Meta-analysis of the effects of respiratory rehabilitation programmes on exercise capacity in accordance with programme characteristics

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CRD summary
This study investigated the effects of respiratory rehabilitation programmes on exercise capacity in terms of programme characteristics. It concluded that exercise programmes were not associated with differences in terms of the locations where the rehabilitation programmes were applied, nor were they affected by programme content, measurement time, parts of the body targeted for exercise, or the duration and frequency of the programme. The authors' findings reflect the evidence presented and are likely to be reliable.

Authors' objectives
To investigate the effects of respiratory rehabilitation programmes on exercise capacity, in terms of programme characteristics.

Searching
MEDLINE and CINAHL were searched, but the period over which the search was conducted was not reported. In addition, study bibliographies were checked for further studies, including unpublished studies and meta-analyses. The search terms were reported.

Study selection
Study designs of evaluations included in the review
Studies that used a randomised experimental design were eligible for inclusion. Single-group pre- and post-experimental studies were excluded.

Specific interventions included in the review
All studies investigating the effects of respiratory rehabilitation programmes on exercise capacity were eligible for inclusion. Components of exercise training included walking, stair climbing, arm and cycle ergometry, treadmill, shuttle walking and weight lifting. In most studies several types of training were applied at the same time.

Participants included in the review
Studies in patients with chronic obstructive pulmonary disease (COPD) were eligible for inclusion.

Outcomes assessed in the review
Studies reporting the effects of respiratory rehabilitation programmes were eligible for inclusion. If more than one outcome variable was measured in a study, the variable used most frequently in other studies was selected. The outcomes included dyspnoea, 6-minute walk distance, 12-minute walk distance and breathlessness at maximum exercise. The included studies were required to report outcome measures as mean values and standard deviations.

How were decisions on the relevance of primary studies made?
The authors did not state how the studies were selected for inclusion in the review, or how many reviewers performed the selection.

Assessment of study quality
A three-point evaluation was undertaken by both authors and agreement assessed using the kappa statistic. The evaluation included items on: whether outcome variables were measured in a consistent way without bias; whether the investigators that performed the assessment were blinded to treatment group details; and whether patients were treated equally.
Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
Pooled estimates of effect size (standard mean difference) were estimated using a random-effects model. The presence of publication bias was tested by examining whether effect sizes were dependent on sample size. The potential impact of publication bias was assessed using a fail-safe number to identify the number of unpublished studies with non significant findings that would be needed to contradict the conclusion of the meta-analysis.

How were differences between studies investigated?
The chi-squared test was used to assess between-study heterogeneity before combining effect sizes. Where the study characteristics were continuous variables, meta-regression was undertaken to test whether the combined effect size of programmes on exercise capacity was influenced by key study characteristics; where the study characteristics were dichotomous variables, meta-analysis of variance was used. Sensitivity analyses were used to examine the impact of study quality on effect size.

Results of the review
Nineteen randomised clinical trials were included. The combined sample size was 946. The mean age of the participants was 64.7 (+/- 4.48) years (range: 59.5 to 67.5) and the mean sample size was 49.79 (+/- 39.27) (range: 14 to 184).

The majority of the studies had a quality score of two or more (numbers not reported) and eight scored three out of three. The fail-safe number was 37.16, implying that publication bias was unlikely to affect the results of the meta-analysis.

The combined effect size of programmes on exercise capacity was not affected by the duration and frequency of the programmes, the participants' forced expiratory volume in one second, the age of the participants, or methodological quality or sample size of the studies. The combined effect sizes of the programmes did not differ by whether a programme was hospital based or not, both were statistically significant.

The combined effect size of the programmes was not affected by programme comprehensiveness. The pooled effect sizes of both comprehensive and exercise-only programmes were statistically significant.

The combined effect size of lower extremity training programmes on exercise capacity was not significantly different to that of combined low- and upper-extremity exercise training. The pooled effect sizes of both lower extremity and combined low- and upper-extremity trained groups were statistically significant.

The combined effect size of programmes was not affected by exercise intensity. The pooled effect sizes of both a maximally and submaximally exercised group were statistically significant.

The combined effect size of programmes was not affected by measurement time. The pooled effect sizes of both impact and maintenance effect were statistically significant.

Authors' conclusions
The effects of exercise programmes were not associated with differences in the settings of rehabilitation programmes, nor were they affected by programme content, measurement time, parts of the body targeted for exercise, or the duration and frequency of the programme.

CRD commentary
The review question was clear and was supported by appropriate inclusion criteria relating to the participants, interventions and study designs. Restricting the search to two electronic databases and study bibliographies does not...
provide reassurance that all relevant data were included in the review. Attempts were made to minimise publication bias but steps taken to minimise bias for data extraction were less clear. The authors' findings appear to be consistent with the evidence in the paper and are likely to be reliable.

**Implications of the review for practice and research**

Practice: The authors did not state any implications for practice.

Research: The authors stated that further studies to examine the effects of respiratory rehabilitation programmes on exercise endurance are required.

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