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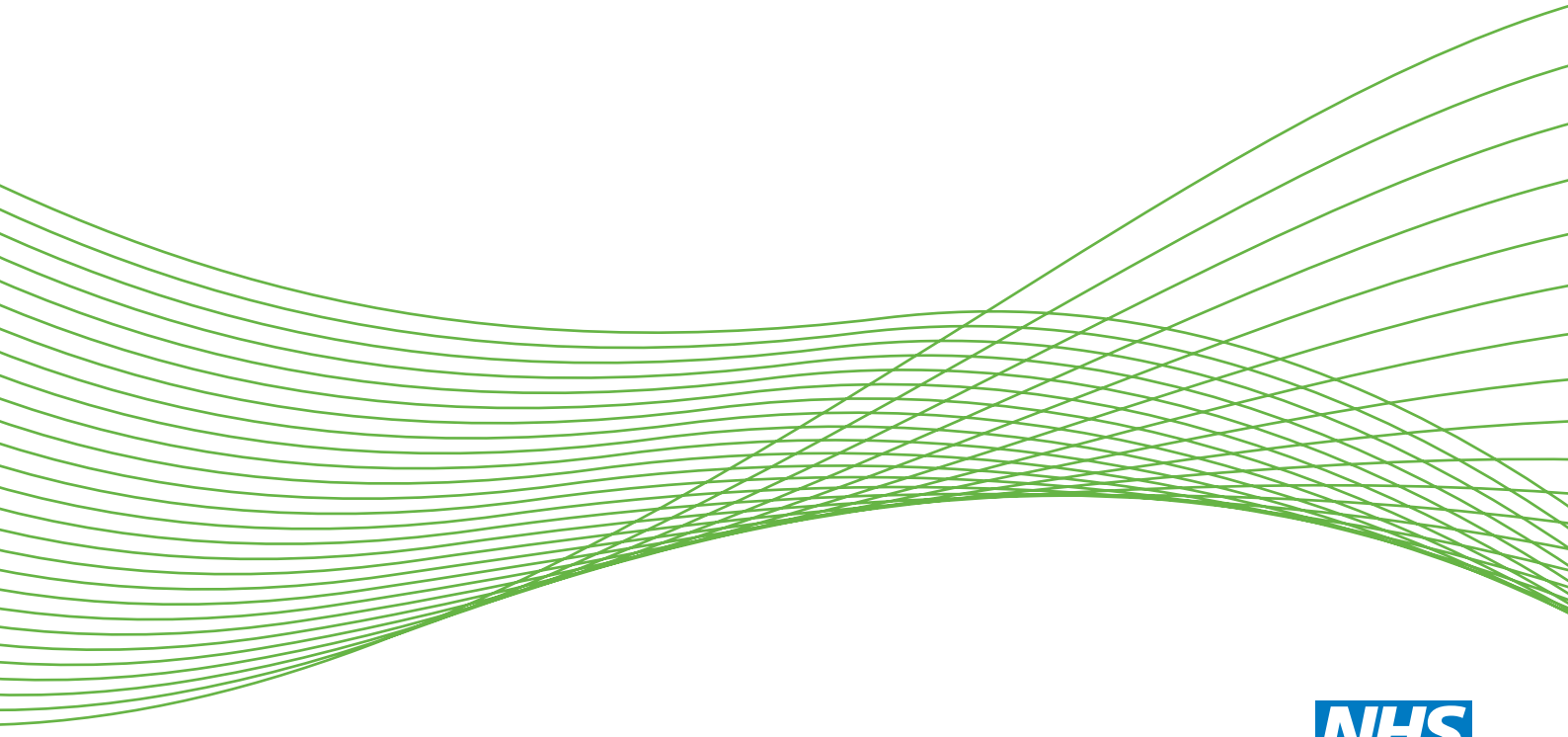

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Abstract

Supported self-management for patients with moderate to severe chronic obstructive pulmonary disease (COPD): an evidence synthesis and economic analysis

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Background: Self-management (SM) support for patients with chronic obstructive pulmonary disease (COPD) is variable in its coverage, content, method and timing of delivery. There is insufficient evidence for which SM interventions are the most effective and cost-effective.

Objectives: To undertake (1) a systematic review of the evidence for the effectiveness of SM interventions commencing within 6 weeks of hospital discharge for an exacerbation for COPD (review 1); (2) a systematic review of the qualitative evidence about patient satisfaction, acceptance and barriers to SM interventions (review 2); (3) a systematic review of the cost-effectiveness of SM support interventions within 6 weeks of hospital discharge for an exacerbation of COPD (review 3); (4) a cost-effectiveness analysis and economic model of post-exacerbation SM support compared with usual care (UC) (economic model); and (5) a wider systematic review of the evidence of the effectiveness of SM support, including interventions (such as pulmonary rehabilitation) in which there are significant components of SM, to identify which components are the most important in reducing exacerbations, hospital admissions/readmissions and improving quality of life (review 4).

Methods: The following electronic databases were searched from inception to May 2012: MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and Science Citation Index [Institute of Scientific Information (ISI)]. Subject-specific databases were also searched: PEDro physiotherapy evidence database, PsycINFO and the Cochrane Airways Group Register of Trials. Ongoing studies were sourced through the *meta*Register of Current

Controlled Trials, International Standard Randomised Controlled Trial Number database, World Health Organization International Clinical Trials Registry Platform Portal and ClinicalTrials.gov. Specialist abstract and conference proceedings were sourced through ISI's Conference Proceedings Citation Index and British Library's Electronic Table of Contents (Zetoc). Hand-searching through European Respiratory Society, the American Thoracic Society and British Thoracic Society conference proceedings from 2010 to 2012 was also undertaken, and selected websites were also examined. Title, abstracts and full texts of potentially relevant studies were scanned by two independent reviewers. Primary studies were included if ≈90% of the population had COPD, the majority were of at least moderate severity and reported on any intervention that included a SM component or package. Accepted study designs and outcomes differed between the reviews. Risk of bias for randomised controlled trials (RCTs) was assessed using the Cochrane tool. Random-effects meta-analysis was used to combine studies where appropriate. A Markov model, taking a 30-year time horizon, compared a SM intervention immediately following a hospital admission for an acute exacerbation with UC. Incremental costs and quality-adjusted life-years were calculated, with sensitivity analyses.

Results: From 13,355 abstracts, 10 RCTs were included for review 1, one study each for reviews 2 and 3, and 174 RCTs for review 4. Available studies were heterogeneous and many were of poor quality. Meta-analysis identified no evidence of benefit of post-discharge SM support on admissions [hazard ratio (HR) 0.78, 95% confidence interval (CI) 0.52 to 1.17], mortality (HR 1.07, 95% CI 0.74 to 1.54) and most other health outcomes. A modest improvement in health-related quality of life (HRQoL) was identified but this was possibly biased due to high loss to follow-up. The economic model was speculative due to uncertainty in impact on readmissions. Compared with UC, post-discharge SM support (delivered within 6 weeks of discharge) was more costly and resulted in better outcomes (£683 cost difference and 0.0831 QALY gain). Studies assessing the effect of individual components were few but only exercise significantly improved HRQoL (3-month St George's Respiratory Questionnaire 4.87, 95% CI 3.96 to 5.79). Multicomponent interventions produced an improved HRQoL compared with UC (mean difference 6.50, 95% CI 3.62 to 9.39, at 3 months). Results were consistent with a potential reduction in admissions. Interventions with more enhanced care from health-care professionals improved HRQoL and reduced admissions at 1-year follow-up. Interventions that included supervised or unsupervised structured exercise resulted in significant and clinically important improvements in HRQoL up to 6 months.

Limitations: This review was based on a comprehensive search strategy that should have identified most of the relevant studies. The main limitations result from the heterogeneity of studies available and widespread problems with their design and reporting.

Conclusions: There was little evidence of benefit of providing SM support to patients shortly after discharge from hospital, although effects observed were consistent with possible improvement in HRQoL and reduction in hospital admissions. It was not easy to tease out the most effective components of SM support packages, although interventions containing exercise seemed the most effective. Future work should include qualitative studies to explore barriers and facilitators to SM post exacerbation and novel approaches to affect behaviour change, tailored to the individual and their circumstances. Any new trials should be properly designed and conducted, with special attention to reducing loss to follow-up. Individual participant data meta-analysis may help to identify the most effective components of SM interventions.

Study registration: This study is registered as PROSPERO CRD42011001588.

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List of abbreviations

A&E	accident and emergency
ANCOVA	analysis of covariance
BTS	British Thoracic Society
CASP	Critical Appraisal Skills Programme
CI	confidence interval
COPD	chronic obstructive pulmonary disease
CRQ	Chronic Respiratory (Disease) Questionnaire
ED	emergency department
EMT	expiratory muscle training
EQ-5D	EuroQoL-5 Dimensions
FEV_1	forced expiratory volume in 1 second
FEV_1% pred	forced expiratory volume in 1 second percentage predicted
FVC	forced vital capacity
GHQ	General Health Questionnaire
GOLD	Global Initiative for Chronic Obstructive Lung Disease
GP	general practitioner
HADS	Hospital Anxiety and Depression Scale
HR	hazard ratio
HRQoL	health-related quality of life
HTA	Health Technology Assessment
ICER	incremental cost-effectiveness ratio
IMT	inspiratory muscle training
IQR	interquartile range
MD	mean difference
MRC	Medical Research Council
NICE	National Institute for Health and Care Excellence
OR	odds ratio
PR	pulmonary rehabilitation
PSSRU	Personal Social Services Research Unit
QALY	quality-adjusted life-year
QoL	quality of life
RCT	randomised controlled trial
RMT	respiratory muscle training
SABA	short-acting β_2-agonist
SD	standard deviation
SE	standard error
SF-36	Short Form questionnaire-36 items
SGRQ	St George's Respiratory Questionnaire
SM	self-management
UC	usual care

Plain English summary

Chronic obstructive pulmonary disease (COPD) is a lung condition that affects about 5% of adults. Patients develop cough and breathlessness, which gets worse over time, and many patients also have 'flare-ups', which can lead to being admitted to hospital for a few days. Patients should try to manage their own health (self-manage) on a daily basis – exercising, eating more healthily, taking medications properly and learning to recognise and self-treat their 'flare-ups' early. The aim is to avoid going to hospital and to maintain better quality of life.

Guidelines recommend that general practitioners and nurses should support patients to self-manage but there is insufficient information about how best to do so. As patients who have just left hospital are at a high risk of being admitted again, one approach would be to introduce a programme of self-management support at this point. However, it is unclear whether this would work or whether it would be efficient financially for the NHS.

In this report, we drew together all available evidence and showed that self-management programmes provided soon after leaving hospital might reduce future hospital admissions and improve patients' quality of life, but the results were inconclusive. However, if better research were undertaken, and programmes were proven to reduce hospital admissions, the approach would be relatively cheap to implement.

We also explored which parts of self-management programmes were the most important, and found that those that included a specific exercise plan appeared to be the most beneficial but it was difficult to be sure about other aspects.

Scientific summary

Background

Systematic reviews have shown that self-management (SM) interventions can lead to improved health-related quality of life (HRQoL) and reduced hospital admissions. However, the content and delivery of SM support varies considerably. There are unanswered questions about whether or not SM support would be effective and cost-effective if started immediately after a hospital admission for an exacerbation, and what is the most effective content and method of delivery of SM programmes.

Objectives

- To undertake a systematic review of the evidence for the effectiveness of SM interventions commencing within 6 weeks of hospital discharge for an exacerbation of chronic obstructive pulmonary disease (COPD) (review 1).
- To undertake a systematic review of the qualitative evidence about patient satisfaction, acceptance and barriers to SM interventions (review 2).
- To undertake a systematic review of the cost-effectiveness of SM support within 6 weeks of hospital discharge for an exacerbation of COPD (review 3).
- To undertake a cost-effectiveness analysis and economic model of post-exacerbation SM support compared with usual care (UC) (economic model).
- To undertake a wider systematic review of the evidence of the effectiveness of SM support including interventions [such as pulmonary rehabilitation (PR)] where there are significant components of SM, to identify which components are the most important in reducing exacerbations, hospital admissions and improving quality of life (review 4).

Methods

Systematic reviews

A comprehensive search strategy of the effectiveness of SM interventions was carried out. The following electronic databases were searched from inception to May 2012, with no language restriction: MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and Science Citation Index [Institute of Scientific Information (ISI)]. Subject-specific databases were also searched: PEDro physiotherapy evidence database, PsycINFO and the Cochrane Airways Group Register of Trials. Ongoing studies were sourced through the *meta*Register of Current Controlled Trials, International Standard Randomised Controlled Trial Number database, World Health Organization, International Clinical Trials Registry Platform Portal and ClinicalTrials.gov. Specialist abstract and conference proceedings were sourced through ISI's Conference Proceedings Citation Index and British Library's Electronic Table of Contents (Zetoc). Hand-searching through European Respiratory Society, the American Thoracic Society and British Thoracic Society conference proceedings from 2010 to 2012 was also undertaken, and selected websites were also examined.

Study selection was undertaken by two independent reviewers using predefined criteria. Full-text manuscripts were obtained of all abstracts that were likely to meet these criteria.

For review 1, randomised controlled trials (RCTs) and relevant outcomes were included. For review 2, only qualitative studies were included. For review 3, any cost-effectiveness study design was accepted. For the

wider exploratory review (review 4), only RCTs were included and the primary outcomes were pre-specified as HRQoL, hospital admissions and exacerbations.

Studies in which ≈90% of patients had COPD, and where the majority of the patients were moderately/severely affected, were included. For reviews 1–3, patients must have been discharged from hospital with acute exacerbation of their COPD within the previous 6 weeks. For review 4, there were no restrictions around time period.

Self-management was defined as including disease education, medication management, smoking cessation advice, action planning, breathing management, bronchial hygiene techniques, respiratory muscle training (RMT), exercise, correct inhaler technique, advice about nutrition, stress management, relaxation and attendance at patient support groups.

Risk of bias of the selected RCTs was assessed using the Cochrane Risk of Bias tool. The quality of the qualitative study was assessed using the Critical Appraisal Skills Programme tool for qualitative evidence, and the Drummond checklist was used to assess the cost-effectiveness study.

The results of each review were presented descriptively and in forest plots where appropriate. When meta-analysis was undertaken, continuous outcome data were pooled using mean difference with 95% confidence intervals (CIs), and hazard ratios (HRs) with 95% CI for dichotomous events. Owing to the expectation of high levels of heterogeneity, random-effects models were used throughout. The I^2-statistic was used to assess statistical heterogeneity between trials. To explore sources of heterogeneity, subgroup analyses were undertaken. Prediction intervals were calculated to describe the range in which 95% of the distribution of the effects lie. HRQoL measured by the St George's Respiratory Questionnaire (SGRQ) were reversed so that a positive result favoured the intervention group.

Economic model of cost–utility of post-discharge self-management support

A Markov model was developed to consider short-term risks of readmission and mortality, and long-term natural history of COPD. The model compared a SM intervention immediately after a hospital admission for an acute exacerbation with UC. Clinical effectiveness parameters for SM were derived from the clinical effectiveness review, specifically the risk reduction in admissions. The model was speculative; thus, although the clinical review was not conclusive, the model could assess the potential effect and the uncertainty around this assumption. Resource use and costs associated with SM and usual treatment for COPD were taken from a mixture of published and unpublished sources, and expert clinical advice. A clinical cohort of 1000 patients of mixed age, sex, smoking status and disease severity was modelled for a 30-year horizon. Incremental costs and quality-adjusted life-years (QALYs) were calculated. Extensive sensitivity analyses were carried out.

Results

Review of self-management post-discharge (review 1)

The search identified 13,355 citations, of which 836 full-text papers were assessed and 12 were included, reporting 10 RCTs. The interventions included were very heterogeneous, ranging from an exercise-only intervention to intensive integrated care at home. Studies generally had small sample sizes, frequently high risk of bias with poor reporting, high loss to follow-up (particularly for the HRQoL outcomes) and inappropriate analyses in some studies.

Meta-analysis identified no evidence of benefit of early SM support on admissions (HR 0.78, 95% CI 0.52 to 1.17; $I^2 = 70.9\%$), mortality (HR 1.07, 95% CI 0.74 to 1.54; $I^2 = 0\%$) and most other health outcomes. A modest improvement in HRQoL was identified, but this was possibly biased owing to high loss to follow-up in studies. However, the direction of effect for many outcomes (including admissions) favoured the SM intervention.

Review of qualitative studies reporting patient experience of self-management post discharge (review 2)

Only one paper from Australia with a small qualitative component was included. Patients found that the SM programme improved their communication with health-care professionals and access to resources.

Review of cost-effectiveness and costing studies post-discharge (review 3)

Only one trial from Spain met the criteria and was a hospital-at-home intervention with a substantial SM component.

The cost analysis [using 2000 price data in euros (€)] found that the home hospitalisation intervention was significantly less costly than conventional care (average cost per patient: €1255.12 vs. €2033.51; $p = 0.003$).

Economic model of self-management support post discharge

Owing to considerable uncertainty around the impact on readmissions and heterogeneity of the trial results, the model-based analysis should be viewed as speculative and, therefore, only providing estimates of the potential impact of a SM programme delivered in the post-exacerbation period.

The main drivers of the model were the effect on hospital readmissions, duration of the effect, and the cost of a SM programme. The base-case analysis showed that, compared with UC, SM support (delivered within 6 weeks of hospital discharge) was more costly but resulted in better outcomes, with a £683 cost difference and a gain of 0.0831 QALYs. To be cost-effective, a SM programme, post admission for an acute exacerbation, would need to cost no more than £2200 if the relative reduction in admissions was consistent with a HR of 0.82. The sensitivity analysis suggested that SM support had a probability of 68% of being cost-effective at a threshold incremental cost-effectiveness ratio of £20,000 per QALY, demonstrating the uncertainty around the impact of SM on readmissions.

Review of effectiveness of different models and components of self-management (review 4)

A total of 194 papers reporting 174 RCTs reported one of the three primary outcomes. The majority of populations had moderate or severe COPD and recruited participants from secondary care. Trials were generally small (47% had < 50 participants) and had short follow-up (45% up to 3 months). Most trials (163, 96.6%) reported HRQoL, 42 (24.1%) reported hospital readmissions and only 20 (11.5%) reported exacerbations. In the intervention groups, exercise was the most commonly reported component (76.9%), followed by breathing techniques and management of dyspnoea (64.2%), and general education about COPD and its management (47.2%). Seventy-three (31.9%) of the intervention arms had six or more components; 38 (16.6%) were single components, with the vast majority of these being exercise-only interventions.

Sequence generation and allocation concealment were adequate in 66 (37.9%) and 27 (15.5%) studies, respectively. Owing to lack of blinding of participants of their allocation, HRQoL results were considered at high risk of bias, except in trials with an active intervention or sham comparator. A frequent and significant risk of bias was the reporting of the characteristics of only those who completed the study, rather than those randomised.

Studies assessing the effect of individual components were few, but only exercise significantly improved patient outcomes compared with UC, which was restricted to HRQoL in the short term (SGRQ at 3-months' follow-up 4.87, 95% CI 3.96 to 5.79; $I^2 = 0\%$). This is above the minimally clinically important difference of four points for the SGRQ. Multicomponent (at least three individual components) SM interventions were likely to be more effective than UC: at 9–12 months' follow-up, SGRQ = 2.40 (95% CI 0.75 to 4.04; $I^2 = 57.9\%$), hospital admissions HR = 0.79 (95% CI 0.60 to 1.05; $I^2 = 62.6\%$). However, the degree of heterogeneity suggests that there are important features of these interventions that need to be established. Compared with UC, multicomponent SM interventions with supervised exercise (as in a PR

programme) or structured unsupervised exercise (as in a home rehabilitation programme) appear effective. SM programmes that provide an enhanced level of care and support (where there is proactive involvement of health-care professionals) may reduce hospital admissions in the medium term (at 6 months: HR 0.78, 95% CI 0.62 to 0.99; $I^2 = 55.1\%$) and improve HRQoL (SGRQ at 6 months = 4.05, 95% CI 2.23 to 5.87; $I^2 = 8.4\%$). The number of studies included in a range of other analyses which investigated modality of exercise, RMT, duration of programme and person delivering the programme were too limited to provide sufficient evidence to determine their effectiveness. No conclusive findings emerged from direct comparisons between different SM interventions. Notably, there was no evidence that action plans were effective by themselves.

