital was significantly lower in the rehabilitation patients (10.4 vs 21.0 days, respectively). In a subsequent cost-utility economic analysis of the results in this pulmonary rehabilitation trial, the authors found that the cost per quality-adjusted life-years indicated that pulmonary rehabilitation was, in fact, cost-effective and would likely result in financial benefits to the health-care system (quality-adjusted life-year is a measure of effectiveness that is commonly used in cost-effectiveness analyses, reflecting survival adjusted for quality of life, or the value that individuals place on expected years of life). In another reported trial, results indicated a significant decrease in yearly hospitalizations and exacerbations >2 years after pulmonary rehabilitation.

A cost analysis that was associated with a randomized controlled trial (RCT) of a 2-month inpatient pulmonary rehabilitation program (followed by 4 months of outpatient supervision) produced statistically and clinically significant improvements in measures of health-related quality of life (HRQOL) and exercise capacity. Although the cost analysis in this study was driven largely by the inpatient phase of the program and, as such, is not applicable to the large majority of outpatients programs, the authors found cost-effectiveness ratios for the chronic respiratory disease questionnaire (CRDQ) component measures to range from \$19,011 to \$35,142 (in Canadian dollars) per unit difference. Even with the added costs associated with the inpatient program, these cost/benefit ratios are within a range that has been typically considered to represent reasonable cost-effectiveness for other widely advocated health-care programs.

In a small randomized trial of early pulmonary rehabilitation after hospitalization for acute exacerbation, the trial authors reported a significant reduction in emergency department visits and a trend toward reduced numbers of hospital admissions and days spent in the hospital over the 3 months after hospital discharge in the pulmonary rehabilitation group compared to the usual-care group. Also, in a multicenter randomized trial of a self-management program of patients with severe COPD, the authors reported a significant reduction in the numbers of hospital admissions and days spent in the hospital in the year following the intervention compared to the usual-care control group.

In a multicenter, observational evaluation of the effectiveness of pulmonary rehabilitation in centers throughout California, self-reported measures of health-care utilization were found to decrease substantially over 18 months of observation after the rehabilitation intervention. In the 3-month period prior to pulmonary rehabilitation, 522 patients reported 1,357 hospital days (2.4 per patient), 209 urgent care visits (0.4 per patient), 2,297 physician office visits (4.4 per patient), and 1,514 telephone calls to physicians (2.7 per patient). Over the

18 months after rehabilitation, the average per patient reported health-care utilization (in the past 3 months) was reduced approximately 60% for hospital days, 40% for urgent care visits, 25% for physician office visits, and 30% for telephone calls. It should be recognized that the results of an observational, noncontrolled study like this may be influenced by the selection of patients for pulmonary rehabilitation shortly after an exacerbation or episode of increased health-care utilization.

METHOD OF GUIDELINE VALIDATION

Not stated

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Not stated

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions for the strength of evidence and recommendation grades (**1A-2C**) follow the recommendations. In addition to recommendations, the committee included several statements when it thought that there was insufficient evidence to make a specific recommendation. These statements are included along with the recommendations but are not graded.

Definition of Pulmonary Rehabilitation

The American Thoracic Society and the European Respiratory Society have recently adopted the following definition of pulmonary rehabilitation: Pulmonary rehabilitation is an evidence-based, multidisciplinary, and comprehensive intervention for patients 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 through stabilizing or reversing systemic manifestations of the disease. Comprehensive pulmonary rehabilitation programs include patient assessment, exercise training, education, and psychosocial support.

This definition focuses on three important features of successful rehabilitation:

1. *Multidisciplinary*: Pulmonary rehabilitation programs utilize expertise from various healthcare disciplines that is integrated into a comprehensive, cohesive program tailored to the needs of each patient.
2. *Individual*: Patients with disabling lung disease require individual assessment of needs, individual attention, and a program designed to meet realistic individual goals.
3. *Attention to physical and social function*: To be successful, pulmonary rehabilitation pays attention to psychological, emotional, and social problems as well as physical disability, and helps to optimize medical therapy to improve lung function and exercise tolerance.

The interdisciplinary team of health-care professionals in pulmonary rehabilitation may include physicians; nurses; respiratory, physical, and occupational therapists; psychologists; exercise specialists; 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.

