Authors' objectives
To review the scientific basis for pulmonary rehabilitation in adults with chronic obstructive pulmonary disease (COPD).

Searching
Published studies were identified by searching the National Library of Medicine databases, and bibliographies from recent studies and review articles. Experts were also contacted for information. The authors did not state the years searched or whether any languages restrictions were applied.

Study selection
Study designs of evaluations included in the review
Controlled trials (randomised or unrandomised), observational studies, and expert opinions.

Specific interventions included in the review
All original scientific work addressing the rationale for using specific modalities in rehabilitation programmes and studies assessing pulmonary rehabilitation as an intervention, were included. The specific modalities included were lower extremity training, upper extremity training, ventilatory muscle training, and psychosocial interventions.

Participants included in the review
COPD. The participants were patients with COPD who were undergoing rehabilitation. The majority of the patients were men, and over the age of 50 years. The settings in the samples varied from in-patient rehabilitation programmes, to home-based programmes.

Outcomes assessed in the review
The outcomes assessed included lung function, exercise endurance, psychological distress, dyspnoea, quality of life, health care utilisation, and survival.

How were decisions on the relevance of primary studies made?
Two members of the review panel reviewed the literature and identified appropriate studies.

Assessment of study quality
The strength of the scientific evidence for each modality and outcome of interest was graded. This reflected the quality of the studies (study design and methods) and the consistency of the results. Grade A reflected scientific evidence provided by well-designed, well-conducted controlled trials (randomised or non-randomised) with statistically-significant results that consistently supported the guideline recommendations. Grade B represented scientific evidence provided by observational studies or by controlled trials, with less consistent results to support the guideline recommendation. Grade C reflected expert opinion that supported the guideline recommendation because the available scientific evidence did not present consistent results, or because controlled trials were lacking. The panel assigned each study a letter grade, designating the overall strength of scientific evidence.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the authors performed the data extraction.

Methods of synthesis
How were the studies combined?
A narrative method was used to combine the studies.

How were differences between studies investigated?
Differences between the studies were not investigated.

Results of the review
There were 14 studies (12 randomised, 2 non-randomised) of lower extremity training involving 564 participants;
6 studies (randomised) of upper extremity training involving 132 participants;
11 (randomised) of ventilatory muscle training involving 334 participants;
12 psychosocial or behavioural studies (4 randomised, controlled; 8 observational) involving 584 participants;
6 studies (5 randomised, 1 non-randomised) which reported the effects of rehabilitation on dyspnoea involving 376 participants;
9 studies (6 randomised, 3 non-randomised) of quality of life involving 570 participants;
12 studies (2 randomised, 2 non-randomised, 8 observational) on health care utilisation involving 1,075 participants; and
6 studies (1 randomised, 1 non-randomised, 4 observational) on survival involving 2,734 participants.

Lung function and exercise endurance.

Lower extremity training: exercise tolerance and ability increased in most of the studies. However, the training programme and the methods used to test exercise tolerance varied, and may be affected by effort. Peak oxygen consumption and minute ventilation showed variable results, and many studies showed no significant difference after the training.

Upper extremity training: exercise tolerance and ability increased in all of the studies. However, the training programme and the methods used to test exercise tolerance varied, and may be affected by effort. Also, some studies tested improvements in arm exercises only. Peak oxygen consumption and minute ventilation were tested in two and one studies, respectively, and all showed decreases.

Ventilatory muscle training.

The maximal inspiratory pressure was only improved in those patients who received more intensive training. Exercise tolerance was improved, although it was not tested in all studies, and those that did test exercise tolerance often involved both exercise training and ventilatory training.

Psychological distress.

Psychological distress was not reduced in randomised controlled trials of rehabilitation programmes. Observational studies without control groups showed a reduction in anxiety and depression, but these results may only occur in those patients whose distress is the greatest.

Dyspnoea (breathlessness).

The symptom of dyspnoea was reduced significantly in all of the included studies, both during activities of daily living and exercise.

Quality of life.
The results of rehabilitation programmes on quality of life were variable, with uncontrolled trials showing a more consistently favourable result. Two of the three randomised, controlled trials using full rehabilitation programmes found improved quality of life using the Chronic Respiratory Disease Questionnaire.

Health care utilisation.

Non significant decreases in hospitalisation and duration of in-patient stay were found in controlled studies, with observational studies showing significant results.

Survival.

Assessing survival in patients with COPD was difficult due to variation in the expected survival, based on age, disease severity, location (high altitude or not), and type of COPD (reactive or nonreactive). One randomised controlled trial found no significant difference in survival, while one non-randomised controlled trial reported greater survival (statistical analysis not reported). Observational studies also indicated a possible survival benefit of pulmonary rehabilitation when compared with historical controls.

Authors’ conclusions

Lower extremity training improved exercise tolerance and is recommended as a part of a pulmonary rehabilitation programme (evidence A). Strength and endurance training improved arm function; arm exercises should be included in pulmonary rehabilitation (evidence B). The scientific evidence did not support the routine use of ventilatory muscle training; it may be considered for individual patients (evidence B). The evidence also did not support the benefits of short-term psychosocial interventions; longer-term interventions may be beneficial; and expert opinion supported the inclusion of educational and psychosocial intervention components in pulmonary rehabilitation (evidence C). Pulmonary rehabilitation improved dyspnoea (evidence A), improved health-related quality of life (evidence B), reduced the number of hospitalisations and days of hospitalisation (evidence B), and may improve survival (evidence C).

CRD commentary

This was a comprehensive review of pulmonary rehabilitation, with clearly defined study objectives, inclusion criteria, a validity grading system, and well-described primary data (via tables). The search was broad, but could have included foreign language and unpublished literature. The data were nicely synthesised as conclusions and recommendations within the text.

The relevance of this review to the subject area is only valid if the reader understands that the conclusion statements are tempered by the 'grade' of evidence supporting them. Some of the concluding statements are strong for the level of evidence.

Implications of the review for practice and research

The authors summarise the research implications into a set of questions. The main questions which need to be answered are as follows.

What is the role of pulmonary rehabilitation in other lung diseases?

How does pulmonary rehabilitation differ for women with COPD?

What are the long-term benefits?

What are the essential components?

What are the optimal methods for measuring outcomes?

What is the cost-effectiveness of pulmonary rehabilitation programmes?
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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.