Conclusions

This report provides a thorough evaluation of the available evidence from which to design future research in this area. The reviews of the effectiveness of SM interventions immediately post admission for an exacerbation revealed modest potential benefits to HRQoL, with no other statistically significant effects, but with most other outcomes (excluding mortality) favouring the SM arm. There were no good qualitative papers reporting patient experience of these early SM interventions and only one cost-effectiveness study. A speculative economic model describes the assumptions required for such an intervention to be cost-effective.

The wider exploratory review of SM interventions revealed that although some components of SM interventions were associated with positive effects of HRQoL, such as structured exercise (either within a supervised group or home based) enhanced care and multicomponent interventions, it was not possible to establish the relative roles of individual components in reducing hospital admissions and improving HRQoL.

Implications for health care

The evidence is not consistent with recommending SM support be provided post discharge from hospital after an acute exacerbation of COPD. However, the risk of readmission is so high that further research is needed to establish whether or not some aspects of SM for some patients might be an effective approach.

It is difficult to recommend specific components that should be included in SM support interventions in general. The evidence is most consistent with exercise being an important and effective component, particularly in a supervised or structured unsupervised format. However, the evidence is insufficient to establish the relative importance of other aspects.

Recommendations for research

1. Current interventions to support patient SM delivered post discharge cannot currently be recommended because interventions are heterogeneous and methodology problematic, and, despite there being potential benefit in terms of HRQoL, there is not enough good evidence to be sure that clinical outcomes could be improved. Therefore:

    i. High-quality studies should be undertaken among patients with COPD post discharge.
    ii. This should include qualitative work to explore barriers and facilitators to SM when patients have recently had an exacerbation, exploration of novel approaches to affect behaviour change and exploration of approaches tailored to the individual and their circumstances.
    iii. New approaches should be evaluated by properly designed and conducted trials, with special attention to reducing loss to follow-up.

2. Owing to the heterogeneity and complexity of interventions, it was not possible to unpick the most important components of SM interventions in general, or to confirm whether they improve clinical outcomes. It is clear that action plans alone do not seem to work in their present form, but that structured exercise and more heavily supported interventions (which may not usually be defined as SM) might work better. Therefore:

    i. Further in-depth work using individual participant data (e.g. an individual participant data meta-analysis) should be carried out to try to identify which are the most effective components of interventions and identify patient-specific factors that may modify this. This work is ongoing by other researchers.
    ii. Future studies might try to identify the characteristics of patients who are more likely to be able to self-manage and consider a more targeted approach.
    iii. Further qualitative work is needed to explore patients' barriers and facilitators to SM interventions.
    iv. Novel approaches to influence behaviour change and to help patients manage or prevent exacerbations should be explored, first using qualitative studies and then properly designed and conducted RCTs.
    v. Most trials include a mixture of components; more trials teasing out the individual elements either as lone interventions, or with the addition of one component, would be useful.

3. Recommendations for the design and conduct of future RCTs of interventions to support patient SM:

    i. In general new trials should adhere to modern standards of design, conduct and reporting in order to reduce risks of bias, for example, blinding of outcome assessment, attempts to maximise follow-up or methods to impute this, reporting of the characteristics of all randomised patients.
    ii. The behaviour change theories and strategies that underpin COPD SM interventions need to be better characterised and described.
    iii. A clear framework for describing and classifying SM interventions and their comparators is required.
    iv. Trials need to be adequately powered to detect a clinically relevant difference and long enough to assess changing effects over time. There should be clear reporting of outcomes to include self-efficacy, behaviour change and clinical outcomes, such as hospital admissions and exacerbations.
    v. Given the wide range of HRQoL outcomes available, it would be useful to standardise their use within COPD research and ensure that they are reported accurately within publications.
    vi. Statistical analysis methods should be improved, in particular (1) analysis of HRQoL outcomes should routinely adjust for baseline values to overcome baseline imbalance, account for correlation between final score and baseline score, and increase statistical power; and (2) time-to-event outcomes should be analysed using suitable analyses that allow for differential patient follow-up and summarised using HRs (rather than odds ratios).

Study registration

This study is registered as PROSPERO CRD42011001588.

Funding

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Chapter 1 Background

Chronic obstructive pulmonary disease: definition, prognosis and burden

Chronic obstructive pulmonary disease (COPD) is a long-term condition characterised by 'persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles and gases'.[1] The most important cause of COPD is cigarette smoking, although other risk factors are thought to be indoor and outdoor air pollution, occupational exposures and diet.[2] Over time, patients experience increasing breathlessness and more frequent exacerbations of respiratory symptoms, leading to increasing disability, reduced quality of life (QoL) and often repeated hospitalisations.[1]

Chronic obstructive pulmonary disease affects 5–10% of people worldwide,[3] is rising in prevalence,[4] and is a leading cause of death.[5] In the UK it is the second most common cause of emergency admissions,[6] costing the NHS over £800M per year.[7] Increasing recognition of the importance of this disease[8,9] culminated in a new National Clinical Outcomes Strategy in 2011.[6]

Diagnosis and severity of chronic obstructive pulmonary disease

A diagnosis of COPD is suspected among people with breathlessness or cough and is supported by post-bronchodilator spirometry to confirm irreversible airflow obstruction.[10] Although definitions of airflow obstruction are inconsistent and controversial,[11] National Institute for Health and Care Excellence (NICE) guidance for COPD currently defines airflow obstruction when the ratio of forced expiratory volume in 1 second (FEV_1) to forced vital capacity (FVC) is < 0.7 (i.e. $FEV_1/FVC < 0.7$).[10] Despite the requirement for confirmation with spirometry, there are many people with a clinical diagnosis of COPD who do not meet these spirometric criteria.[12] Late-onset asthma, other comorbidities and difficulty obtaining spirometry data may contribute to misdiagnoses.

Severity of airflow obstruction in the UK is graded using categories of FEV_1 as a percentage of predicted normal values of a healthy reference population (*Table 1*),[10] although these definitions may vary across countries, and have changed over time.

Severity of airflow obstruction does not necessarily reflect either the level of disability experienced or the frequency of exacerbation and composite measures to capture the global impact of the disease have been proposed.[1] However, they are not yet widely used as the basis for treatment decisions. Most research

TABLE 1 Current UK categories of airflow limitation

Category	FEV_1% pred
Mild	> 80
Moderate	50–79
Severe	30–49
Very severe	< 30

FEV_1% pred, forced expiratory volume in 1 second percentage predicted.

studies evaluating treatments use FEV_1% pred (forced expiratory volume in 1 second percentage predicted) to select and describe patients. FEV_1 is also often used as an outcome measure to describe prognosis of patients, as are clinical measures (such as dyspnoea and exacerbations), global measures such as health-related quality of life (HRQoL) and health service utilisation (e.g. hospital admissions).

Exacerbations of chronic obstructive pulmonary disease

Exacerbations or 'flare-ups' of COPD occur in approximately 50–60% of moderate/severe patients with COPD, per year, in published cohorts and trials[13,14] and similar rates are also observed in primary care (unpublished data from the Birmingham COPD cohort study). They are a characteristic component of disease progression, often requiring hospitalisation[1] and are associated with long-term poor outcome. Exacerbations are caused primarily by viral respiratory infections, particularly the common cold (associated with about two-thirds of exacerbations).[15] They result in worsening of a patient's symptoms for several days, this being more frequent during winter months.[16]

Approximately 15% of patients with COPD per year have exacerbations that are severe enough to lead to hospital admission,[7] which contributes to over half of the total direct costs of COPD to the NHS.[7] Readmission for an exacerbation within 3 months is high at > 30%,[17] as is 30-day mortality. Exacerbations are often not independent events, and there are a group of people who are frequent exacerbators.[18] Exacerbations are usually treated with an increase in usual medication, a course of antibiotics and/or steroids.[10]

Management of chronic obstructive pulmonary disease

In early-stage disease patients may not display or recognise their symptoms but, as the disease progresses, varying degrees of cough, sputum, wheeze and dyspnoea[1] may develop until eventually patients may require long-term oxygen therapy.[10] Other than the acute treatment of exacerbations, therapy is aimed at reducing progression and managing symptoms and is primarily based around smoking cessation, inhaled medications, pulmonary rehabilitation (PR) and, increasingly, more preventative disease management approaches [including self-management (SM)].[10]

Management of long-term conditions in the UK

More than 15 million people in England are living with long-term conditions such as COPD, diabetes, heart disease and asthma.[19] Long-term conditions represent > 70% of hospital bed-days and more than half of general practitioner (GP) consultations, and account for at least 70% of the total health and social care budget.[19] For patients, long-term conditions reduce QoL and ability to carry out daily tasks, as well as contributing to premature mortality. In the past, treatment of people with long-term conditions would have been more reactive. However, in 2004, the NHS Improvement Plan set out the plans for the future care of these patients by focusing on avoiding admissions and caring for patients at the primary care level, and encouraging patients to manage their own condition (SM).[20]

Patients access health-care professionals relatively infrequently and, therefore, in order to optimise their health patients must be able to manage their own condition successfully on a daily basis. Support should be available to help patients (and their families/carers) manage their own condition and make healthier choices about their diet, physical activity and lifestyle.[20] Since the NHS Improvement Plan was published, this approach has been embedded in subsequent policy documents,[21] which clearly emphasise the important role of SM. However, it is clear that clinicians are often reluctant to take this approach and, therefore, the support for patient SM is likely to be suboptimal.[19]

Surveys indicate that > 90% of patients with long-term conditions would like to become more active self-managers, although in many conditions report insufficient knowledge or support to do so.[22]

Self-management: definition and models

'Self-management' has been defined as the ability of a patient to deal with all that a chronic disease entails, including symptoms, treatment, physical and social consequences and lifestyle changes.[23] The exact nature of SM will vary from condition to condition and person to person. Indeed, there is debate about the interpretation of the goals of SM, which may differ between health-care professionals and patients, and between countries and health-care systems.

There are many factors that may affect a patient's ability to self-manage (e.g. severity, presence of comorbidities, depression, education, psychological factors, ethnicity).[24–27] One behavioural model that describes SM is Patient Activation,[28] which emphasises that patients should have the knowledge, skills and confidence to manage their own health and health care. Interventions to promote SM should aim to address each of these components.

Interventions to support self-management

Self-management support involves collaboration between the health-care professional and the patient so that the patient acquires and demonstrates the knowledge and skills required to manage his/her medical regimens, change their health behaviour, improve control of their disease and improve their well-being.[29] Patient education alone is not sufficient; monitoring and assessment of progress is also essential. SM interventions should teach skills that promote health behaviour modification with the aim of increasing self-efficacy (the belief that one can successfully execute particular behaviours), thus improving clinical outcomes, including adherence.[30] Strategies to promote self-efficacy include personal experience and practice, feedback and reinforcement, analysis of causes of failure and shared experience with successful peers.[30] Indeed, the established NHS Expert Patient Programme for managing chronic diseases is based on Bandura's theory of self-efficacy.[31] Evaluations of SM programmes should therefore first assess patients' self-efficacy, change in behaviour and then patient outcomes and health-care utilisation.

Self-management programmes can be delivered in a number of ways (e.g. series of workshops, written material, by telephone, internet or a mixture) by various professionals or lay personnel, and can have a range of components. Systematic reviews of SM programmes for long-term conditions have concluded that such programmes tend to lead to small improvements in some outcomes for some chronic diseases (but not all) and that further research is needed.[32,33] More recently there have been some unsuccessful high-profile trials in primary care settings,[34–36] some of which suggest that only a subgroup of patients may be able to self-manage.

Self-management of chronic obstructive pulmonary disease: principles and current practice

Self-management for patients with COPD is complex and challenging.[10,25] It requires patients to be able to manage various facets of their condition on a daily basis, including understanding and taking their medications appropriately with good inhaler technique, early recognition of exacerbations of symptoms and early instigation of treatment during an exacerbation, receiving annual influenza vaccinations, managing their breathlessness (including stress management/relaxation) to allow them to undertake activities of daily living, bronchial clearance techniques, taking regular exercise to maintain their lung function and exercise capacity, quitting smoking and maintaining a healthy diet.[29,30,37]

In reality, the true extent to which patients manage these aspects is not well described but it is likely to be suboptimal. A survey published in 2009 in Canada[38] revealed that although patients felt that their knowledge about the disease was good, in reality their knowledge of the causes of COPD, the consequences of not adhering to their medication and how to manage exacerbations was inadequate. A small study in one GP practice in the UK in 2004[39] indicated that only 48% of patients with COPD had discussed levels of exercise with their GP/nurse and only 50% had spare antibiotics/steroids at home in case of exacerbations, although > 80% reported understanding their inhalers, knowing what to do if they had an exacerbation and having given up smoking.

Current self-management support for chronic obstructive pulmonary disease in the UK

Self-management support for COPD is less well developed than in other long-term conditions both in the UK and worldwide. NICE quality standards state that patients with COPD should have a comprehensive, up-to-date personalised management plan, including information/educational material about the condition and its management.[40] NICE guidance also emphasises that patients at risk of having an exacerbation of COPD should be given SM advice/treatment that encourages them to respond promptly to the symptoms of an exacerbation.[10] Other aspects of SM advice include promoting proactive behaviour change, such as smoking cessation and increased exercise. However, the evidence about the exact nature and the effectiveness and cost-effectiveness of potential components of a SM package is acknowledged to be inadequate.[10]

A variety of tools are available, such as the 'Living Well with COPD' programme developed by the Montreal Chest Institute and mentioned in the American Thoracic Society statement,[30] materials provided by the British Lung Foundation,[41] and materials developed by individual hospitals/universities or private health-care companies, but there is no one consistent recommended approach.[6,10] Limited evidence suggests that programmes are patchily provided and unlikely to be individualised.[42] Qualitative studies in the UK and elsewhere suggest that patients report a lack of SM support and a lack of understanding of their condition.[43,44]

This heterogeneity is reflected in the literature describing trials of a wide variety of interventions. It is accepted, however, that the optimum package of care is not known,[10] and this fact is one of the premises upon which this report is based.

There is considerable overlap between programmes that are defined as SM and other more complex supervised programmes, such pulmonary rehabilitation (PR).[37,45] PR is defined as 'an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased daily life activities . . . programs involve patient assessment, exercise training, education, nutritional intervention, and psychosocial support'.[30] A continuum of support is now recognised, which should, ideally, be personalised to reflect an individual patient's needs, including disease severity and other comorbidities.[37,45]

For this reason, in the second study within our evidence report, we have included trials of a wide range of care packages including PR in order to identify which features of SM are most important, as long as they involve one or more of the specified components of SM.

Evidence for the effectiveness and cost-effectiveness of self-management support for chronic obstructive pulmonary disease: existing literature

Current literature on SM for COPD largely addresses the effectiveness of SM support when delivered to patients in a stable state. There are now many trials and overlapping systematic reviews of interventions (such as PR, integrated care), which include a SM component, although to varying degrees.[46–50] A Cochrane systematic review of SM education interventions[48] (excluding studies on PR, updated in 2009) identified 14 randomised controlled trials (RCTs) that showed that SM interventions delivered to patients with COPD in the stable state could significantly reduce hospital admissions compared with usual care (UC) [odds ratio (OR) = 0.64, 95% confidence interval (CI) 0.47 to 0.89], significantly improve some domains of QoL and effect a small improvement in dyspnoea. However, many of the other results were inconclusive, possibly because of the great heterogeneity in the populations studied, nature of the interventions, outcomes measured and length of follow-up. The authors concluded that 'data were still insufficient to formulate clear recommendations regarding the form and contents of SM education programmes in COPD . . . with a need for more large RCTs with long-term follow-up'.[48]

A systematic review of five trials on the effectiveness of action plans only (with only limited education) found that although patients were significantly more likely to recognise exacerbations and initiate treatment, there was no reduction in health-care utilisation, and they concluded that a more significant SM approach might be needed.[50] A further systematic review of COPD disease management programmes,[49] including 10 trials and three before-and-after studies, indicated that such programmes (which often include SM components) may decrease hospital admission and improve QoL, although further exploration of the elements that bring the greatest benefit are needed.

A more recent systematic review of integrated disease management demonstrated a significant improvement in QoL and respiratory admissions,[47] and there are other recent systematic reviews of breathing exercises,[51] outreach nurses[52] and exercise training.[53] These reviews are significantly overlapping in their inclusion but none of them comprehensively reviews all of the latest trials relating to SM interventions/components or attempts to delineate the relative effectiveness of the different components.

One important factor that varies among the trials already reviewed[48] is the nature of the populations involved. It has been suggested that SM programmes should target those patients with more severe COPD and frequent exacerbations in order to be beneficial.[29,30] Patients who are admitted to hospital have a high risk of readmission within 90 days.[17] Thus a focus on patients who are currently hospitalised for COPD (or recently discharged) could have the most potential for health gain and reduction in resource use. Data on such interventions following hospitalisation (other than PR programmes) are limited.[54]

Rationale for evidence review

Although there is a plethora of RCTs published and increasing numbers of systematic reviews on different aspects of SM support for COPD, results are conflicting about which of the many types of interventions, and particularly which components, are the most effective.[10] Furthermore, there remain significant unanswered questions about the timing and delivery of SM support, particularly whether SM support provided soon after discharge from hospital is effective or cost-effective.

In 2010, the National Institute for Health Research (NIHR) Health Technology Assessment (HTA) programme published a commissioning brief: supported SM for patients with moderate to severe COPD. It asked for a wide systematic review of the literature, particularly focusing on patients, around or soon after discharge, to answer: 'What are the elements of supported SM that prevent readmission to hospital and adverse outcomes?' We report a series of systematic reviews and an economic model to address this question.

Chapter 2 Aims and objectives

There were two main aims of this research project. The first was to undertake a systematic review of the effectiveness and cost-effectiveness of supported self-management among people with moderate to severe chronic obstructive pulmonary disease who had recently been discharged from hospital following an acute exacerbation of their condition, and to use this evidence to undertake a model-based cost-effectiveness analysis from the UK NHS perspective. With a wider systematic review, we also planned to identify the features and elements of self-management interventions that are most effective.

Each aim had specific objectives.

Aim 1

Among patients with chronic obstructive pulmonary disease at discharge, or recently discharged from hospital within the last 6 weeks, to undertake:

- a systematic review of:
  - the evidence for the effectiveness of self-management support evaluating health behaviour change, self-efficacy, health service utilisation and patient-reported outcomes such as QoL (review 1)
  - the qualitative evidence about patient satisfaction, acceptance and barriers to self-management support (review 2)
  - the cost-effectiveness of self-management support (review 3)
- a cost-effectiveness analysis and economic model of self-management support compared with usual care (economic model).

Aim 2 (review 4)

Among patients with chronic obstructive pulmonary disease, at any time point, to:

- undertake a wider systematic review of the evidence of the effectiveness of self-management support [including interventions (such as pulmonary rehabilitation) for which there are significant components of self-management] in reducing exacerbations, hospital admissions/readmissions and improving QoL
- describe the features and elements of self-management interventions in relation to their effectiveness by simple categorisation and tabulation
- perform subgroup analysis and meta-regression to explore features such as the effect of study quality, population, setting and nature of intervention on the effectiveness of self-management interventions compared with usual care
- use mixed-treatment comparison meta-analysis methods to explore which components or combinations of components are most effective.

Structure of the report

The following chapters report separately on:

- *Chapter 3*: Aim 1 – clinical effectiveness review (review 1)
- *Chapter 4*: Aim 1 – qualitative evidence review (review 2)
- *Chapter 5*: Aim 1 – cost-effectiveness review (review 3)
- *Chapter 6*: Aim 1 – economic model
- *Chapter 7*: Aim 2 – review of effectiveness of components of self-management (review 4).

Each of the above chapters incorporates methods, results and discussion, and then, finally, *Chapter 8* provides an overall summary.

Chapter 3 A systematic review of the clinical effectiveness of supported self-management interventions delivered shortly after hospital discharge: review 1

The aim of this chapter is to present the findings of a systematic review of the evidence for the effectiveness of SM support evaluating health behaviour change, self-efficacy, health service utilisation and patient-reported outcomes, such as quality of life (QoL).