Summary of Recommendations for Pulmonary Rehabilitation

1. A program of exercise training of the muscles of ambulation is recommended as a mandatory component of pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD). **Grade of Recommendation 1A**
2. Pulmonary rehabilitation improves the symptom of dyspnea in patients with COPD. **Grade of Recommendation 1A**
3. Pulmonary rehabilitation improves health related quality of life (HRQOL) in patients with COPD. **Grade of Recommendation 1A**
4. Pulmonary rehabilitation reduces the number of hospital days and other measures of health-care utilization in patients with COPD. **Grade of Recommendation 2B**
5. Pulmonary rehabilitation is cost-effective in patients with COPD. **Grade of Recommendation 2C**
6. There is insufficient evidence to determine if pulmonary rehabilitation improves survival in patients with COPD. **No recommendation is provided.**
7. There are psychosocial benefits from comprehensive pulmonary rehabilitation programs in patients with COPD. **Grade of Recommendation 2B**
8. Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. **Grade of Recommendation 1A** Some benefits, such as HRQOL, remain above control at 12 to 18 months. **Grade of Recommendation 1C**
9. Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. **Grade of Recommendation 2C**
10. Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. **Grade of Recommendation 2C**
11. Lower-extremity exercise training at higher exercise intensity produces greater physiologic benefits than lower-intensity training in patients with COPD. **Grade of Recommendation 1B**
12. Both low- and high-intensity exercise training produce clinical benefits for patient with COPD. **Grade of Recommendation 1A**
13. Addition of a strength training component to a program of pulmonary rehabilitation increases muscle strength and muscle mass. **Strength of evidence: 1A**
14. Current scientific evidence does not support the routine use of anabolic agents in pulmonary rehabilitation for patients with COPD. **Grade of Recommendation 2C**
15. Unsupported endurance training of the upper extremities is beneficial in patients with COPD and should be included in pulmonary rehabilitation programs. **Grade of Recommendation 1A**
16. The scientific evidence does not support the routine use of inspiratory muscle training as an essential component of pulmonary rehabilitation. **Grade of Recommendation 1B**

17. Education should be an integral component of pulmonary rehabilitation. Education should include information on collaborative self-management and prevention and treatment of exacerbations. **Grade of Recommendation 1B**
18. There is minimal evidence to support the benefits of psychosocial interventions as a single therapeutic modality. **Grade of Recommendation 2C**
19. Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion support the inclusion of psychosocial interventions as a component of comprehensive pulmonary rehabilitation programs for patients with COPD.
20. Supplemental oxygen should be used during rehabilitative exercise training in patients with severe exercise-induced hypoxemia. **Grade of Recommendation: 1C**
21. Administering supplemental oxygen during high-intensity exercise programs in patients without exercise-induced hypoxemia may improve gains in exercise endurance. **Grade of Recommendation: 2C**
22. As an adjunct to exercise training in selected patients with severe COPD, noninvasive ventilation produces modest additional improvements in exercise performance. **Grade of Recommendation: 2B**
23. There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD. **No recommendation is provided**
24. Pulmonary rehabilitation is beneficial for some patients with chronic respiratory diseases other than COPD. **Grade of Recommendation: 1B**
25. Although no recommendation is provided since scientific 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 treatment strategies common to both COPD and non-COPD patients.

Definitions:

Strength of Evidence

High (A) Well designed randomized controlled trials (RCTs) yielding consistent and directly applicable results. In some circumstances, high-quality evidence can be the result of overwhelming evidence from observational studies.

Moderate (B) Evidence based on RCTs with limitations that may include methodological flaws or inconsistent results. Studies other than RCTs that may yield strong results are also included in the moderate-quality category.

Low (C) Evidence from other types of observational studies (the weakest type of evidence).