Methods

A systematic review of published evidence of the effectiveness of interventions to support self-management (SM) among patients with chronic obstructive pulmonary disease (COPD) who had recently been discharged from hospital.

Definition of self-management used for this review

'Self-management' has been defined as the ability of a patient to deal with all that a chronic disease entails, including symptoms, treatment, physical and social consequences and lifestyle changes.[23] SM interventions involve collaboration between the health-care professional and the patient so that the patient acquires and demonstrates the knowledge and skills required to manage their medical regimens, change their health behaviour, improve control of their disease and improve their well-being.[29] This definition of SM was used as a basis to devise a list of SM interventions/components that were considered for this review (*Table 2*). Because SM interventions are so heterogeneous, we specifically chose to include all possible aspects of SM to ensure completeness. However, we excluded interventions of smoking cessation alone, as there is already good evidence of the benefits of smoking cessation in general, and a large number of systematic reviews addressing the effectiveness of smoking cessation interventions (currently 60 Cochrane systematic reviews alone). Most evidence of the effectiveness of smoking cessation relates to general populations, rather than people with a particular condition. Any study that included smoking cessation as one component of a multicomponent package in people with COPD was included. Similarly, there is already a systematic review of pulmonary rehabilitation (PR) at this time point;[55] therefore, it was not considered necessary to repeat it but rather use it for comparison.

Search strategy for effectiveness studies

A comprehensive search strategy was designed and conducted by an experienced information specialist. The searches were kept broad to capture evidence to suit both aims.

Searches for relevant studies were conducted across the following bibliographic databases: MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations and EMBASE (via Ovid), Cochrane Central Register of Controlled Trials (CENTRAL – Wiley) and Science Citation Index (Institute of Scientific Information). Subject-specific databases were also searched: PEDro physiotherapy evidence database, PsycINFO (via Ovid) and the Cochrane Airways Group Register of Trials. Ongoing studies were sourced through the *meta*Register of Current Controlled Trials, International Standard Randomised Controlled Trial Number database, World Health Organization International Clinical Trials Registry Platform Portal and ClinicalTrials.gov. Specialist abstract and conference proceedings were sourced through the Institute of Science Information's Conference Proceedings Citation Index and British Library's Electronic Table of Contents (Zetoc). Hand-searching through European Respiratory Society, the American Thoracic Society and British Thoracic Society (BTS) conference proceedings from 2010 to 2012 was also undertaken, and selected websites were also examined. No language restrictions or methodological filters were applied to the searches.

TABLE 2 Interventions and/or components included or excluded as SM

Intervention/component	Included/excluded	Comments
Adherence to medication	Include	Education about taking treatment correctly, promoting adherence
Ambulatory oxygen	Exclude	Unless it concerns education or support to take prescribed treatments such as ambulatory oxygen
Breathing techniques	Include	For example, pursed lip breathing
Bronchial hygiene techniques	Include	Mucus/airways clearance
Case management	Exclude	Unless elements of SM
Community matrons	Exclude	Unless elements of SM
Complementary therapies	Exclude	Exclude anything on acupuncture and massage, etc.
Early recognition of symptoms/action plans	Include	Must be self-monitoring, not external monitoring by external agency, unless there is a teaching/training element (e.g. patient being taught how to recognise the symptoms and act accordingly)
Education	Include	Any topics
Exercise	Include	Any type of exercise
Hospital at home	Exclude	Unless elements of SM
Inhaler technique	Include	Including assessment of inhaler technique
Integrated care	Exclude	Unless elements of SM
Nutritional programmes	Include	Include anything which encourages/helps people to maintain good nutrition or modify their diet; exclude anything to do with (proprietary) supplements, dietary programmes or trials of effectiveness
Patient empowerment	Include	As recommended by patient advisory group
Relaxation	Include	Any types
Respiratory muscle training	Include	Including both inspiratory and EMT
Smoking cessation	Exclude	Unless as a component of a larger package (not as a single active intervention)
Stress management	Include	Any types including counselling
Support groups	Include	As recommended by patient advisory group
Telecare	Include	Exclude if purely telemonitoring – not just about contact; include if there is an encouragement/support component, e.g. help to promote adherence to medication

EMT, expiratory muscle training.

Electronic database searching was carried out from inception to May 2012, and no updated searches were undertaken beyond this time point. The search strategies used for electronic databases can be found in *Appendix 1*; terms for COPD were combined with those for SM and, where possible, utilised appropriate medical subject headings.

The citation lists of all included studies and any citations within relevant reviews were scanned for additional relevant studies. Consultations with experts in the field through the investigators identified additional relevant literature.

Reference Manager version 11 (Thomson ResearchSoft, San Francisco, CA, USA) was used to store and manage all search results.

Study selection process

After removal of duplicates, titles and abstracts of the remaining search results were independently reviewed by two reviewers. Full texts were obtained for papers meeting the inclusion criteria or when the abstract was unclear. Full texts were then independently reviewed by two reviewers using detailed and piloted selection criteria concerning study design, populations, interventions, comparators and outcomes for each review. Any discrepancies were resolved by a third reviewer. Any non-English language papers were assessed, based on titles and abstract, but when information was lacking or unclear, translators were used to decide final inclusion. A reviewer worked alongside translators to avoid misinterpretation of the selection criteria. During full-text screening, papers were categorised into their appropriate objectives or were excluded with reasons.

Selection criteria

The selection criteria for this review are summarised in *Table 3*.

Only primary studies were included. Studies concerning patients with moderate to severe COPD were included, and those with patients with mild or very severe COPD were included only if the majority of the study population was moderate/severe. A COPD study population of approximately 90% was required for inclusion unless data on the subset of patients with COPD were provided separately. Studies were included if the intervention was set within either a hospital or a community. Studies of any SM intervention/package or components of SM interventions were included. For example, medication management, action plans, exercise, inhaler technique and stress management (see *Table 2*). Comparators consisting of usual care (UC), control/sham or other SM interventions were accepted.

Risk of bias assessment

All RCTs were assessed using the recommended and validated Cochrane Risk of Bias tool.[56] The following six domains were assessed: sequence generation, allocation concealment, blinding of personnel and participants (by outcome), incomplete outcome data (by outcome), selective outcome reporting and other potential threats to validity. Domains were judged as high risk of bias, low risk of bias and unclear risk of bias. For trials with multiple papers, information from all of the studies was used to judge risk of bias. After a piloting process, all studies were assessed by two independent reviewers with a third reviewer overseeing the process. The GRADE[57] framework was used to denote overall quality of evidence across studies for each of the primary outcomes and also HRQoL, using a scoring system of 4 (high) to 1 (very low) quality. The findings were summarised in a table, incorporating the results but also aspects that led to the final judgement.

Data extraction and manipulation

Approach

Data were extracted into piloted tables by the first reviewer with a second reviewer checking the extraction and a third reviewer overseeing the process. The results of all studies were tabulated and described and considered for combination in meta-analyses. Authors of included studies were contacted to clarify details and provide additional data required for analyses.

TABLE 3 Criteria for selecting studies

Study designs	RCTs
Population	Patients with moderate to severe COPD (defined clinically, with or without spirometry) recruited specifically at discharge or up to 6 weeks post discharge for an acute exacerbation of their condition (patients with mild or very severe COPD were included if they were a minority of the population group)
	Approximately 90% of patients in studies should have COPD
	The setting could be either hospital or community
Intervention	SM packages or important components of SM
	Excluding trials of smoking cessation and PR
Comparator	No intervention, UC, control/sham, other SM intervention
Primary outcomes	Any of:
	Health service outcomes and mortality
	Primary care consultations
	Hospital admissions
	Readmissions
	Duration of admissions
	Mortality
	Emergency department visits
Secondary outcomes	Any considered but to include:
	Behaviour change
	Self-efficacy
	Specific behaviours, e.g. increase in exercise/activity
	Patient-reported outcomes
	Exacerbations
	HRQoL
	Anxiety/depression
	Patient satisfaction
	Dyspnoea
	Other
	Lung function (FEV_1 and FEV_1/FVC)

Types of data extracted

The following types of data were extracted from all papers:

1. *Study characteristics* Including sample size, mean age, severity according to mean FEV_1% pred, place of recruitment, descriptions of intervention and control groups, outcomes, length of intervention and length of follow-up. When multiple papers were derived from the same trial, study characteristics were obtained from the original paper.
2. *Study results* Summary results from baseline and all follow-up times were extracted, including treatment effects, *p*-values, confidence intervals (CIs), mean scores at follow-up and/or mean changes in each group, numbers of events, hazard ratios (HRs), rates, loss to follow-up, etc. If multiple interventions were considered in a study then data were extracted for each pair of interventions compared.

Data manipulation

In order to maximise and prepare the data for statistical analyses, a number of steps were taken:

- Lengths of intervention and follow-up were converted to weeks as a proportion of a 52-week year and rounded to the nearest week.
- For continuous outcomes, for example QoL, reported mean difference (MD) estimates and 95% CIs calculated from an analysis of covariance (ANCOVA) were preferred, as this method adjusts for baseline imbalances. If not reported, the following methods were used in order of priority:
    - MDs reported from an analysis of change scores
    - MDs reported from an analysis of final scores
    - MDs calculated indirectly by ourselves from other information (e.g. mean change score for each group or the mean final score for each group).

If standard errors (SEs) were not reported directly, they were calculated from other information where available (such as *p*-values, 95% CIs, number in each group) at the end of follow-up, and the standard deviation (SD) of values in each group at the end of follow-up.

- For effect estimates for numbers of events over time, for example number of admissions or exacerbations over follow-up, we preferentially used HRs (e.g. from a Cox regression analysis) because they compare the rate of events over the whole follow-up period and account for individuals lost to follow-up (censored). We used only first admissions, as it is not possible to combine different types of measures (e.g. with mean number of admissions per patient) without making very strong assumptions, and this was the most common measure. Where not reported, the following methods were used to estimate the HR and its 95% CI indirectly, used in this priority order:
    - Methods of Parmar *et al.*,[58] which allowed indirect estimation of the HR and its CI from the *p*-value, and the number of patients and outcomes in each group.
    - If numbers of events and sample size were available, the method of Perneger[59] was used. Where there were zero cells then a continuity correction (1/sample size of the opposite group) was added to each cell to allow HRs to be calculable.[60]

- Where necessary, MD results and $\log_e$ HRs presented on the same plots were multiplied by –1 to ensure that all estimates and intervals obtained related to the same direction of effect (e.g. that a MD in HRQoL of < 0 meant the same thing in each study).
- To utilise more results on emergency department (ED) visits, reported mean numbers of visits during follow-up were converted to rate of ED visit by assuming that all patients not lost to follow-up were observed for the full duration of the trial.

Forest plots

Results for each outcome were presented, where relevant, on a forest plot. Interventions were heterogeneous across the studies so results were placed in subgroups most consistent with the intensity and duration of support provided:

(a) more-supported SM package – six or more contacts or unspecified contacts but ≥ 6 weeks' duration
(b) less-supported SM package – fewer than six contacts or unspecified contacts and < 6 weeks' duration
(c) exercise-based intervention.

Within each of these subgroups, studies were displayed in order of length of follow-up except for QoL outcomes, which were also grouped by questionnaire [St George's Respiratory Questionnaire (SGRQ), Chronic Respiratory (Disease) Questionnaire (CRQ), EuroQoL-5 Dimensions (EQ-5D)]. As there were multiple follow-up points, it was decided that for each outcome, only data from the final follow-up period would be displayed in the forest plot and used in any subsequent meta-analysis. The subgroups were specified prior to inspection of the results to allow sensible exploration of the different types of interventions. Meta-regression was not possible owing to the limited number of studies.

Meta-analyses

General approach

For each outcome the core group met to discuss whether or not meta-analysis was appropriate. Meta-analysis was considered only when at least three studies were available.

All analyses were undertaken using Stata statistical software, version 12 (StataCorp LP, College Station, TX, USA). When it was not appropriate to pool data, studies were displayed graphically in a forest plot but without pooling.

Meta-analysis methods

A random-effects meta-analysis model was used to synthesise effect estimates across trials[61] to account for between-trial heterogeneity in intervention effects across the trials. MDs were pooled on the original scale, but HRs were pooled on the $\log_e$ scale.

Heterogeneity across studies was summarised using the I^2-statistic (which gives the percentage of the total variability in the data due to between-trial heterogeneity)[62] and the tau-squared statistic (the between-trial variance).[61]

When two or more interventions from the same study contributed to the same meta-analysis with the same control group, an adjustment was required:

- For continuous outcomes, the SE of each estimate was inflated by first obtaining the pooled SD (assuming equal variances) using the estimates of SE and sample size in each group. An inflated SE was then calculated using the full sample size in the intervention group, and the sample size in the control group divided by the number of comparisons it contributed to within the meta-analysis.
- For one study the same control group appeared twice or more in the analysis when using a HR outcome. As the HRs for this study had been calculated using two-by-two tables,[59] adjustment was made by modifying the number of control events and the total sample size in the control group by dividing by the number of comparisons in which that control group was incorporated. The modified two-by-two tables were then used to calculate new HRs to be used in the meta-analyses where appropriate.[59]

Assessing publication bias

This was not possible as there were fewer than 10 studies for each of the outcomes.

Patient advisory group

A patient advisory group was established from local patients with COPD, chaired by Mr Michael Darby. Meetings were held at the University of Birmingham, and the group provided advice on how COPD affected their lives, their understanding of the importance of SM and different components, and their experiences of

SM programmes. This assisted in the development of the definition of SM for the inclusion criteria of this review. For example, they suggested the need for including peer support groups as an essential component. They also commented on the plain English summary.

Results

Search results

Study identification and flow chart

Initial database searches identified 13,355 records, of which 836 remained after scanning titles and abstracts using the inclusion/exclusion criteria (*Figure 1*). After the same criteria were applied to the full papers, 12 papers reporting 10 trials were finally included in the review.[63–74] *Appendix 2* details the reasons for exclusion at each stage. These were largely because patients were not recruited at the appropriate time point during/after discharge. Overall, 5% of all full texts required arbitration by a third reviewer.

The inclusion of two trials was particularly difficult to assess.[68,75] Both were comparing 'hospital at home' with UC and had substantial SM components. One trial[75] was excluded because all patients were seen in the ED then randomised to home compared with hospital (and therefore patients were not admitted at all unless in the control group). In the second study,[68] although patients were assessed in the ED, a substantial proportion of patients in both arms were initially admitted and then discharged from hospital. The difference between the two arms was (a) the proportion of patients requiring admissions and (b) the intervention arm had ongoing SM support at home, whereas, once discharged, the control group had usual primary care support. Thus, this trial was included.[68]

Conference abstracts meeting the inclusion criteria for this review are listed in *Appendix 3*. There were a further four trials that were ongoing at the time of the search end date (see *Appendix 4*).

Characteristics of included studies

There were 10 RCTs (from 12 papers).[63–74] One study[69] had a limited qualitative element referring to patient satisfaction, which will be discussed in the following chapter (see *Chapter 4*), and one study[68] included a cost analysis, which is presented in *Chapter 5*. *Table 4* details the characteristics of the RCTs.

Characteristics of included randomised controlled trials

Size, setting, recruitment

Randomised controlled trials ranged in size from 33[73] to 464[63] total participants. One[66] was a cluster RCT, based in 45 nursing homes. One paper was the 18-month follow-up of the original study,[64,65] and one paper[72] referred to the Spanish centre of a European study.[71]

Participants were largely recruited in hospital during an exacerbation of COPD or at (or immediately after) discharge. Two papers[67,68] also included patients recruited at the ED who may not have been admitted to hospital.

The definition of COPD for inclusion was generally based on a clinical diagnosis (except for Bucknall *et al.*,[63] which also required patients to meet the spirometric criteria for airflow obstruction). One study[70] included a mixed population of patients with chronic lung disease, although 89% had COPD.

Patient exclusion from trials was usually based on inability to provide consent; terminal illness or extreme comorbidities preventing inclusion in rehabilitation/exercise; or social conditions/lack of access to a telephone. All of the studies were set among patients living at home except for the cluster RCT, which was specifically based in nursing homes.[66]

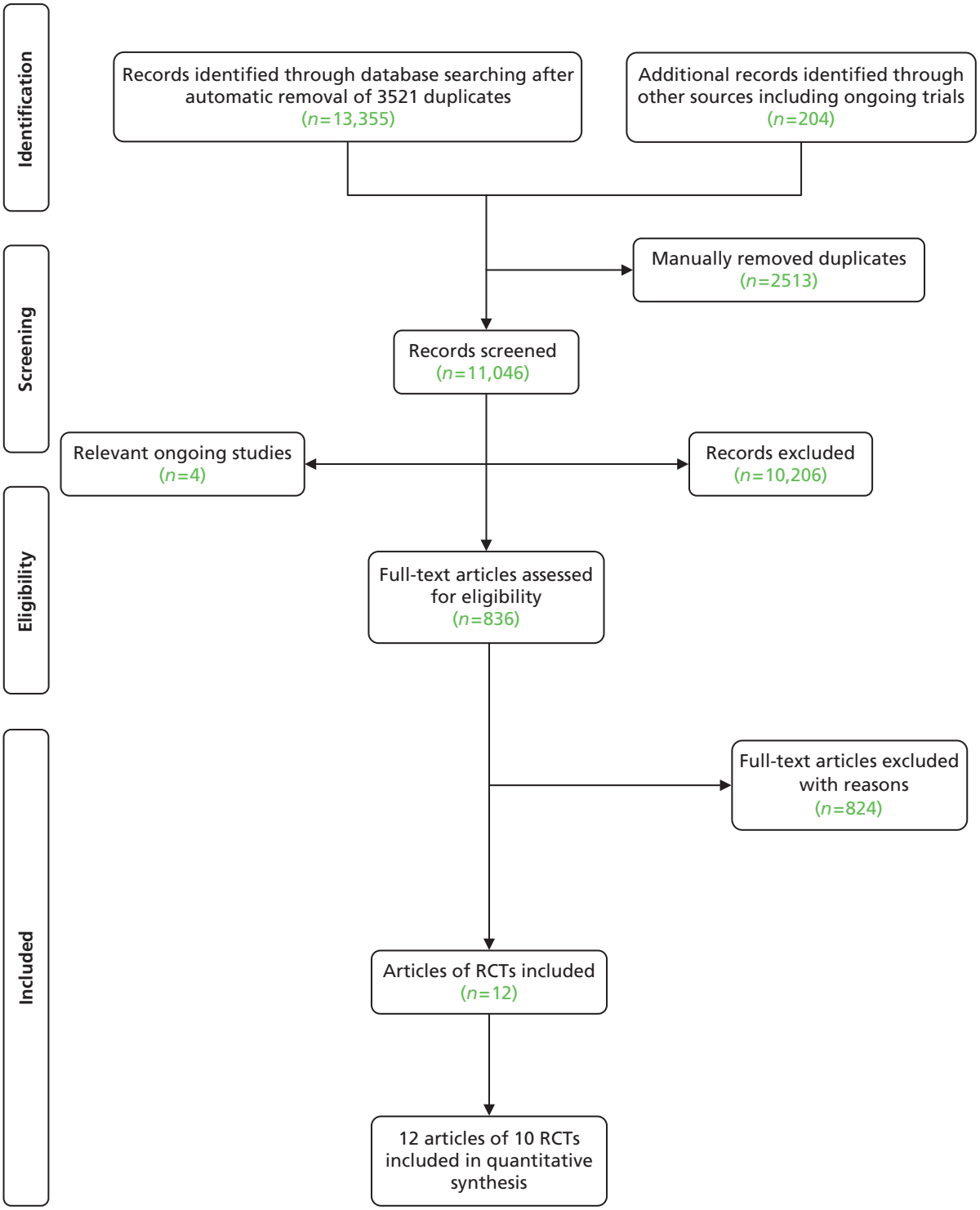


FIGURE 1 The selection process for clinical effectiveness studies.

TABLE 4 Characteristics of included RCTs

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Behnke, 2000,[64] Germany, RCT	*Inclusion*: Severe COPD; patients admitted owing to acute exacerbation *Exclusion*: Unstable cardiac disease, cor pulmonale or other comorbidities preventing exercise participation, e.g. orthopaedic inabilities or peripheral vascular disease	*N* = 46 Recruited in hospital 4–7 days post hospital admission *Of 30 completers*: Mean age (years) (SD): Int: 64.0 (1.9) Cont: 68.0 (2.2) Sex (male) *n* (%): Int: 12 (80.0) Cont: 11 (73.3) Mean FEV_1% pred (SD): Int: 34.1 (7.4) Cont: 37.5 (6.6)	TRAINING (*n* = 23) Usual medication and 30 minutes daily breathing exercises Ten-day hospital-based training including daily 6-minute treadmill and five self-controlled walking sessions Followed by 6 months individually tailored home-based walking programme, three times a day Diaries of exercise Two-weekly visits for 3 months then monthly telephone calls for 3 months	CONTROL (*n* = 23) Usual medication and 30 minutes' daily breathing exercises Ten-day hospital-based training, including daily 6-minute treadmill and five self-controlled walking sessions Advised to perform exercise at home without specific instruction	Mortality (6 months) QoL – CRQ (3 and 6 months) Exercise capacity: 6-MWT treadmill (1, 2, 3 and 6 months) Dyspnoea: Baseline/Transitional Dyspnoea Index (every visit post discharge) Lung function: FEV_1, FVC, TLC, ITGV, DLCO, RV (days 0 and 11, 3 and 6 months) Blood gas analysis, BP, heart rate (days 1 and 11, and 6 months)

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Behnke, 2003,[65] Germany, RCT	*Inclusion*: Severe COPD; patients admitted due to acute exacerbation *Exclusion*: Unstable cardiac disease, cor pulmonale or other comorbidities preventing exercise participation, e.g. orthopaedic inabilities or peripheral vascular disease	*N* = 46 Follow-up of 26 of 30 patients who had participated in the Behnke *et al.*[64] 6-month trial *Of 26 completers*: Mean age (years) (SD): Int: 64.0 (7.5) Cont: 69.0 (6.9) Sex (male) *n* (%): Int: 11 (76) Cont: 9 (75) FEV_1% pred (SD): Int: 34.9 (7.1) Cont: 37.5 (6.9)	TRAINING (*n* = 23) Usual medication and 30 minutes' daily breathing exercises Ten-day hospital-based training, including daily 6-minute treadmill and five self-controlled walking sessions Eighteen-month home-based training programme, three times a day for 15 minutes based on 125% of 6-MWT for 3 months and then advised to continue regular exercise Diaries of exercise Two-weekly visits for 3 months then monthly telephone calls for 3 months	CONTROL (*n* = 23) Usual medication and 30 minutes' daily breathing exercises No exercise training instructions in hospital or home No visits, but did receive monthly telephone calls	QoL: CRQ (6, 12, 18 months) Exercise capacity: 6-MWT treadmill (6, 12, 18 months) Dyspnoea: Borg Scale at rest; Baseline/Transitional Dyspnoea Index (6, 12, 18 months) Lung function: FEV_1, VC, TLC, ITGV, DLCO, RV (6, 12, 18 months) Hospital admissions (6-month periods for 18 months) Activity data (training group only) (each month) Inhaler and medications use

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Lee, 2002,[66] Hong Kong, cluster RCT	*Inclusion*: COPD; aged 65+ years; present residents of participating nursing home; at least one admission in previous 6 months *Exclusion*: Terminal illness (not expected to survive > 6 months) Communication problems	*N* = 45 nursing homes *N* = 112 patients Patients recruited from the geriatric units of two hospitals with main diagnosis of COPD and soon to be discharged *Of 89 completers*: Mean (SD) age (years): Int: 81.08 ± 6.03 Cont: 79.68 ± 6.53 Sex (male) *n* (%): Int: 27 (56.3) Cont: 20 (48.8) Mean FEV_1% pred (SD): Int: 30.64 (10.12) Cont: 31.08 (13.25) Severity *n* (%): • Mild (≥ 50%) Int: 3 (6.3%) Cont: 4 (9.8%) • Moderate (35–49%) Int: 12 (25.0%) Cont: 11 (26.8%) • Severe (< 35%) Int: 33 (68.8%) Cont: 26 (63.4%)	CARE SUPPORT TO NURSING HOME (*n* = 48 completers) Support to nursing home staff provided by community nurses *Visit 1*: Within 1 week of discharge: • Assessment of health status • Plans individualised care • Educates nursing home staff • Provides written information sheets • Teaches patients appropriate care procedures (e.g. drug and diet regime, breathing exercises, use of inhalers) Weekly visits by same community nurse for 1 month to reinforce recommended care and education Monthly visits by same nurse to provide ongoing support and education to the staff Between visits and as necessary community nurse would additionally provide advice via: • telephone • visit This may include advice on need for ED visit or admission If readmitted, protocol and visits recommenced on discharge back to the home	CONTROL (*n* = 41 completers) Usual community nursing, e.g. wound/catheter management	Hospitalisation (6 months) • COPD readmissions • COPD hospital days • Days to first readmission ED visits (6 months) • COPD ED visits • Days to first ED visit Functional status (6 months): Barthel Index Respiratory status (6 months): FEV_1% pred Psychological status (6 months): GHQ: total and subscales Patient satisfaction (6 months): Thirteen-item Likert scale; not administered to control arm Nursing health staff satisfaction (1 month): Eleven-item Likert scale; not administered to control arm

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Egan 2002,[69] Australia, RCT plus qualitative element ($n = 18$)	*Inclusion*: COPD; ≥ 18 years; history of chronic bronchitis (with infection), emphysema, chronic obstruction, chronic asthma, or combination; admission to respiratory unit bed within 72 hours of hospital admission *Exclusion*: Cognitive function insufficient to complete questionnaire	$N = 66$ Patients admitted with COPD to a major private hospital; recruited during admission Mean age (years): Int: 67.8 Cont: 67.2 Sex (male) *n* (%): Int: 12 (36) Cont: 20 (60) FEV_1% pred: NR Severe ($FEV_1 < 35$% pred) Int: 19 (57.6%) Cont: 19 (57.6%) Mild/moderate (FEV_1 35–50% pred) Int: 14 (42.4) Cont: 14 (42.4)	CASE MANAGEMENT ($n = 33$) *Nursing assessment and review*: comprehensive – to identify physical, psychological, social, spiritual, resource needs; standardised clinical pathway of care during hospital admission Coordination between medical, nursing and allied health personnel by case manager Coordinated case management with patient and carer education on managing the disease, medication, rehabilitation, available community services and arranged discharge planning Regular telephone calls to patient and carer at 1 week and 6 weeks	UC ($n = 33$) Nursing assessment (not clear); standardised clinical pathway of care during hospital admission No contact with case manager, no case conferences and no post-discharge follow-up	Hospital readmission: 3 months QoL: SGRQ and Subjective Well-Being Scale: 1 and 3 months Social support survey: 1 and 3 months Anxiety and depression: HADS (1 and 3 months) Patient satisfaction: qualitative semistructured interview with 18 participants, 3 months

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Hermiz, 2002,[67] Australia, RCT	*Inclusion*: COPD; 30–80 years; patients attending hospital ED or admitted with COPD *Exclusion*: Resided outside region; insufficient English skills; resident in nursing home; confused or demented	*N* = 177 Patients attending hospital ED or admitted with COPD; not clear exactly when recruited but visit 1 occurred 1 week after discharge Mean age (years): Int: 67.1 Cont: 66.7 Sex (male), *n* (%): Int: 41 (48.8) Cont: 43 (46.2) FEV_1% pred: NR	HOME VISITS (*n* = 84) Two home visits (community nurse) *Visit 1*: Within 1 week of discharge • Assessment of health status and pulmonary function • Education (verbal and written) on disease • Advice on smoking cessation, management of ADL, energy conservation, exercise, medication, health maintenance, early recognition of signs that require medical intervention • Care plan sent to GP • Referral to services/contact with GP if necessary *Visit 2*: (1 month post discharge) Progress review Patient encouraged to refer to education booklet for guidance	UC (*n* = 93) UC (GP)	Mortality (3 months) Readmissions or ED visits (3 months) GP consultations or nurse home visits (3 months) GP prescribed drugs GP arranged follow-up GP provided patient with education GP provided carer with education QoL: SGRQ (3 months) Behaviour change (3 months) • Smoking habits • Immunisations • Knowledge/understanding • Help-seeking Patient satisfaction (3 months)

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Dheda, 2004,[73] UK, RCT	*Inclusion*: Diagnosis of COPD; first admission of COPD *Exclusion*: Another dominant medical condition; mandatory reason for hospital follow-up, e.g. suspected cancer; already under outpatient follow-up; refused consent	*N* = 33 First admission of COPD Not clear when recruited but implies at discharge (data may be completers only – not clear): Mean age (years) (SD): Int: 68.4 (5.8) Cont: 71.3 (8.4) Sex (male) *n* (%): NR Mean FEV_1% pred (SD): Int: 44.7 (21.8) Cont: 39 (11.9) Disease severity (BTS guidelines) Int: 20% mild, 20% moderate, 60% severe Cont: 20% mild, 27% moderate, 53% severe	HOSPITAL OUTPATIENT FOLLOW-UP (*n* = 15) Visit to respiratory nurse and/or chest physician: (*n* = 4+) over 6-month period (3, 6, 8, 12 or 16 weeks) • Review of inhaler technique and peak flow diary • Medication assessment • Smoking cessation advice • Advice about nutrition and exercise • Introduction to patient support group	PRIMARY CARE FOLLOW-UP (*n* = 18) Visit primary care teams as required	Hospital admissions (6 months) Exacerbations (two or more) (6 months) QoL: SGRQ, SF-36 (6 months) Lung function: FEV_1 Oxygen saturation Pharmacological prescriptions: oxygen, nebuliser, theophylline, bronchodilators

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Hernandez, 2003,[68] Spain, RCT	*Inclusion*: COPD exacerbation; absence of any criteria for imperative hospitalisation as stated by the BTS guidelines *Exclusion*: Not living in the area or admitted from a nursing home, lung cancer and other advanced neoplasm, extremely poor social conditions, severe neurological or cardiac comorbidities, illiteracy, no telephone	*N* = 222 Patients with COPD exacerbation. Recruited at emergency room of two tertiary hospitals Mean age (years) (SD): Int: 71 (9.9) Cont: 70.5 (9.4) Sex (male)%: Int: 96.7 Cont: 97 Mean (SD) FEV_1 l (% pred): NR at baseline	HOME-BASED HOSPITALISATION (*n* = 121) Assessed by specialised team in emergency room At discharge Standard pharmacological treatment was used in accordance with national guidelines Non-pharmacological treatment, 2 hour, including: • education on knowledge of disease, adherence to treatment, recognition/prevention of triggers of exacerbations • selection of appropriate equipment • smoking cessation • patient empowerment with ADL, breathing exercises, exercises, nutrition recommendations • socialisation and changes in lifestyle Home visit (1 hour) by nurse within 24 hours of discharge Duration of home hospitalisation determined by nurse; up to five visits permitted during 8-week period, but no limit of telephone contact; action plan revisited and education reinforced Failure was based on referral to emergency room or more than five nurse visits required	UC (*n* = 101) Standard assessment by physician in emergency room Standard pharmacological treatment No post-discharge follow-up	Mortality (2 months) Readmissions or ED visits (2 months) Hospitalisation: hospital days (2 months) QoL: SGRQ and SF-12 scale (2 months) Lung function: FEV_1, FVC (2 months) Patient satisfaction (2 months) Disease knowledge (2 months) Inhaler technique (2 months) Medication prescriptions and home rehabilitation (2 months) Costs (2 months)

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Kwok, 2004,[70] Hong Kong, RCT	*Inclusion*: CLD (89% had COPD); 60+ years; having at least one hospital admission for CLD in the 6 months before index admission *Exclusion*: Resided outside region; communication difficulties; no family caregiver; resident in institutional care; terminal disease with life expectancy < 6 months	*N* = 157 Hospitalised patients with principal diagnosis of CLD recruited from medical wards of two hospitals within 3 days of admission Of 149 completers: Mean age (years) (SD): Int: 75.3 ± 7 Cont: 74.2 ± 5.7 Sex (male) *n* (%): Int: 56 (73) Cont: 55 (69) Mean FEV_1: NR	INTERVENTION (*n* = 77) A community nurse *Visit 1*: Before discharge: • provide health counselling (drug compliance, inhaler technique, dietary advice as required) • encourage to contact nurse when they developed medical problems via telephone hotline *Visit 2*: (7 days' post-discharge home visit) • Review condition • Give health counselling – reinforce drug and diet regime, provide advice on modifications of home environment to avoid irritants or physical danger, encourage physical exercise • Provide psychosocial support • Arrange social and health services • Encourage use of hotline when symptoms arose Weekly home visits for 4 weeks and monthly thereafter for up to 6 months to monitor changes in physical condition, reinforce health counselling, and encourage hotline use if necessary	UC (*n* = 80) Routine follow-up by same medical teams Some patients received home visit if referred	Hospital readmissions (4 weeks, 6 months) Period of hospitalisation (bed-days) ED visits (6 months) Psychosocial scores: London Handicap Scale, GHQ score, Multidimensional Health Locus of Control Scales (6 months) Exercise capacity: 6-MWT (6 months) Mortality (6 months) Care burden (6 months): Cost of Care Index

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes

Wong, 2005,[74] Hong Kong, RCT	*Inclusion*:
	
	Diagnosis of COPD; alert and orientated; contactable by telephone
	
	Exclusion:
	
	Discharged to an old-age home; serious alcohol or drug abuse or psychiatric disease; diagnosed with IHD, musculoskeletal disorders or other disabling diseases that may limit rehabilitation; dying and/or unable to provide informed consent
		N = 60
		
		At discharge from medical department of acute care hospital
		
		Mean age (years) (SD):
		
		73.6 (7.8)
		
		Sex (male) *n* (%):
		
		47 (78.3)
		
		FEV_1% pred: NR
			TELEPHONE FOLLOW-UP (*n* = 30)
			
			Structured, individualised educational and supportive telephone follow-up programme delivered by a respiratory nurse
			
			Based on Bandura's theory of self-efficacy[31]
			
			• Goal-setting and patient education including:
			  ○ management of dyspnoea and energy-saving techniques
			  ○ verbal persuasion (medication adherence)
			  ○ stress management techniques (relaxation, breathing techniques)
			
			Two telephone contacts on days 3–7 and days 14–20 with each call lasting 10–20 minutes
				ROUTINE CARE (*n* = 30)
				
				UC
					Health service utilisation: ED, outpatient, admissions (1, 3 months)
					
					Self-efficacy: Modified Chinese COPD Self-Efficacy Scale for dyspnoea (day 35)

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Casas, 2006,[71] Spain, RCT	*Inclusion*: COPD; hospital admission > 48 hours due to exacerbation *Exclusion*: Not living in health-care area; severe comorbid conditions; logistical limitations due to poor social conditions, e.g. no telephone access; admitted to nursing home	*N* = 155 (*n* = 113, Barcelona; *n* = 42, Leuven) Recruited immediately after hospital discharge from two tertiary hospitals (Barcelona, Leuven) Mean age (years) (SD): Int: 70 (9) Cont: 72 (9) Sex (male) *n* (%): Int: 50 (77) Cont: 79 (78) Mean FEV_1% pred (SD): Int: 43 (20) Cont: 41 (15)	INTEGRATED CARE (*n* = 65) *Four-part integrated care*: 1. Comprehensive assessment of patient 2. Education session on SM (2 hours) (disease knowledge, smoking cessation, promotion of physical activity, nutritional advice, instructions on other non-pharmacological treatment, medication administration, teaching SM strategies to cope with future exacerbation) 3. Individually tailored care plan: • Barcelona: 1× joint visit by specialised nurse and primary care team • Leuven: regular home GP visits using standard guidelines 4. Weekly telephone calls for 1 month. Telephone calls at 3 months and 9 months with no education 5. Access to the specialist nurse at the hospital through ICT platform including web-based call centre. Could trigger a visit Note that there is some inconsistency with Garcia-Aymerich[72]	UC (*n* = 90) *UC*: Hospital physician decided on outpatient control regime. Standard protocol for pharmacological prescription and in-hospital treatment Physician visit every 6 months	Mortality (6, 12 months) Hospital admissions (12 months) Health-care resource utilisation (12 months): includes GP consultations

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Garcia-Aymerich, 2007,[72] Spain (subset of Casas *et al.*[71]), RCT	*Inclusion*: COPD; admitted because of an episode of exacerbation requiring hospitalisation for > 48 hours *Exclusion*: Not living in the health-care area or living in a nursing home; lung cancer or other advanced malignancies; logistic limitations due to poor social conditions, illiteracy or no telephone access; extremely severe neurological or cardiovascular comorbidities	*N* = 113 Recruited immediately after discharge from one tertiary hospital *Of 62 completers*: Mean age (years) (SD): Int: 72 (10) Cont: 73 (9) Sex (male) *n* (%): Int: 16 (80.0) Cont: 37 (90) FEV_1% pred: NR Described as 'severe'	INTEGRATED CARE (*n* = 44) *Four-part integrated care*: 1. Comprehensive assessment of patient 2. Education session on SM (2 hour) (disease knowledge, smoking cessation, promotion of physical activity, nutritional advice, instructions on other non-pharmacological treatment, medication administration, teaching SM strategies to cope with future exacerbation); written information provided and education on skills to identify deterioration and advised/taught to call the call centre if signs and symptoms indicative of clinical deterioration; call to specialist nurse generated advice or home visit as necessary 3. Individually tailored care plan (devised by nurse case manager and primary care team); joint visit made within 72 hours of discharge regarding comorbidities and social support; weekly telephone calls 1 month, one further call at months 3 and 9 to reinforce SM 4. Access to the specialist nurse at the hospital through ICT platform including web-based call centre	UC (*n* = 69) *UC*	Mortality (6 and 12 months) QoL: SGRQ, EQ-5D (6 and 12 months) Dyspnoea: MRC (6 and 12 months) Treatment adherence and inhaler technique: Medication Adherence Scale, Inhaler Adherence Scale and observation; medication use (6 and 12 months) Medications and oxygen therapy (6 and 12 months) Lung function – FEV_1, FVC, PaO_2, $PaCO_2$ (6 and 12 months) Vaccination uptake (influenza, pneumococcal): 6 and 12 months Patient satisfaction (6 and 12 months) Smoking (6 and 12 months) Exercise (6 and 12 months) Knowledge: about disease and identification/treatment of exacerbations BMI

continued

TABLE 4 Characteristics of included RCTs (*continued*)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
Bucknall, 2012,[63] UK, RCT	*Inclusion*: Patients with COPD admitted to hospital with acute exacerbation; $FEV_1 < 70\%$ pred and $FEV_1/FVC < 0.7$ *Exclusion*: History of asthma or left ventricular failure; active malignant disease; evidence of confusion or poor memory	*N* = 464 During or shortly after hospital admission; six acute hospitals and contributing hospitals with eligible patients; augmented by review of patients attending PR and checking for evidence of hospital admission Mean age (years) (SD): 69.1 (9.3) Sex (male) *n* (%): 170 (37%)	SUPPORTED SM (*n* = 232) Long-term treatment optimised, inhaler techniques checked, offered appropriate smoking cessation advice and PR Symptom daily diaries Supported SM by nurses trained in 'self-regulation theory'; this aims to empower patients to manage COPD by improved knowledge and understanding of the disease and skills to monitor symptoms and carry out appropriate actions, such as altering treatment early in early stages of an exacerbation	UC (*n* = 232) Long-term treatment optimised, inhaler techniques checked, offered appropriate smoking cessation advice and PR Symptom daily diaries UC: continuing management by GP, hospital clinicians or both	Mortality (12 months) Hospital admission with exacerbation of COPD (12 months) Successful SM (initiating treatment during exacerbation) (12 months) QoL: SGRQ, EQ-5D (6 and 12 months) Anxiety/depression – HADS (6 and 12 months) Self-efficacy – COPD Self Efficacy Scale (6 and 12 months)

Author, year, country, study design	Population inclusion criteria	Participants	Intervention (*n*)	Comparator (*n*)	Outcomes
		Mean FEV_1% pred (SD): 40.5 (13.6)	SM material based on 'Living Well with COPD programme' Content included: • Disease knowledge • Events that led to hospital admission • Nature of exacerbations • Recognising early signs of an exacerbation • Managing future exacerbations and monitoring signs and symptoms • How drugs work • Reinforcement of self-management behaviours • SM plan • Four 40-minute individual training sessions delivered at home every 2 weeks for 2 months plus home visits at least every 6 weeks thereafter for 10 months		

6-MWT, 6-Minute Walk Test; ADL, activities of daily living; BMI, body mass index; BP, blood pressure; Cont, control; DLCO, diffusing capacity of the lung for carbon monoxide; GHQ, General Health Questionnaire; GP, general practitioner; HADS, Hospital Anxiety and Depression Scale; ICT, information communication technology; IHD, ischaemic heart disease; Int, intervention; ITGV, intrathoracic gas volume; MRC, Medical Research Council; n/a, not applicable; NR, not reported; $PaCO_2$, partial arterial carbon dioxide tension; PaO_2, partial arterial oxygen tension; SF-12, Short Form questionnaire-12 items; SF-36, Short Form questionnaire-36 items; RV, residual volume; TLC, total lung capacity.