Grades of Recommendations and Estimates of Net Benefit

- 1A** Strong recommendation
- 1B** Strong recommendation
- 1C** Strong recommendation
- 2A** Weak recommendation

2B Weak recommendation

2C Weak recommendation

Relationship of Strength of the Supporting Evidence to the Balance of Benefits to Risks and Burdens

	Balance of Benefits to Risks and Burdens			
Strength of Evidence	Benefits Outweigh Risks/Burdens	Risks/Burdens Outweigh Benefits	Evenly Balanced	Uncertain
High	1A	1A	2A	
Moderate	1B	1B	2B	
Low or very low	1C	1C	2C	2C

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (refer to "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate use of pulmonary rehabilitation

POTENTIAL HARMS

Not stated

CONTRAINDICATIONS

CONTRAINDICATIONS

Severe osteoporosis is a contraindication to strength training.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

The evidence-based practice guidelines published by The American College of Chest Physicians (ACCP) incorporate data obtained from a comprehensive literature review of the most recent studies then available. Guidelines are

intended for general information only, are not medical advice, and do not replace professional medical care and physician advice, which always should be sought for any specific condition. Furthermore, guidelines may not be complete or accurate because new studies that may have become available late in the process of guideline development may not be incorporated into any particular guideline before it is disseminated. The ACCP and its officers, regents, governors, executive committee, members, and employees (the ACCP Parties) disclaim all liability for the accuracy or completeness of a guideline, and disclaim all warranties, express or implied. Guideline users always are urged to seek out newer information that might impact the diagnostic and treatment recommendations contained within a guideline. The ACCP Parties further disclaim all liability for any damages whatsoever (including, without limitation, direct, indirect, incidental, punitive, or consequential damages) arising out of the use, inability to use, or the results of use of a guideline, any references used in a guideline, or the materials, information, or procedures contained in a guideline, based on any legal theory whatsoever and whether or not there was advice of the possibility of such damages.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Quick Reference Guides/Physician Guides

For information about [availability](#), see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Ries AL, Bauldoff GS, Carlin BW, Casaburi R, Emery CF, Mahler DA, Make B, Rochester CL, Zuwallack R, Herrerias C. Pulmonary Rehabilitation: Joint

ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest 2007 May;131(5 Suppl):4S-42S. [211 references] [PubMed](#)

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1997 (revised 2007 May)

GUIDELINE DEVELOPER(S)

American Association of Cardiovascular and Pulmonary Rehabilitation - Medical Specialty Society
American College of Chest Physicians - Medical Specialty Society

SOURCE(S) OF FUNDING

Not stated

GUIDELINE COMMITTEE

ACCP/AACVPR Pulmonary Rehabilitation Guidelines Panel

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Andrew L. Ries, MD, MPH, FCCP (*Chair*); Gerene S. Bauldoff, RN, PhD, FCCP; Brian W. Carlin, MD, FCCP; Richard Casaburi, PhD, MD, FCCP; Charles F. Emery, PhD; Donald A. Mahler, MD, FCCP; Barry Make, MD, FCCP; Carolyn L. Rochester, MD; Richard ZuWallack, MD, FCCP; Carla Herrerias, MPH

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

At several stages during the guideline development period, panel members were asked to disclose any conflict of interest. These occurred at the time the panel was nominated, at the first face-to-face meeting, the final conference call, and prior to publication. Written forms were completed and are on file at the American College of Chest Physicians (ACCP).

The authors have reported to the ACCP that no significant conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based guidelines. ACCP/AACVPR Pulmonary Rehabilitation

Guidelines Panel. American College of Chest Physicians. American Association of Cardiovascular and Pulmonary Rehabilitation. Chest 1997 Nov 5;112(5):1363-96.

GUIDELINE AVAILABILITY

Electronic copies: Available to subscribers of [Chest - The Cardiopulmonary and Critical Care Journal](#).

Print copies: Available from the American College of Chest Physicians, Products and Registration Division, 3300 Dundee Road, Northbrook IL 60062-2348.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- Pulmonary rehabilitation executive summary. Joint American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation Evidence-Based Clinical Practice Guidelines. Chest 2007 May; 131(5 Suppl):S1-3.

Electronic copies: Available to subscribers of [Chest - The Cardiopulmonary and Critical Care Journal](#).

Print copies: Available from the American College of Chest Physicians, Products and Registration Division, 3300 Dundee Road, Northbrook IL 60062-2348.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on November 19, 1999. The information was verified by the guideline developer as of December 15, 1999. This NGC summary was updated by ECRI Institute on July 10, 2007. The updated information was verified by the guideline developer on July 16, 2007.

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