Description of included patients

Mean age of participants was similar across the included RCTs (66–74 years), except in the cluster RCT based in nursing homes,[66] where the mean age was approximately 80 years. Sex distribution, however, was variable across studies (ranging from 37% to 97% males). Where reported, severity of disease was similar with mean FEV_1 ranging from approximately 31% to 42% of predicted values. Most patients were described as having moderate or severe COPD.

Description of self-management interventions and comparators

Interventions were varied and have been described in full in *Table 4*. *Figure 2* provides a summary diagram of the included RCTs, with interventions grouped into three categories:

(a) '*More supported*' Six or more contacts or ≥ 6 weeks' duration if contacts not specified. This category included:

- large RCT in the UK of supported SM (based on the Living Well with COPD materials) for 12 months, compared with UC[63]
- RCT in Spain/The Netherlands of integrated care including supported SM for 12 months,[71,72] compared with UC
- RCT in Hong Kong[70] of a community nurse-supported discharge programme, including SM support, with weekly visits for 4 weeks and then monthly, with additional telephone hotline and a total follow-up of 6 months, compared with UC
- small RCT in the UK[73] of hospital outpatient visit-based SM support over 16 weeks with total 6 months' follow-up, compared with UC
- cluster RCT in Hong Kong[66] of support by community nurses to nursing home staff and patients with a supported SM component, weekly visits for 1 month and thereafter monthly visits for a total of 6 months, compared with UC.

(b) '*Less supported*' Fewer than six contacts or < 6 weeks' duration if contacts not specified. Including:

- RCT in China of telephone-based SM (based on Bandura's theories of self-efficacy[31]), with two telephone calls before week three and total follow-up for 3 months, compared with UC[74]
- RCT in Australia of SM support provided by two visits after 1 week and 1 month, with total 3 months' follow-up, compared with UC[67]
- RCT in Spain of home-based hospitalisation, including SM education and action plans, reinforced during up to five home-visits and telephone contacts over an 8-week period, compared with UC[68]
- RCT in Australia of case management with SM support with review and two telephone calls and follow-up for 3 months in total, compared with UC.[69]

(c) '*Exercise-only intervention*' Home-based exercise-only interventions:

- small RCT of home-based exercise, supervised regularly for 3 months and with 6-month[64] and 18-month[65] follow-up, compared with general exercise advice.

Description of comparators

Comparators were 'UC' [often with little description but focused on usual GP management] except for the exercise trials,[64,65] for which the control group had some initial exercise training in hospital and were then advised to perform exercise at home.

Range of outcomes reported

All included trials measured at least one of the primary outcomes. Mortality was reported in six trials;[63,64,67,68,70–72] hospital admissions (measured in multiple ways) in all 10 trials;[63–74] and other health-care utilisation in six trials.[66–68,70–72,74]

Of the secondary outcomes, HRQoL was assessed in seven trials[63–68,71–73] and was provided as an overall score as well as subdomains. The most common score was the SGRQ.

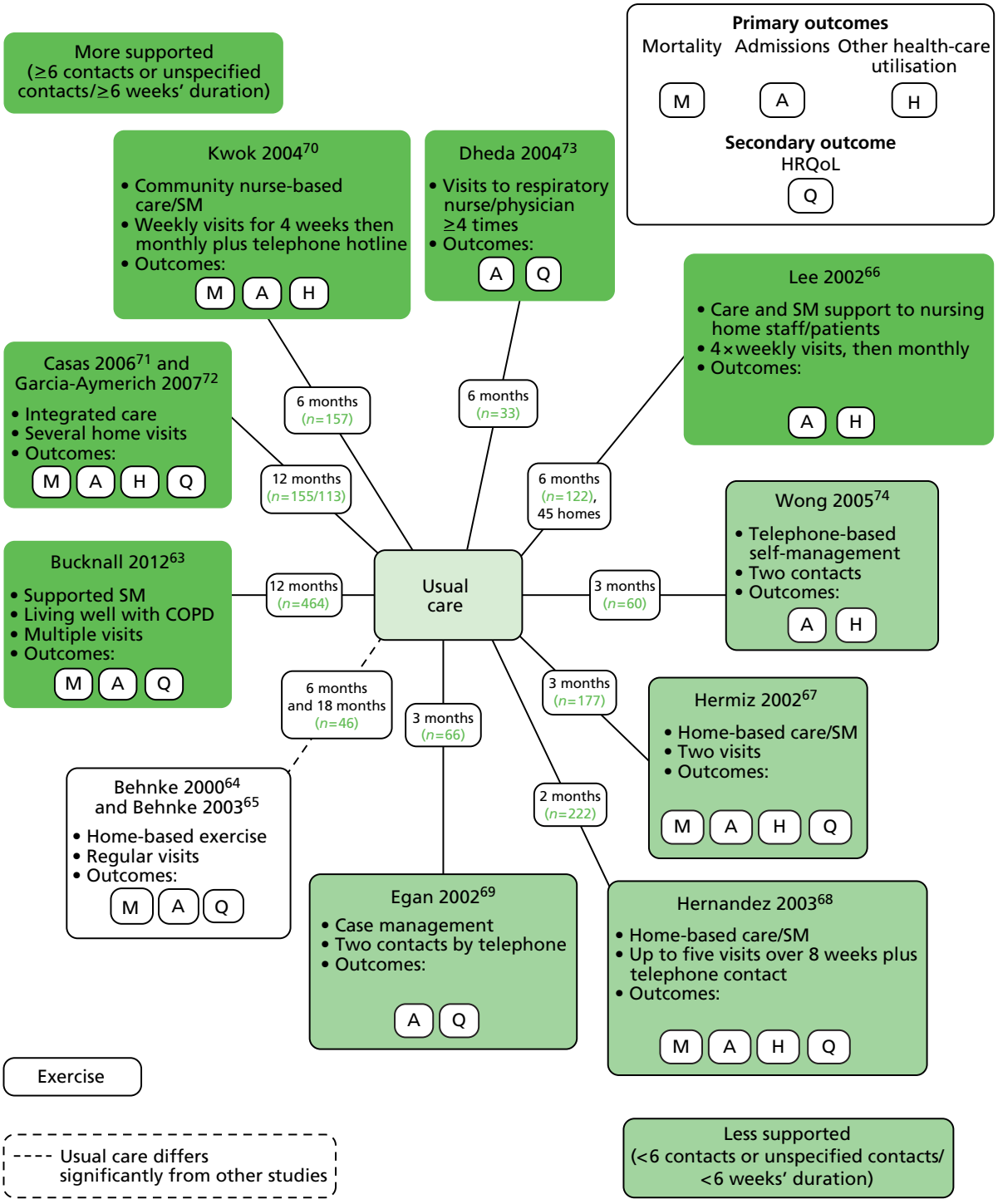


FIGURE 2 Study characteristics of the included RCTs.

Exacerbations were reported in only one trial.[73] Self-efficacy was measured in two trials;[63,74] behaviour change in four trials;[63,67,68,72] anxiety/depression in five trials;[63,66,69,70] exercise capacity in two trials;[64,65,70] dyspnoea in two trials;[64,65,72] and lung function in five trials.[64–66,68,72,73]

Patient satisfaction with the intervention was described in five trials,[66–68,72] one of which is described in full in the next chapter, as it involved qualitative interviews.[69] Costs were described in one trial,[68] but no trials described days lost from work.

Quality of included randomised controlled trials

Risk of bias evaluations are presented in *Table 5* and are described as high, low or unclear risk for each aspect of potential bias.

TABLE 5 Risk of bias assessment of included trials

Sources of bias	[a]Behnke 2000[64]	[a]Behnke 2003[65]	Egan 2002[69]	Hermiz 2002[67]	Lee 2002[66]	Hernandez 2003[68]
1. Sequence generation	Unclear: Randomly allocated but method not described	Unclear: Randomly allocated but method not described	Low: Stratified and then random number tables	Unclear: 'Simple randomisation' at one site and permutated block at another	Unclear: Intervention and control nursing homes matched by readmission rates and stratified into high, medium, low risk. Randomised in pairs but details not given	Low: Computer-generated random numbers in 1 : 1 or 2 : 1 ratio
2. Allocation concealment	Unclear: Insufficient information	Unclear: Insufficient information	Unclear: Insufficient information	Unclear: Insufficient information	Unclear: Insufficient information	Unclear Although described as 'blindly assigned to groups'
3. Blinding of outcomes						
a. Hospital admissions	n/a	Low	Low	Low	Low	Low
b. ED visits	n/a	n/a	n/a	n/a	Low	Low
c. Primary care consultations	n/a	n/a	n/a	Low Available from GP	n/a	n/a
d. Mortality	Low	n/a	n/a	Low	n/a	Low
e. Patient-reported outcomes	HRQoL: high Dyspnoea: high Patient not blinded	HRQoL: high Patient not blinded	HRQoL: high Anxiety and depression: high Patient not blinded	HRQoL: high Behaviour change: high Patient satisfaction: high Patient not blinded	Psychological status: high Patient satisfaction: high Patients not blinded	HRQoL: high Patient satisfaction: high Investigator administrating questionnaire blinded but patient not blinded
f. Other outcomes of interest	Lung function: unclear No information provided but interviews conducted by the physicians managing the care so unlikely to be blind Exercise capacity: low risk because assessor gave no encouragement	Lung function: unclear No information provided, but interviews conducted by the physicians managing the care so unlikely to be blind Exercise capacity: low risk because assessor gave no encouragement	n/a	n/a	Lung function: unclear Not known whether or not assessors were blinded	Lung function: unclear Not known whether or not assessors were blinded
4. Incomplete outcome data		Outcomes only provided on completers 14/23 (61%) in intervention arm 12/23 (52%) in control arm		Ignoring deaths, 11% loss to follow-up, although reasons not provided for withdrawals	Outcomes only provided on completers (79.5% overall) Insufficient reporting of attrition/exclusions	Implies that the only attrition during 8-week period was due to death

Dheda 2004[73]	Kwok 2004[70]	Wong 2005[74]	[b]Casas 2006[71]	[b]Garcia-Aymerich 2007[72]	Bucknall 2012[63]
Unclear: Randomly allocated but method not described	Low: 'Random number table'	Low: 'Research randomiser'	Low: Computer-generated random numbers	Low: Computer-generated random numbers	Low: Computer-generated sequence using permuted blocks and minimisation
Unclear: Insufficient information	Unclear: Insufficient information	Unclear: Insufficient information	Unclear: Although described as 'blindly assigned to groups'	Unclear: Although described as 'blindly assigned to groups'	Low: Treatment group allocation were obtained by telephone after baseline assessment had been made
Low	Low	Low	Low	n/a	Low
n/a	Low	Low	n/a	n/a	n/a
n/a	n/a	n/a	Low	n/a	n/a
n/a	Low	n/a	Low	Low	Low
HRQoL: high	GHQ score: high	Self-efficacy: high	n/a	High	High
Patients not blinded	Patients not blinded	Patients not blinded although assessors blinded		HRQoL; dyspnoea; treatment adherence/ inhaler technique; vaccine uptake; patient satisfaction; smoking; exercise; knowledge	HRQoL; anxiety and depression; self-efficacy Patients not blinded
Lung function: unclear Not known whether or not assessors were blinded Exacerbations: unclear No information	Exercise capacity: low Assessors were blinded		n/a	Unclear Lung function No information provided on blinding	n/a
	Most outcomes only provided on completers (89%)	Low: all participants accounted for, 3.3% dropout; missing values replaced by group mean			

continued

TABLE 5 Risk of bias assessment of included trials (*continued*)

Sources of bias	[a]Behnke 2000[64]	[a]Behnke 2003[65]	Egan 2002[69]	Hermiz 2002[67]	Lee 2002[66]	Hernandez 2003[68]
a. Hospital admissions	n/a	High	Unclear	Low 89% followed up	High	Unclear
b. ED visits	n/a	n/a	n/a	n/a	High	Unclear
c. Primary care consultations	n/a	n/a	n/a	Low: 89% followed up	n/a	n/a
d. Mortality	Low	n/a	n/a	Low: 100% followed up		Low
e. Other	High: Withdrawals reported; outcomes provided only on completers (65% in each arm)	High	High: Other than deaths, 12% loss to-follow-up, although reasons/ characteristics not provided for withdrawals Data not provided for all participants	Low: 89% followed up		HRQoL: unclear
5. Selective outcome reporting	Unclear: Protocol not identified	Unclear Protocol not identified Mention of collection of GP consultations and exacerbations, but not reported	Unclear: Protocol not identified	Unclear: Protocol not identified	Unclear: Protocol not identified	Unclear: Protocol not identified
Other comments	Methodology of lung function measurement not given Table of characteristics provided only on completers	Baseline differences for age, CRQ, lung function and 6-MWT Table of characteristics only provided on completers	Clear imbalance of gender at baseline, and possibly other characteristics Outcome data very difficult to interpret as change provided between interim time points only		Study design problematic Although a cluster design analysis does not take this into account Unknown validity of satisfaction questionnaire Methodology of FEV_1 measurement not given	Baseline differences with respect to smokers, oxygen therapy, although comparable to disease severity (FEV_1% pred) Short follow-up period Outcome assessment not clear; percentage not always correct Lung function analyses not adjusted for baseline

6-MWT, 6-Minute Walk Test; GHQ, General Health Questionnaire; ITT, intention to treat; n/a, not applicable; SEM, standard error of the mean.
a Behnke *et al.*[64] and Behnke *et al.*[65] refer to the same trial.
b Casas *et al.*[71] and Garcia-Aymerich *et al.*[72] refer to subgroups of the same trial.

Dheda 2004[73]	Kwok 2004[70]	Wong 2005[74]	[b]Casas 2006[71]	[b]Garcia-Aymerich 2007[72]	Bucknall 2012[63]
Unclear: Unclear follow-up rate	Low: 89% followed up	Low: 97% followed up	Low	n/a	Low
	Low	Low	n/a	n/a	n/a
	89% followed up	97% followed up			
n/a	n/a	Low: 97% followed up	Low: Withdrawals reported; other than deaths < 10% lost	n/a	n/a
n/a	Low	n/a	Low	Low	Low
HRQoL: high Lung function: high 66.7% followed up in intervention arm and 83.3% followed up in control arm Withdrawals reported but no information on characteristics reported and, not accounted for in analysis	Exercise capacity: high 77% took part due to loss to follow-up and mobility problems	Low: 97% followed up	n/a	High: High loss to follow-up (other than deaths, 14.2% lost) Reasons for withdrawals reported but analyses undertaken only on completers Lost to follow-up appeared more severely affected than completers	High: HRQoL; self-efficacy; anxiety and depression high loss to follow-up; only 61% completed questionnaires at 6 months Non-completers had greater morbidity and worse baseline self-efficacy, and more likely to be in the control arm
Unclear: Protocol not identified	Unclear: Protocol not identified	Unclear: Protocol not identified	High: Data not available for HRQoL	Unclear: Protocol not identified	Unclear: Protocol not identified
Very small study Methods of outcome assessment not described Numerical data not available for lung function Rather limited information provided throughout One patient excluded from analysis owing to visiting GP (not ITT) No table of characteristics Confusion over SEM or SD	Three subjects in control were undergoing PR	Change in sample size calculation External validity of Chinese Self-Efficacy Scale Gender may not be very well balanced across arms	Differences in text and Table 2 for differences in rate of admissions Not well balanced on previous hospitalisations, and receipt of influenza vaccination	No description of lung function test methods Intervention arm seemed to have higher number of admissions in the previous year and possibly worse SGRQ score	

In general, the quality of reporting and conduct of the included studies was low, with some very small, poorly conducted studies.[64,65,73] Out of the 10 RCTs,[63–74] appropriate methods of randomisation (e.g. computer random number generator) were used in six trials[63,68–72,74] suggesting a low risk of bias, although methods were unclear in the remaining four.[64–67,73] Allocation concealment was insufficiently described in all except the largest most recent trial,[63] which used a central telephone method of allocation to reduce the risk of bias.

Blinding of patients and health-care personnel would not have been appropriate for this type of SM and similar such interventions; therefore, the results of any patient-reported outcomes or non-blinded, investigator-assessed outcomes would be potentially subject to bias. In this review, the important patient-reported outcomes were consistently judged to be subject to high risk of bias across all of the trials, including HRQoL, dyspnoea, anxiety and depression, self-efficacy, patient satisfaction and behaviour change.

Measurements of lung function and exercise capacity both rely on assessors' encouragement and could be subject to bias if not blinded. It was usually unclear whether or not investigators were blind to treatment when assessing lung function, although when measured, exercise capacity was judged to have low risk of bias because either the assessors were blind[70] or it was explicitly stated that they did not provide encouragement.[64,65] In general, conduct of outcome measurement were frequently poorly described, with standards and conduct of lung function testing particularly unclear.[64,65,68,72]

However, assessment of hospital admissions, other health-care utilisation and mortality would be likely to have a low risk of bias (either self-reported or obtained from records), as concluded for most of the included trials.

The most obvious flaw in the conduct of some of the included studies was the lack of completeness in follow-up, which was considerably < 70% in some trial arms and would be likely to bias most clinical measures and HRQoL (and other questionnaire) outcomes in particular,[63–65,73] and any other questionnaire/clinical measures. This was even discussed by the authors of the largest, most recent trial with only 61% of randomised patients with HRQoL reported at follow-up,[63] who concluded that the data were therefore unreliable. Several of the studies[64,65] reported characteristics of only the completing participants rather than all randomised participants, or gave no table of characteristics at all.[73] This weakens any attempt to assess baseline imbalance and any bias introduced at this stage.

As is usual, it was difficult to assess selective outcome reporting without availability of protocols. In addition, outcome data were unclearly analysed in several studies,[64–66,69,73] and the older studies (pre 2005) were often limited in their description of methods in general. There were signs of baseline imbalance between arms in some studies, which was not addressed in the analyses.[65] The best conducted and reported trials tended to be the most recent.[63,70–72,74]

Primary outcomes

All-cause mortality: no evidence of effect

Six trials[63,64,67,68,70–72] contributed mortality results (*Figure 3* and *Appendix 5*). There was a wide range of event rates across the trials. Despite the general heterogeneity of interventions, there was no statistical heterogeneity and the overall results indicated that there was no evidence of effect on mortality (HR 1.07, 95% CI 0.74 to 1.54). Using the GRADE system, we would judge that this is moderate-quality evidence (*Table 6*).

Hospital admissions: no evidence of effect

Seven trials[63,65,67,68,70,71,73] contributed data to the admissions results (*Figure 4* and *Appendix 6*). The results of three trials[66,69,74] could not be included in the combined results because they reported mean number of

Author	Length of follow-up (weeks)	Intervention events	Intervention total	Event rate in intervention arm	Control events	Control total	Event rate in control arm	HR directly reported	HR (intervention/control) (95% CI)
More supported interventions									
Kwok 2004[70]	26	3	77	0.08	6	80	0.16	No	0.51 (0.13 to 2.04)
Bucknall 2012[63]	52	30	232	NR	22	232	NR	Yes	1.35 (0.76 to 2.38)
Casas 2006[71]	52	12	65	0.20	14	90	0.17	No	1.21 (0.56 to 2.61)
Less supported interventions									
Hernandez 2003[68]	8	5	121	0.27	7	101	0.47	No	0.59 (0.19 to 1.85)
Hermiz 2002[67]	13	9	84	0.45	10	93	0.46	No	1.00 (0.40 to 2.45)
Home exercise interventions									
Behnke 2000[64]	26	1	23	0.09	1	23	0.09	No	1.00 (0.06 to 15.86)
Overall (I^2=0.0%, p=0.714)									1.07 (0.74 to 1.54)

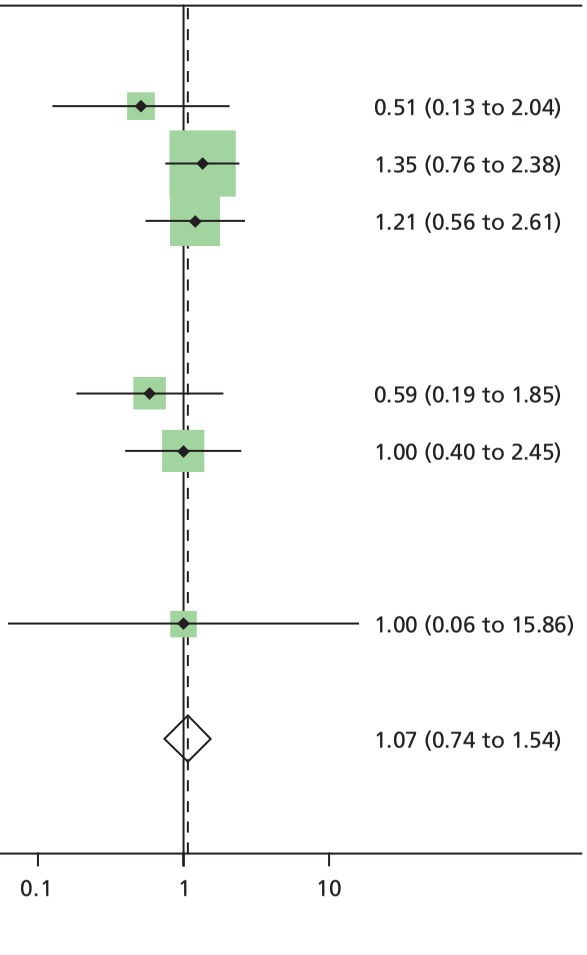


FIGURE 3 All-cause mortality. NR, not reported.

TABLE 6 GRADE summary of findings for main outcomes

Outcome	Control risk	Intervention risk	Results	No. of participants (trials)	Quality rating	Comments
Mortality	56/598	59/581	1.15 (95% CI 0.79 to 1.67)	1179 (6)	+++; moderate	Outcome measurement likely to be unbiased $I^2 = 0\%$ Generally, low risk of bias except allocation concealment rarely mentioned
Hospital admissions	259/621	211/596	0.78 (95% CI 0.52 to 1.17)	1217 (7)	++; low	Outcome measurement problematic in some trials due to loss to follow-up $I^2 = 70.9\%$ Wide CIs crossing line of no effect Some study results based on completers only
ED visits	n/a	n/a	Not combined RR ranged from 0.27 to 1.06	932 (5)	++; low	Unclear methods of randomisation and allocation in two trials Follow-up was generally short and results inconsistent
GP consultations	n/a	n/a	Not combined No significant effects	332 (2)	+; very low	Very little information
HRQoL	n/a	n/a	SGRQ 3.84-point improvement (95% CI 1.29 to 6.40 points)	845 (6)	+; very low	Biased follow-up – enormous loss to follow-up Outcome measurement likely to be biased I^2 = low

n/a, not applicable to report as combined values not computed; RR, rate ratio.

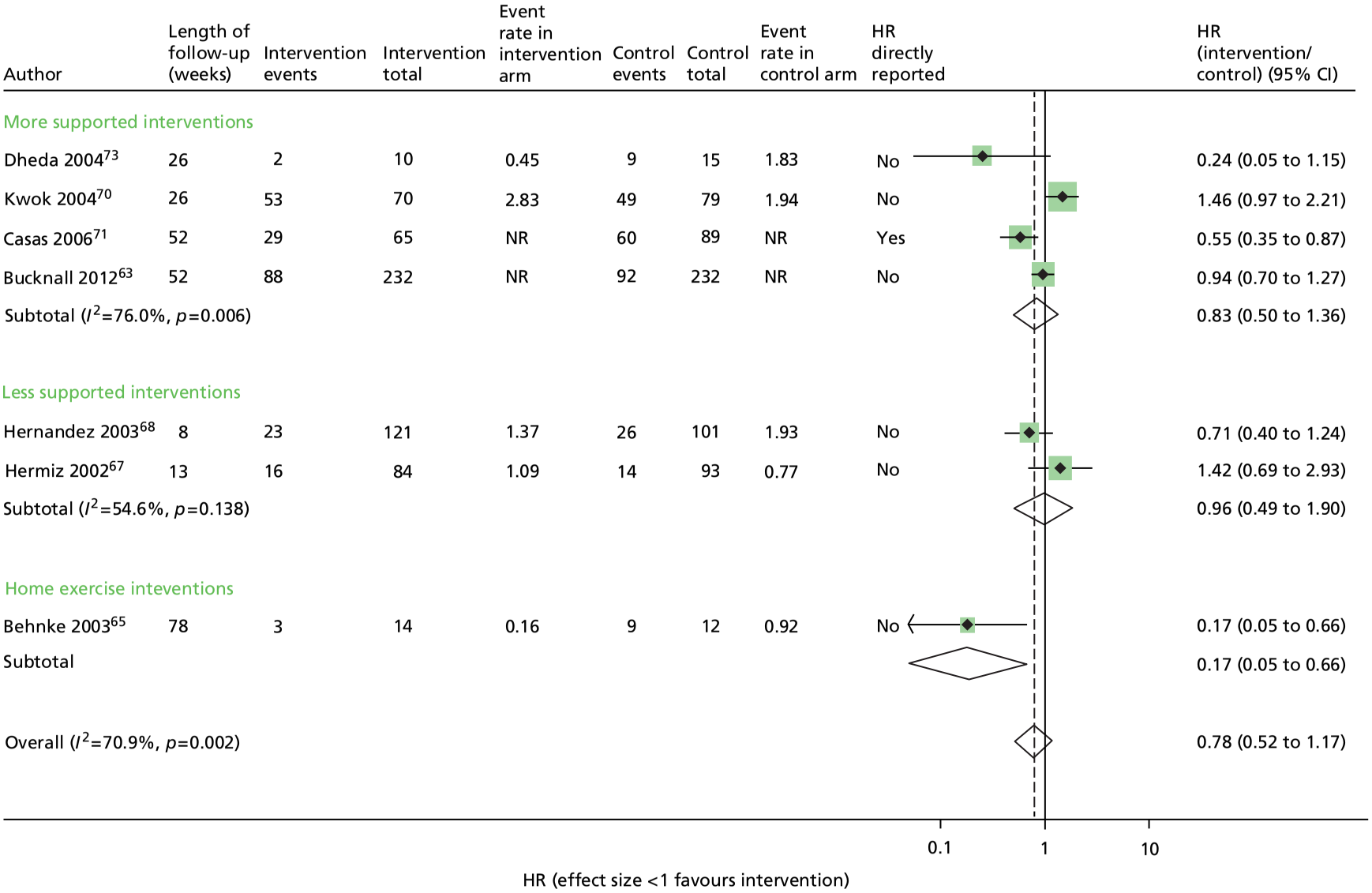


FIGURE 4 First hospital admission. NR, not reported.

admissions rather than first admission and one[69] also did not provide sufficient information to calculate a SE.

Overall, statistical heterogeneity was high ($I^2 = 70.9\%$), and subdividing by level of support explained only a fraction of this. Estimates are provided by level of SM support, although there was no evidence of any effect for the non-exercise-based interventions and substantial remaining heterogeneity.

One of the studies that may have contributed to the remaining heterogeneity in the non-exercise-based studies is the small study of 33 participants by Dheda *et al.*,[73] which was poorly reported, had signs of inadequate randomisation and very high loss to follow-up, especially in the intervention arm. This study[73] had the most extreme results in its category.

The trial of home-based exercise[65] demonstrated a large relative reduction on the rate of first admission (HR 0.17, 95% CI 0.05 to 0.66), although this trial was very small and these results were based only on participants who completed the study (< 60% of those randomised), and thus would also be subject to high risk of bias. Furthermore, although subgrouping by intervention category was an a priori identified analysis, care must be taken in the interpretation of results due to multiple comparisons being performed. The evidence above was judged to be of low quality according to GRADE (see *Table 6*).

General practitioner consultations: no evidence of effect

Two trials reported GP-related health-care activity (see *Appendix 7*).[67,71] Neither trial reported any evidence of differences between physician contacts, drug prescriptions or amount of education provided between the intervention arm and the control arm. Note that one trial[67] reported mean number of visits, although it is likely that median values would be more appropriate. The evidence was of very low quality (see *Table 6*).

Emergency department visits: no evidence of effect

The effect on ED visits is displayed in *Figure 5* (see *Appendix 8*), for which five trials[66–68,70,72] contributed data. Four trials[66,68,70,74] reported mean visits per patient and two[67,68] reported first visit. The two trials with a longer follow-up of 6 months[66,70] failed to demonstrate any evidence of an effect on ED visits. This evidence was also of low quality (see *Table 6*).

Secondary outcomes

Health-related quality of life: consistent with improvement although potential bias

Six trials[63–66,67,68,72,73] contributed data on HRQoL using the SGRQ, the CRQ or the EQ-5D (*Figure 6* and *Appendix 9*). The data from one study[69] could not be used as they reported median change only. Five trials[63,67,68,72,73] used the SGRQ, two trials[63,72] reported the EQ-5D and one trial[64] the CRQ.

Overall, SM interventions resulted in an improvement of 3.84 (95% CI 1.29 to 6.40) points on the SGRQ scale compared with control (close to the minimal clinically important difference of four points), although follow-up (where reported) ranged from about 25% to 83% across studies, and, therefore, this result should be treated with caution and contributed to the overall judgement that this evidence was of very low quality (see *Table 6*). In particular, the study by Dheda *et al.*,[73] which produced the most extreme results, had many methodological flaws.

Exercise capacity: possible effect with exercise-based intervention only

Two trials[64,65,70] reported on exercise capacity (see *Appendix 10*). For the study by Behnke *et al.*,[64] we analysed results from the longest follow-up time point (18 months). At this point, the home exercise programme showed strong statistical evidence of a large benefit compared with exercise advice only (MD in treadmill distance in 6 minutes = 355.0 m, 95% CI 269.2 m to 440.9 m). Note that this trial was likely to be biased, as only completing participants were described, and the trial had a loss to follow-up

Author	Length of follow-up (weeks)	Intervention events	Intervention total	Event rate in intervention arm	Control events	Control total	Event rate in control arm	HR directly reported	First or all events for each patient	Rate ratio (intervention/control) (95% CI)
More supported interventions										
Kwok 2004[70]	26	154	70	NR	182	79	NR	No	All visits	0.95 (0.77 to 1.18)
Lee 2002[66]	26	76	48	NR	61	41	NR	No	All visits	1.06 (0.76 to 1.49)
Less supported interventions										
Hernandez 2003[68]	8	11	121	0.62	21	101	1.52	No	First visit	0.41 (0.20 to 0.85)
Hermiz 2002[67]	13	2	84	0.1	8	93	0.36	No	First visit	0.27 (0.06 to 1.26)
Hernandez 2003[68]	8	16	121		31	101		No	All visits	0.44 (0.24 to 0.79)
Wong 2005[74]	13	3	30		12	30		No	All visits	0.28 (0.09 to 0.91)

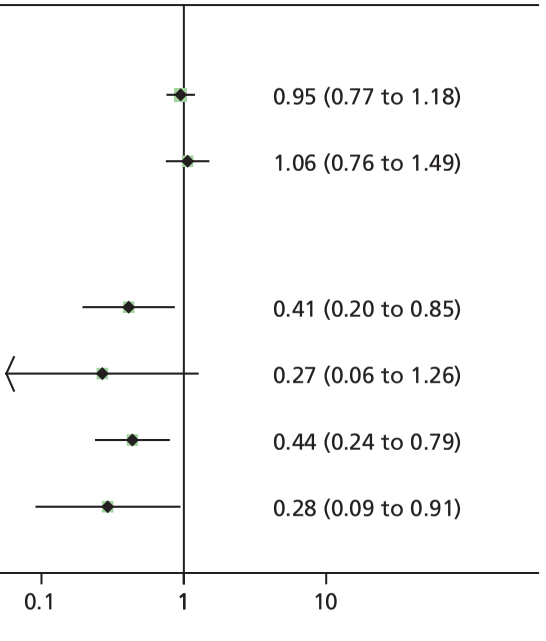


FIGURE 5 Emergency department visits. NR, not reported.

Author	Length of follow-up (weeks)	Baseline difference (intervention–control)	Analysis method	Follow-up in intervention arm *n*(end)/*n*(start) (%)	Follow-up in control arm *n*(end)/*n*(start) (%)	Intervention category	Mean difference (intervention–control) (95% CI)
SGRQ							
Dheda 2004[73]	26	NR	Comparison of final scores	10/15 (67)	15/18 (83)	More supported interventions	15.00 (2.46 to 27.54)
Garcia-Aymerich 2007[72]	52	–9.3	Comparison of change since baseline	21/44 (48)	41/69 (59)	More supported interventions	2.39 (–5.78 to 10.56)
Bucknall 2012[63]	52	0.8	ANCOVA	69/232 (30)	53/232 (23)	More supported interventions	4.52 (–0.03 to 9.07)
Hernandez 2003[68]	8	NR	Comparison of change since baseline	NR/121 (NR)	NR/101 (NR)	Less supported interventions	4.50 (0.66 to 8.34)
Hermiz 2002[67]	13	3.02	Comparison of change since baseline	67/84 (80)	80/93 (86)	Less supported interventions	1.32 (–2.97 to 5.61)
Subtotal (I^2=14.6%, p=0.321)							3.84 (1.29 to 6.40)
CRQ							
Behnke 2000[64]	26	NR	Comparison of final scores	15/23 (65)	15/23 (65)	Home exercise interventions	1.95 (1.32 to 2.58)
Subtotal							1.95 (1.32 to 2.58)
EQ-5D							
Garcia-Aymerich 2007[72]	52	NR	ANCOVA	21/44 (48)	41/69 (59)	More supported interventions	0.62 (–0.51 to 1.75)
Bucknall 2012[63]	52	NR	Comparison of change since baseline	107/232 (46)	75/232 (32)	More supported interventions	–6.90 (–36.14 to 22.34)
Subtotal (I^2=0.0%, p=0.615)							0.61 (–0.52 to 1.74)

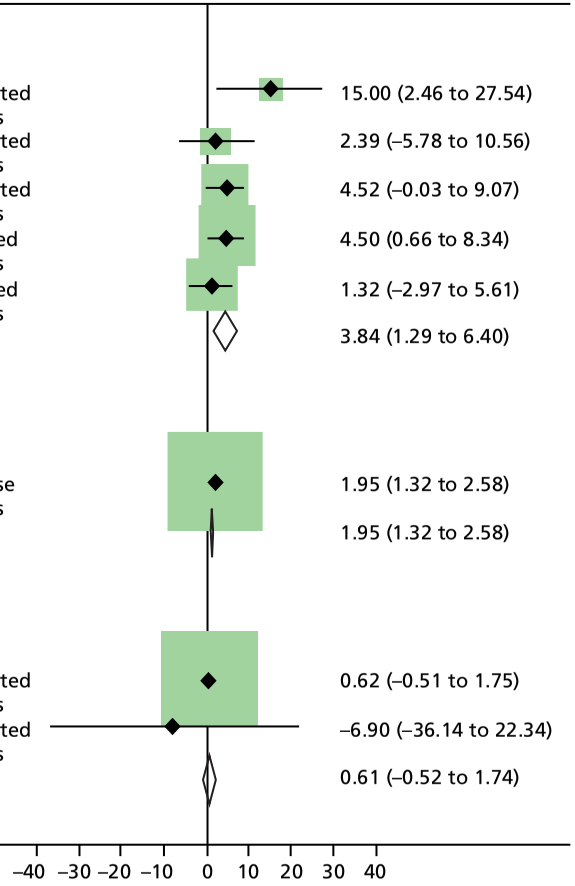


FIGURE 6 Health-related quality of life as measured by SGRQ, CRQ and EQ-5D. NR, not reported.

of > 40%. In neither trial was the substantial baseline imbalance taken into account, which would have exaggerated the effect size. In contrast, the trial of nurse-supported discharge in Hong Kong retained nearly 90% of its patients, and there was no statistical evidence of a difference after 6 months in mean distance walked compared with the UC arm (MD 24 m, 95% CI –7.1 m to 55.1 m).

Lung function: no evidence of effect

Data from four trials[64–66,68,72] were plotted (see *Appendix 11*). Three trials provided results on raw FEV_1 values (*Figure 7*),[64,65,68,72] and two trials the effect on percentage predicted FEV_1 (*Figure 8*).[65,66] There was no evidence of any effect from any of the individual trial results, and it was not deemed appropriate to pool the individual trials due to the small number of studies and heterogeneity of outcomes, follow-up time and methods of analysis. The findings are in agreement with the fifth trial[73] which reported no evidence of effect on FEV_1 but did not provide data. Again, the proportion of patients followed up across the trials was very variable.

Anxiety and depression: possible improvement in scores

Four trials (see *Appendix 12*)[63,66,69,70] reported on psychological health outcomes; however, only two trials[63,66] contributed to the analysis on anxiety (*Figure 9*) because one trial[69] reported only median changes and the other[70] did not provide separate results for anxiety. Although there were data on less than half of the sample in the larger study,[63] the intervention group had a mean reduction of 1.06 points (95% CI 0.04 to 2.08 points) in the 'anxiety' component of the Hospital Anxiety and Depression Scale (HADS) score compared with the control group, and the other trial[66] demonstrated a mean reduction of 1.5 points (95% CI 0.62 to 2.38 points) in the 'anxiety and insomnia' component of the General Health Questionnaire (GHQ) relative to the control group.[66]

One of the above trials[66] also showed some evidence of a reduction in depression score (MD –1.0, 95% CI –1.97 to –0.03), although follow-up rates were not reported, whereas there was no evidence of effect in the larger trial[63] (*Figure 10*).

Exacerbations: no evidence of effect

Only one small, poor-quality trial[73] of hospital outpatient follow-up ($n = 33$) reported on exacerbations. This study reported that there were 'fewer patients with two or more exacerbations within a six-month period (2 v. 3) in the intervention group but the small numbers precluded meaningful statistical analysis'.

Dyspnoea: possible effects in exercise trial

Two RCTs[64,65,70] reported effects on dyspnoea (see *Appendix 13*) reporting a variety of different measures. The Behnke trial[64,65] of home-based exercise reported effects at 1, 2, 3, 6, 12 and 18 months using the Baseline/Transitional Dyspnoea Index and the 'dyspnoea' domain of the CRQ questionnaire. Significant improvements in dyspnoea score in the intervention arm were observed throughout the trial, with all measures. However, > 45% of the 46 original patients had dropped out by the end of the follow-up period.

A trial of integrated care[72] also reported dyspnoea among 62 of 113 completers using the Medical Research Council (MRC) dyspnoea scale, finding no evidence of effect after 12 months (MD between two arms –0.38, 95% CI –1.1 to 0.34).

Behaviour change: improvement in knowledge but inconsistent evidence of effects on behaviour

Three trials[67,68,72] reported effects of the intervention on a range of health behaviours (see *Appendix 14*). None of the studies used validated questionnaires.

All three trials[67,68,72] reported significantly better knowledge about the disease and how to recognise and treat exacerbations among patients receiving the SM intervention, and two trials[68,72] reported significantly better adherence to inhaler treatment and inhaler technique. This was not matched by improvements in smoking behaviours or uptake of vaccines. Effects on physical activity were inconsistent.

Author	Length of follow-up (weeks)	Baseline difference (intervention–control)	Method of analysis	Follow-up in intervention arm *n*(end)/*n*(start) (%)	Follow-up in control arm *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
More supported interventions						
Garcia-Aymerich 2007[72]	52	NR	Comparison of change since baseline	21/44 (48)	41/69 (59)	–0.07 (–0.19 to 0.05)
Home exercise interventions						
Behnke 2003[65]	Average over 18 months	–0.04	Comparison of change since baseline	14/23 (61)	12/23 (52)	0.08 (–0.20 to 0.36)
Less supported interventions						
Hernandez 2003[68]	8	NR	Comparison of final scores	NR	NR	0.20 (–0.04 to 0.44)

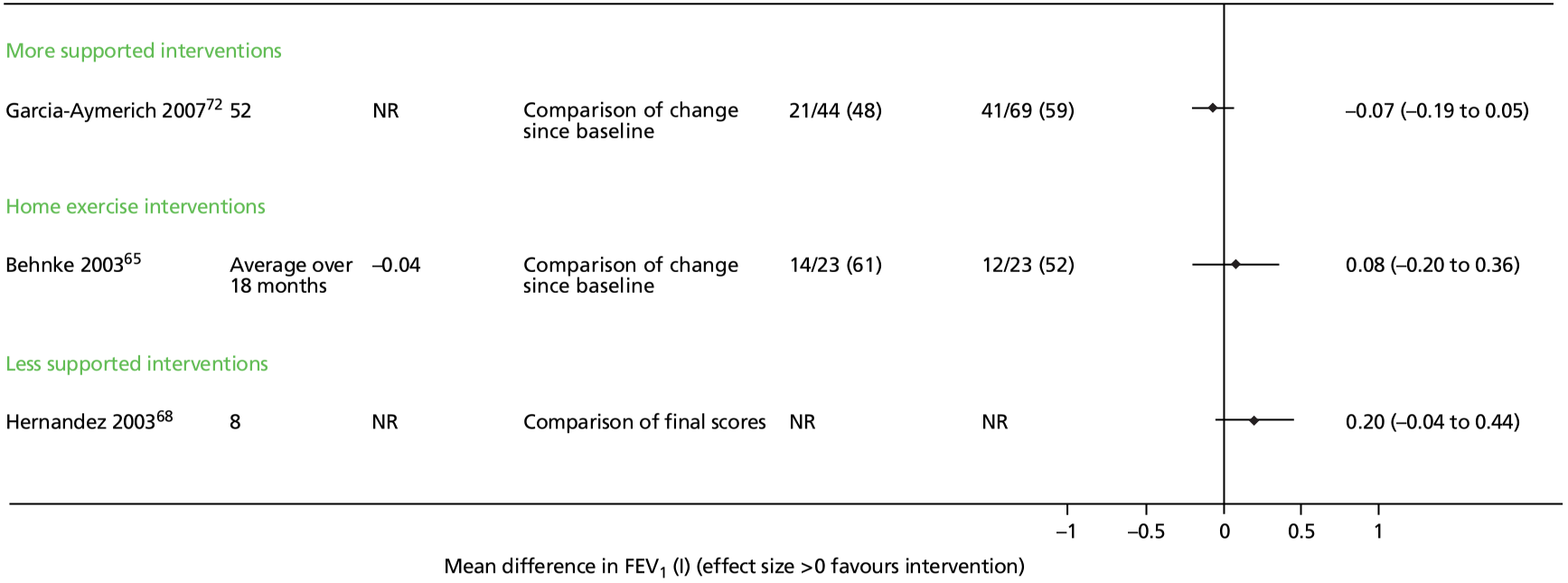


FIGURE 7 Lung function (FEV_1, l). NR, not reported.

Author	Length of follow-up (weeks)	Baseline difference (intervention–control)	Method of analysis	Follow-up in intervention arm *n*(end)/*n*(start) (%)	Follow-up in control arm *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Home exercise interventions						
Behnke 2003[65]	Average over 18 months	1	Comparison of final scores	14/23 (61)	12/23 (52)	5.90 (–4.78 to 16.58)
More supported interventions						
Lee 2002[66]	26	–3.4	Comparison of final scores	NR	NR	0.50 (–5.00 to 6.00)

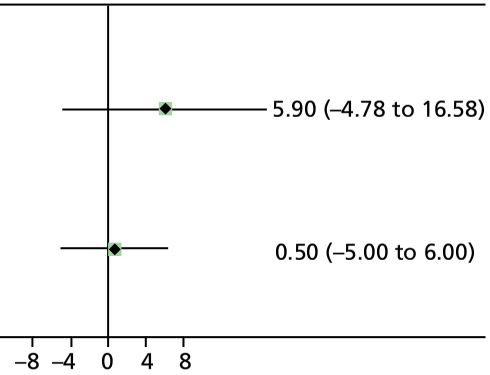
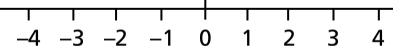


FIGURE 8 Lung function (FEV_1% pred). NR, not reported.

Author	Scale	Length of follow-up (weeks)	Method of analysis	Baseline difference (intervention–control)	Follow-up in intervention arm *n*(end)/*n*(start) (%)	Follow-up in control arm *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
More supported interventions							
Lee 2002[66]	GHQ (anxiety and insomnia)	26	Comparison of change since baseline	0.77	NR	NR	–1.50 (–2.38 to –0.62)
Bucknall 2012[63]	HADS	52	ANCOVA	0.7	104/232 (45)	82/232 (35)	–1.06 (–2.08 to –0.04)



Mean difference in score (effect size <0 favours intervention)

FIGURE 9 Anxiety. NR, not reported.

FIGURE 10 Depression. NR, not reported.

Self-efficacy: inconsistent effects

Two trials[63,74] reported effects on self-efficacy (see *Appendix 15*). Significant improvements in self-efficacy were observed in the trial[74] of a community nurse-supported discharge programme in Hong Kong after 3 months ($p = 0.009$), which was most marked in the physical exertion and weather/environment domains. Despite a high loss to follow-up, a much larger and more intensive trial[63] of supported SM reported no evidence of improvement in self-efficacy after 12 months.

Patient satisfaction: inconsistent results

Four trials[66–68,72] reported effects on patient satisfaction with the intervention using different questionnaires (often with little detail provided; see *Appendix 16*). Two[66,68] of the trials[66–68,72] indicated increased satisfaction with their care compared with the control arm. However, loss to follow-up was generally high.

Discussion

Key results

Despite a rigorous search we identified only 10 RCTs[63–74] that evaluated the effectiveness of interventions providing SM support to patients shortly after being discharged from hospital with an acute exacerbation of their COPD.

Few of the trials had consistently low risk of bias. Many studies were small and suffered from inadequate reporting and high loss to follow-up, particularly affecting patient-reported outcomes such as HRQoL.

Although the participants seemed relatively homogeneous, interventions were very heterogeneous, with some trials[67–69,74] providing low-intensity, short-term support of 2–3 months and others[63] a very intensive package lasting for 12 months.

Overall, there was limited evidence of effect on health-related behaviours and outcomes. There was some evidence of improvement in patient knowledge, treatment of exacerbations and inhaler technique,[68,69,73] but there was inconsistent evidence of effect on other health-promoting behaviours[68,73] or on self-efficacy.[64,75]

In terms of health outcomes, the most consistent effects were observed on patients' QoL, with an overall improvement with data from five trials[63,67,68,72,73] of 3.8 points on the SGRQ score (close to the minimally clinically important difference of four points). Notably, though, this estimate should be treated with caution because, although reaching statistical significance, there was substantial and differential loss to follow-up in both arms, which could bias the results in favour of a positive effect. The authors of the largest trial[63] indicated, themselves, that the results from their trial could be unreliable. The reduction in anxiety exhibited in two trials,[63,66] however, supports some potential effect on patients' psychological health (although it is not clear whether or not this would be clinically important).

An important outcome for these patients is whether the SM package had any effect on subsequent hospital admissions. We were able to use data that reported time to first all-cause admission. Despite subdividing by intensity of intervention, we were unable to explain the substantial heterogeneity observed, but, overall, there was no clear evidence of effect on hospitalisation (HR 0.78, 95% CI 0.52 to 1.17; $I^2 = 71\%$). Post hoc inspection of the data suggested a possibility of a greater effect with the exercise-based intervention but would require more data to be explored in depth. It is possible, however, that the effects on admissions would be diluted because we extracted admissions due to any cause (although in our analysis the majority were for respiratory causes).

There was no apparent evidence of effect on mortality and no clear patterns with duration of intervention.

In general, the most positive results across the outcomes were observed in the small trial of home-based exercise[64,65] but, given the multiple methodological limitations of the trial in terms of reporting and analysis, the results have to be interpreted with caution.

How this fits with other literature

This is the first systematic review that addresses the effectiveness of SM support provided to patients with COPD soon after hospital discharge. The only other review related to this time point is a Cochrane review of PR,[76] which identified nine trials and showed significant reduction in hospital admissions [pooled odds ratio (OR) 0.22, 95% CI 0.08 to 0.58], over 25 weeks and mortality (OR 0.28, 95% CI 0.10 to 0.84) over 107 weeks. Effects of PR on HRQoL were well above the minimal important difference when measured by the CRQ and the SGRQ total score (MD –9.88, 95% CI –14.40 to –5.37). However, in common with our review, trials were small and methodologically inadequate, and, although loss to follow-up was not discussed or assessed in the risk of bias section, a large proportion did not complete the rehabilitation. There was also significant heterogeneity across many of the outcomes. The authors discussed the possibility of publication bias and possible overestimate of effect with small trials but suggested this would not account for the whole effect. The results would fit with our tentative observation that trials with an exercise component might be more effective.

The majority of the studies and reviews of SM support are set among patients who have COPD in a stable state. Our results, although showing few significant effects, are consistent with some of the other systematic reviews. For example, a systematic review of SM education[48] showed evidence of a significant reduction in respiratory admissions (OR 0.64, 95% CI 0.47 to 0.89; $n = 8$ RCTs) and a significant mean improvement of 2.6 points (95% CI 0.2 to 5.0 points) on the SGRQ score ($n = 7$ trials). A review of PR[46] reported an overall mean improvement in SGRQ score of 6 points (95% CI 3 to 9 points; $n = 6$ trials) and a review of integrated disease management[47] found a similar improvement in HRQoL: SGRQ 3.71 points (95% CI 1.6 to 5.8 points; $n = 13$); CRQ 1.02 points (95% CI 0.67 to 1.36 points; $n = 4$) and respiratory admissions (OR 0.68, 95% CI 0.47 to 0.99; $n = 7$) and a similar lack of effect on mortality. Conversely, a review of action plans found little evidence of benefit on HRQoL or health-care utilisation.[50]

In the last couple of years, and particularly since the completion of our searches, there have also been a number of individual trials and commentaries that question whether patients are actually able to self-manage.[34,36,77,78] Two of these among patients with COPD[35,62] identify a group of successful self-managers in post hoc exploratory analyses. The first of these[63] is included in our review but no other studies have explored these subgroups so we were unable to examine this point further.

Strengths and weaknesses

A strength of this review was the comprehensive search and selection process, which made it unlikely that we would have missed relevant studies. In addition, we followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance with respect to study selection, data extraction, risk of bias assessment, reporting and analysis.

The main limitation relates to the paucity of evidence and methodological weaknesses of many of the available studies, which limits our conclusions, and the heterogeneous nature of the interventions that makes comparisons hard and conclusions difficult to draw. The particular problems with these studies, especially the older ones, include generally inadequate reporting of important items, particularly methods of randomisation and limited data on baseline characteristics. Many studies were small, with data reported only for participants completing the trial and had substantial loss to follow-up of > 30% in some arms, which is likely to bias all self-reported items and HRQoL in particular. There was a lack of information about the assessment of some outcomes, especially lung function measurements and analyses were often unclear or inappropriate. In addition, the admission results were reported in several different ways, for example first admission, mean admissions, etc. Although ideally we would like to be able to capture all of this information – especially as some patients may have multiple admissions – current methodologies are

inadequate to do so. We chose rate of first admission because there were more data available; however, it is unclear how the effect of the interventions would vary if all admissions could be considered.

With the limited number of trials it was not possible to assess publication bias, but it is possible that because of the small size of the studies showing positive effects this would be a potential problem.

Another issue is that of generalisability, as only two RCTs[63,73] were set in the UK health-care setting. Studies in China and other areas of Europe may not necessarily be relevant; the feasibility and effectiveness of different types of support may be dependent on both financial and practical issues in individual settings. With the limited data available it was not possible to explore the effect of different settings.

Implications for research and practice

It is difficult to recommend any type of SM support to be provided immediately after discharge with the evidence available as there is no clear evidence of effect across most of the outcomes. This conclusion is in contradiction to the current recommendations in the COPD discharge care bundle.[79] Notwithstanding, the point estimate is consistent with ≈20% reduction in admissions which has been observed in other systematic reviews.

However, to move forward with this area of research, there should be:

- more in-depth work to explore the needs/views of patients with regard to SM support after a recent discharge from hospital before designing novel interventions aimed at behaviour change
- an adequate standard of reporting ensured in future trials, and they should be conducted to modern standards with an adequate number of participants
- a clear framework for describing and classifying SM interventions and their comparators
- an exercise component included in future studies
- clear reporting of outcomes to include self-efficacy, behaviour change and clinical outcomes, including separate reporting of COPD-related and all-cause admissions
- consideration that patients may be too ill at this point (both physically and psychologically) to take up the more rigorous parts of SM interventions until they are in a more stable state; the difficulty in recruitment and retention in the included studies bears this out.

Conclusions

- Self-management support delivered shortly after an acute exacerbation may have some benefit in terms of HRQoL and possibly admissions but the evidence is thin and unconvincing.
- Exercise may play an important role but there are not enough data to explore this.
- Any future trials should address issues of bias, particularly loss to follow-up, but this may be inherent in the nature of the intervention and the fact that patients are still trying to recover from an exacerbation.
- The evidence is not in support of SM interventions to be put into practice for patients with COPD at, or recently after, hospital discharge.

Chapter 4 A systematic review of the qualitative evidence about patient satisfaction, acceptance and barriers to supported self-management interventions delivered shortly after hospital discharge: review 2

The aim of this chapter is to present the findings of a systematic review of the qualitative evidence about patient satisfaction, acceptance and barriers to self-management (SM) support.

Methods

A systematic review of published evidence of the qualitative evidence about patient satisfaction, acceptance and barriers to SM support programmes among patients with chronic obstructive pulmonary disease (COPD) recently discharged from hospital.

Definition of self-management

As described for review 1 and tabulated in *Table 2*.

Search strategy

A comprehensive search strategy was undertaken as described as for review 1. The search was broad and covered many databases and no study design filters were applied. Search terms related to qualitative evidence included 'patient-centred' and 'patient focus'.

Study selection process

As described for review 1.

Selection criteria

Selection criteria were as described for review 1, with the difference of two elements: study design and outcomes. Only qualitative study designs (interviews and focus groups) were sought and outcomes relating to patient satisfaction, acceptance and barriers to SM were assessed.

Study quality, data extraction and synthesis

Study quality was assessed using the Critical Appraisal Skills Programme (CASP) checklist for qualitative research.[80] As well as extracting data related to study and patient characteristics, any quotes, key themes and concepts identified were extracted. As outlined in the protocol, an interpretive analysis (meta-ethnography)[81] was planned if findings allowed. This involved looking for similarities (reciprocal translation), differences (refutational translation) or creating a line of argument using concepts proposed in included primary studies. However, as only one study described a small element of qualitative interviewing, this was not undertaken.

Results

Search results

Figure 11 outlines the flow of included studies. One of the included randomised controlled trials (RCTs)[69] from review 1 had a limited qualitative element referring to patient satisfaction and was therefore included in this review. There was also one ongoing study (see *Appendix 4*).

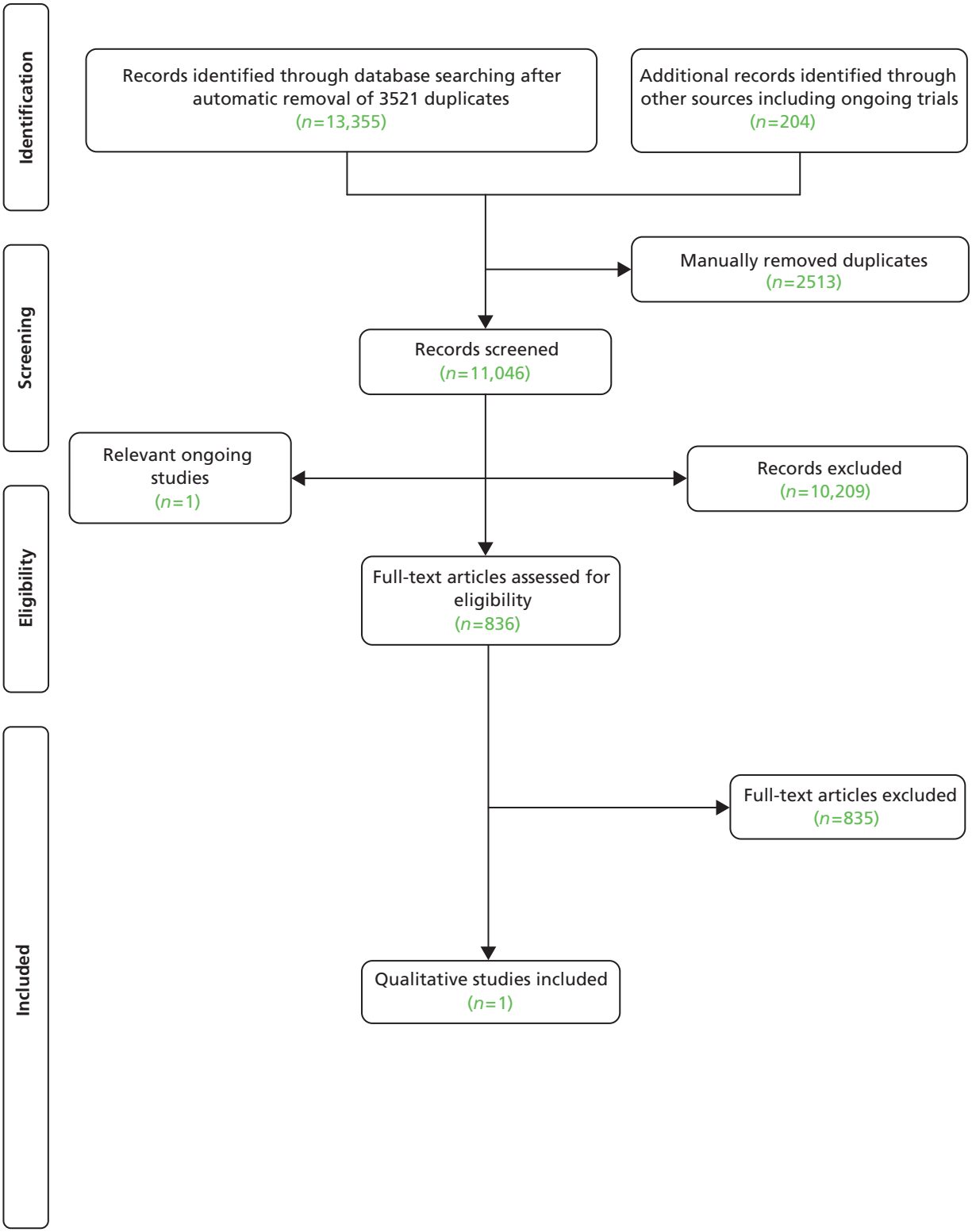


FIGURE 11 Selection process for qualitative studies.

Characteristics of included study

The included trial was a trial of nursing-based case management among 66 patients in Australia admitted to hospital with COPD. The intervention comprised SM support with review and two telephone calls and follow-up for 3 months in total, compared with usual care.[69] A subgroup of 18 patients and their carers from both arms of the trial were interviewed in more depth using semistructured interviews focusing on issues associated with patients and caregiver satisfaction with care. The interviews were recorded, and then transcribed and coded to identify themes. These interviews revealed that patients were very satisfied with their care in hospital and, for those in the intervention arm, ongoing contact with the community nurse was very helpful in improving their access to resources and communication with the health professionals. For those in the control arm, those with family support or medical contact were satisfied but those without were not. *Table 7* describes the patient and caregiver quotes in relation to case managers.

Quality of included studies

Table 8 presents an assessment of the quality of this study. The aims of the study were not very clear from the outset, which means that it was difficult to assess which methodology would be appropriate. It was possible to infer that patients'/carers' views and satisfaction with the intervention would be sought, which would mean that these semistructured qualitative interviews would be appropriate. However, although the authors mentioned that patients were selected to maximise variability, the only factor that they mention is about representing both intervention and control groups.

There is mention of the home setting, although not the justification for it, but they do not mention a topic guide, any modification of the methods, details of any interviewer biases, how the themes were identified or whether or not saturation was reached. Thus, the findings are really not very valuable.

TABLE 7 Patient and caregiver quotes from included qualitative study

Context	Quotation
The caregiver of a patient in the control group without support – such as extensive family, medical support from health-care professionals	*It is absolutely hopeless*
A patient from the intervention group who received a CM talking about benefits of having a CM	*I became more involved with (the CM) and it was good to know that she cared . . . kept on your hammer all the time . . . So I think that . . . it will give some peace of mind to the patients, you know. The big thing is to know what is happening*
A patient from the intervention group commenting on benefits that a CM provides	*(The CM) made me aware of things that were available that I didn't bother to want to know about before*
A caregiver of a patient of the intervention group commenting on benefits that a CM provides	*(The CM) helped me organize (a nebulizer); she pointed out a lot of things to me, different things that should be done (for the patient)*

CM, case manager.
Source: quotes taken from study by Egan *et al.*[69]

TABLE 8 Risk of bias assessment of included qualitative study using CASP checklist for qualitative research

CASP checklist questions	Judgement and comments/quotes
Was there a clear statement of the aims of the research?	Unclear Aims of the RCT made clear Authors state a lot of focus is around economic outcomes rather than patient-focused outcomes; no clear aim relating to qualitative research
Is a qualitative methodology appropriate?	Unclear *This is an RCT which has both quantitative and qualitative analyses* Unclear as the research goal is not clearly stated although they mention focusing on issues to do with patient and caregiver satisfaction
Was the research design appropriate to address the aims of the research?	Unclear Very little detail of qualitative methodology reported, although semistructured interviews seem appropriate
Was the recruitment strategy appropriate to the aims of the research?	Unclear *Participants were selected to maximise variability and to represent both intervention and control groups* Variability not detailed; subgroup of 18 patients from RCT selected for qualitative
Were the data collected in a way that addressed the research issue?	Unclear Audiotaped interviews Patient interviews – semistructured Patients and caregivers interviewed at home No topic guide, no mention of any modifications during study, no justifications for setting for data collection
Has the relationship between researcher and participants been adequately considered?	Unclear No details of biases; not clear who led interviews
Have ethical issues been taken into consideration?	Unclear 'The study received ethical clearance from the participating hospital' – This is in reference to the RCT; no other details regarding ethics
Was the data analysis sufficiently rigorous?	Unclear Not enough detail to permit judgement *All interviews, including those with the respiratory physicians were audiotaped then transcribed and coded to identify recurring themes and patterns*
Is there a clear statement of findings?	Unclear Not particularly adequate *Based on the qualitative interviews, all patients were very satisfied with their care in hospital*
How valuable is the research?	Not very valuable as it stands with limited details

Discussion

Key results

A comprehensive search of the literature revealed only one RCT[69] with a limited qualitative aspect and limited conclusions.

Strengths and weaknesses

The search strategy was broad, conducted across several databases and with no study design filters applied. Additionally, reviewers adhered to a systematic methodology with two independent reviewers assessing studies for inclusion and exclusion against a prespecified selection criteria; therefore, it was unlikely that any relevant qualitative evidence will have been overlooked. However, after a thorough search and identification process, only one study[69] was included.

How this fits with the findings of the effectiveness review (review 1)

Unfortunately, the included study[69] only gave scant information regarding the qualitative aspects, and it is difficult to be sure of the true purpose of the interviews and how they were actually conducted. The study,[69] however, reported that patients who received a case manager were very satisfied with their care, and were made aware of resources available to them and how to use them. Those in the control arm without family support were more concerned about their situation, although those in the control arm with family support seemed reasonably satisfied. This reflects the evidence from the quantitative studies for which the evidence was inconsistent (two studies[66–68,72] showed better satisfaction with the intervention and two did not) but does not really gain much further insight.

Conclusions

There is almost no qualitative evidence about patients' views on SM support programmes that are delivered post discharge, and, given that the quantitative evidence reveals uncertainty about the effectiveness of such interventions in their current form, it is therefore a potential area of research need.

Chapter 5 A systematic review of the cost-effectiveness of supported self-management interventions delivered shortly after hospital discharge: review 3

The aim of this chapter is to present the findings of a systematic review of the cost-effectiveness of self-management (SM) interventions delivered post discharge in patients with chronic obstructive pulmonary disease (COPD) compared with usual care (UC).

Methods

A systematic review of the literature was conducted to identify all published studies assessing the cost-effectiveness of SM interventions delivered to patients with COPD within 6 weeks of hospital discharge following an acute exacerbation.

Search strategy

A comprehensive search strategy was undertaken by an experienced information specialist from inception to May 2012. Three electronic databases were searched: MEDLINE and EMBASE via Ovid and Cochrane NHS Economic Evaluation Database (Wiley). Searches were not limited by date nor were any language restrictions applied. The search strategies used for each database can be found in *Appendix 17*. Relevant literature from the clinical effectiveness searches were also identified and included for review, if they had not already been captured in the searches for cost-effectiveness.

Reference Manager version 11 was used to store and manage all references.

Study selection process

The inclusion and exclusion criteria outlined below were used to select studies. A two-stage review process was applied by two independent reviewers: first, screening titles and abstracts, and then reviewing full papers. Discrepancies were resolved by a third reviewer with expertise/knowledge in the field of health economics.

Selection criteria

Study design

Full and partial economic studies, costing studies and costing models were included.

Population

Studies including patients admitted to hospital with an acute exacerbation of COPD, who were recruited at the point of discharge or within 6 weeks after discharge were included (see *Chapter 3*, *Methods*).

Intervention

Any SM programme, package or intervention including adherence to medication, inhaler technique, breathing techniques, exercise, education and support groups among others. Pulmonary rehabilitation was not included for this review.

Comparator

Comparators considered were UC, other SM interventions or no intervention.

Outcomes

Cost-related outcomes included health service utilisation, hospital admissions and readmissions, duration of admissions, ED visits, days lost from work, drug utilisation and cost-effectiveness. Effectiveness outcomes were as reported for the clinical effectiveness review (see *Chapter 3*).

Risk of bias assessment

Risk of bias of included studies was assessed using the Drummond checklist, as suggested in the *Cochrane Handbook*.[56] Risk of bias assessment was undertaken by two reviewers independently, one of whom had expertise in the field of health economics.

Data extraction

Study characteristics and results were extracted independently by two reviewers. Meta-analysis was not considered appropriate for this review because of the paucity of evidence.

Results

Search results

Figure 12 outlines the study identification process. A total of 1611 references were imported into Reference Manager, and 240 duplicates were removed automatically and manually. Overall, 1131 titles and abstracts were screened, with 129 articles being identified for full-text review. Only one study[68] met the inclusion criteria for this review, which also formed part of the clinical effectiveness review. A further four studies met initial inclusion criteria but were ongoing and so have been listed in *Appendix 4*.

A number of other studies ($n = 27$) were identified as potentially useful to inform the independent economic analysis (see *Chapter 6*). These studies included relevant primary or secondary data on the cost or utilisation of health care associated with SM in patients with COPD; however, the intervention was not delivered to patients in hospital at the point of discharge or within 6 weeks of hospital discharge. Data from some of these studies were used to estimate the costs of SM in the model (see *Chapter 6*).

Characteristics of included studies

The single included trial by Hernandez *et al.*[68] was conducted in two tertiary hospitals in Barcelona, Spain, with a total sample size of 222 patients: 121 patients were randomised to the home hospitalisation group and 101 were randomised to conventional care. The hospital-at-home intervention included four phases: assessment by a specialist team during admission to the emergency room; treatment at discharge; home hospitalisation with follow-up; and assessment after 8-week follow-up. Specific SM components implemented as part of the hospital-at-home service included 2 hours of the following delivered at the point of discharge and later reinforced during home visits (along with action plan reinforcement):

- education on disease, adherence to medication and recognition/prevention of triggers of exacerbations
- selecting appropriate equipment at home and training on the correct administration of pharmacological therapy
- smoking cessation
- patient empowerment for daily life activities, including hygiene, dressing, household tasks, leisure activities, breathing exercises and skeletal muscle activity
- nutrition recommendations
- socialisation and changes in lifestyle.

The following outcomes were reported: mortality, readmissions or ED visits, hospitalisation, HRQoL, lung function, patient satisfaction, disease knowledge, inhaler technique, medication prescriptions, and home rehabilitation and costs.

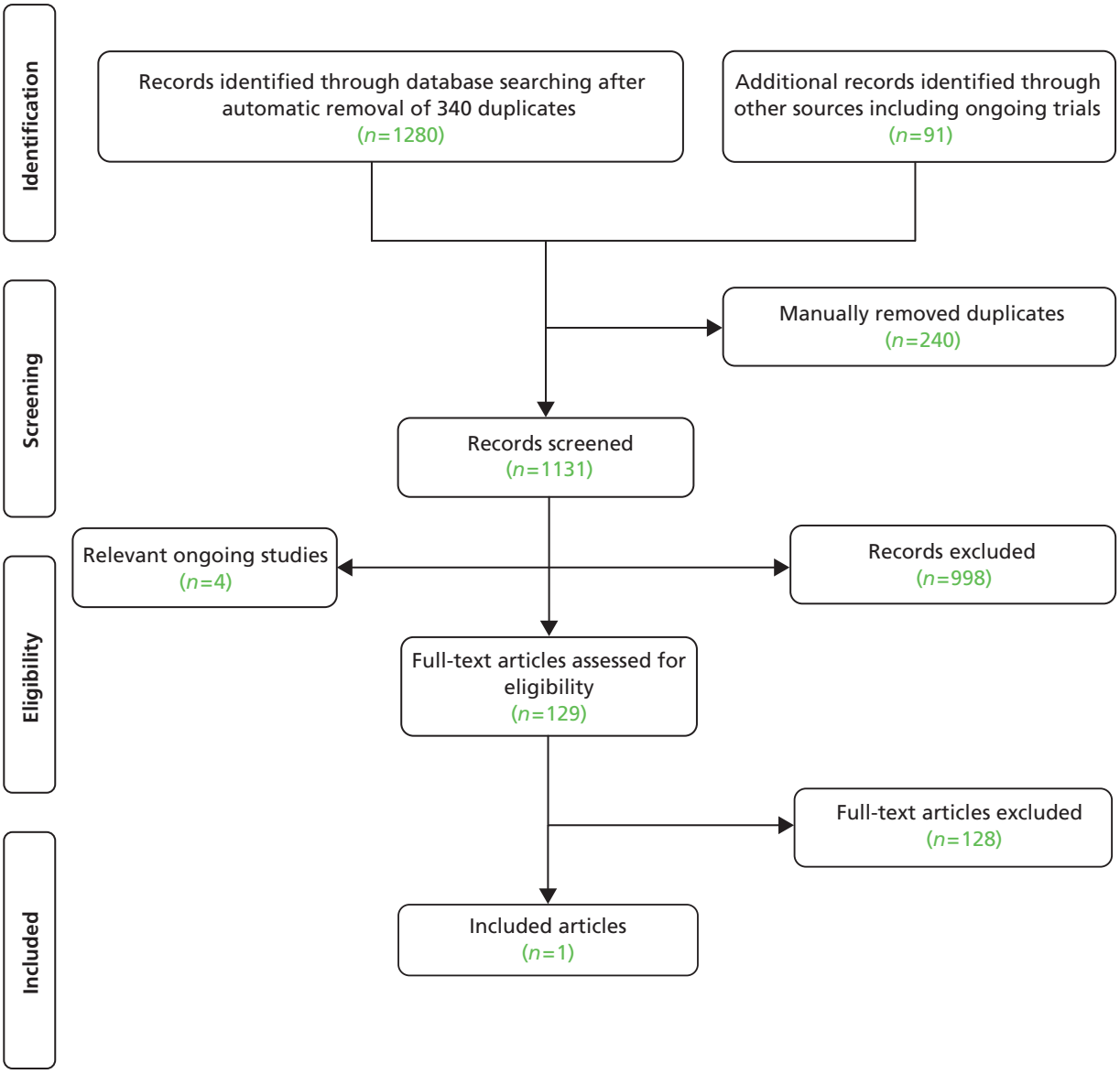


FIGURE 12 Selection process for cost-effectiveness studies.

Quality of included studies

The details of a cost analysis economic evaluation[68] were described and are summarised in *Table 9*. The research question was stated with reasons for its importance as well as for the rationale for the intervention and control under comparison. A public insurer perspective was taken but not justified; however, the limitations of taking this viewpoint were highlighted. The source of effectiveness estimates was stated and details of the design and results of the effectiveness study were provided. Outcome measures were clearly outlined and quantities of resource use (per patient) were given separately from unit costs. Details of direct and indirect costs were provided with nurse home visits, prescriptions, telephone calls and transport being calculated directly and inpatient hospital stay, emergency room visits, outpatient visits, primary care consultations and social support visits being calculated indirectly. Costs incurred by patients or carers were not considered. Currency and price data were reported using 2000 price data (euros); however, no details were provided regarding any price adjustments for inflation or currency conversions. The time horizon for the study was 1 year; thus, discount rates were not applied. Tariff prices were applied to resource-use data that were collected to calculate an average annual health-care cost per patient in both arms. Although differences in both costs and outcomes were reported, they did not conduct a full economic evaluation by presenting the relative cost-effectiveness. As the costs for the intervention were lower and outcomes better, this study[68] suggests the intervention dominated UC. Sensitivity analyses, and the details thereof, were discussed only briefly.

TABLE 9 Summary of study included in cost-effectiveness review

Author	Hernandez *et al.*[68]
Date	2003
Type of economic evaluation	Cost analysis
Currency used	Euros (€)
Year to which costs apply	2000
Perspective used	Public insurer
Comparators	Home hospitalisation compared with conventional care
Source(s) of effectiveness data	Clinical effectiveness data from RCT
Source(s) of resource-use data	Based on data from RCT
Sources of unit cost data	Directly calculated from data from trial, as well as indirectly calculated from tariffs for patients with COPD in a public insurance company
Modelling approach used	Not applicable
Summary of effectiveness results	Mortality: HR = 0.59 (95% CI 0.19 to 1.85)
	First ED visit: HR = 0.41 (95% CI 0.20 to 0.85)
	All ED visits: HR = 0.44 (95% CI 0.24 to 0.79)
	Hospital admission: HR = 0.71 (95% CI 0.40 to 1.24)
	QoL: MD = 4.50 (95% CI 0.66 to 8.34)
	Lung function: MD = 0.20 (95% CI –0.04 to 0.44)
Summary of cost-effectiveness results	Intervention dominates UC
Sensitivity analysis	Intervention dominates UC when resources released by the intervention were 75% or 50% of the average cost

Cost-effectiveness

As only one study met inclusion criteria for this review, no meta-analysis was undertaken; instead, the cost analysis results from the included study[68] are reported.

Costs were reported for the following outcomes (categories) following an 8-week follow-up period: length of hospital stay, emergency room visits (excluding visits that required further hospital admission), outpatient visits, primary care consultations, social support visits, home visits by nurse, prescriptions, telephone calls (both to the nurse from the patient and from the nurse to the patient) and transport costs. Details of the costs reported for each outcome are provided in *Table 10*.

The cost analysis found the home hospitalisation intervention to be significantly less costly than conventional care (average cost per patient: €1255.12 vs. €2033.51; $p = 0.003$). Hospital stay, emergency room visits, outpatient and social support visits were at a greater cost per patient for the conventional care group than for the home hospitalisation group, with the difference for hospital stay and emergency room visits reaching significance ($p < 0.001$ and $p = 0.01$, respectively). Prescription costs were significantly higher in the intervention group than in the control group (cost per patient: €217.21 vs. €172.06; $p = 0.001$). Primary care visits were also greater in the intervention group, although the difference was not reported to be statistically significant.

A sensitivity analysis based on resources for home hospitalisation at 50% and 75% of the average cost per patient (to capture intervention costs in the longer term) was undertaken. Cost savings in favour of home hospitalisation were conserved across each assumption.

TABLE 10 Costs associated with home hospitalisation and conventional care

Resource-use item	Cost per patient (€)		*p*-value[a]
	Home hospitalisation	Conventional care	
Inpatient hospital stay	941.40	1795.47	< 0.001
Emergency room visits	10.31	24.59	0.01
Outpatient visits	5.49	22.04	–
Primary care physician visits	8.19	7.57	–
Prescriptions	217.21	172.06	0.001
Nurse home visits	41.94	–	–
Social support visits	1.62	2.19	–
Telephone calls	20.99	–	–
Transport	7.97	9.59	–
Average cost (€) per patient (95% CI)	1255.12	2033.51	0.003

CI, confidence interval.
a Non-parametric Mann–Whitney *U*-test.

Discussion

Summary of results

A comprehensive search strategy identified one study[68] that met the inclusion criteria for this review. The overall quality of the study was high, with some issues related to reporting. Meta-analysis was not possible. The study[68] revealed that home hospitalisation is less costly than conventional care [£1041.75 vs. £1687.81 (conversion rate €1 = £0.83)].

How this fits with other literature

One relevant study[82] published after the search strategy had been completed was subsequently identified. Xin Lie *et al.*[82] developed a Markov model to evaluate the impact of a hypothetical exacerbation management programme that could detect the risk of exacerbation and divert the risk of hospitalisation. In patients without prior history of exacerbation, they estimated that this would result in savings of US$2900 per patient over 12 years, and in higher-risk patients – with a history of one or two exacerbations per year – this estimate increased to US$16,000 per patient.

Strengths and limitations

This is the first systematic review of the cost-effectiveness literature of SM interventions for patients who have recently been discharged from hospital after an acute exacerbation of COPD. The methods used throughout this cost-effectiveness review were systematic. A comprehensive search strategy was undertaken and the results were reviewed independently by two reviewers, including a health economist. The recommended quality assessment checklist was used.

It should be noted that the patients in this study were recruited from the emergency room rather than after discharge post hospital admission, which may or may not cause variations in the applicability of the results. A scarcity of evidence of the cost-effectiveness of SM interventions was evident. The identified study included the cost of implementing a hospital-at-home programme with components of SM, thus the SM components reflect only a proportion of the costs and cost savings incurred.

Implications for research

There is a need for more economic evaluations, alongside randomised controlled trials, specifically addressing patients who have recently been discharged from an inpatient hospital admission stay after an acute exacerbation of COPD, and who have been treated with SM interventions or components of SM, such as education, action plans, breathing techniques, relaxation and stress management amongst others.

Chapter 6 Economic evaluation

Methods

This section provides a detailed description of the economic model that was developed and used to evaluate the cost-effectiveness (cost–utility) of self-management (SM) support delivered within 6 weeks of hospital discharge compared with usual care (UC) in a patient population with chronic obstructive pulmonary disease (COPD) who have been admitted for an exacerbation. The evidence for the effectiveness of SM programmes (see *Chapter 3*) demonstrated that there was considerable uncertainty for the outcome measures of mortality, quality of life (QoL) and admissions. The model presented here considers the potential impact of reduced admissions due to a SM programme, in terms of costs, mortality and QoL. However, owing to the uncertainty around the point estimate of reduction in admission and the considerable heterogeneity between studies, this effect must be considered with some caution. Therefore, the economic model should be viewed as speculative, with the aim of estimating the potential cost–utility of SM if it is truly effective at reducing hospital admissions for exacerbations.

Model description

A Markov decision model, built in TreeAgePro 2014 (TreeAge Software, Inc., Williamstown, MA, USA) was structured to consider short-term increased risks of readmission and mortality, and the long-term natural history of the disease, taking into account exacerbations, increasing COPD severity and mortality (*Figure 13*). This structure was an adapted version of other COPD Markov models[83] with health states linked to GOLD (Global Initiative for Chronic Obstructive Lung Disease) severity. It incorporated additional health states to capture the higher risks reported in patients immediately after discharge in audits of patients admitted to hospital.[84] The model had a time cycle of 1 month and a lifetime time horizon (30 years) was used. All costs and outcomes were considered from a NHS perspective for a price year of 2012.

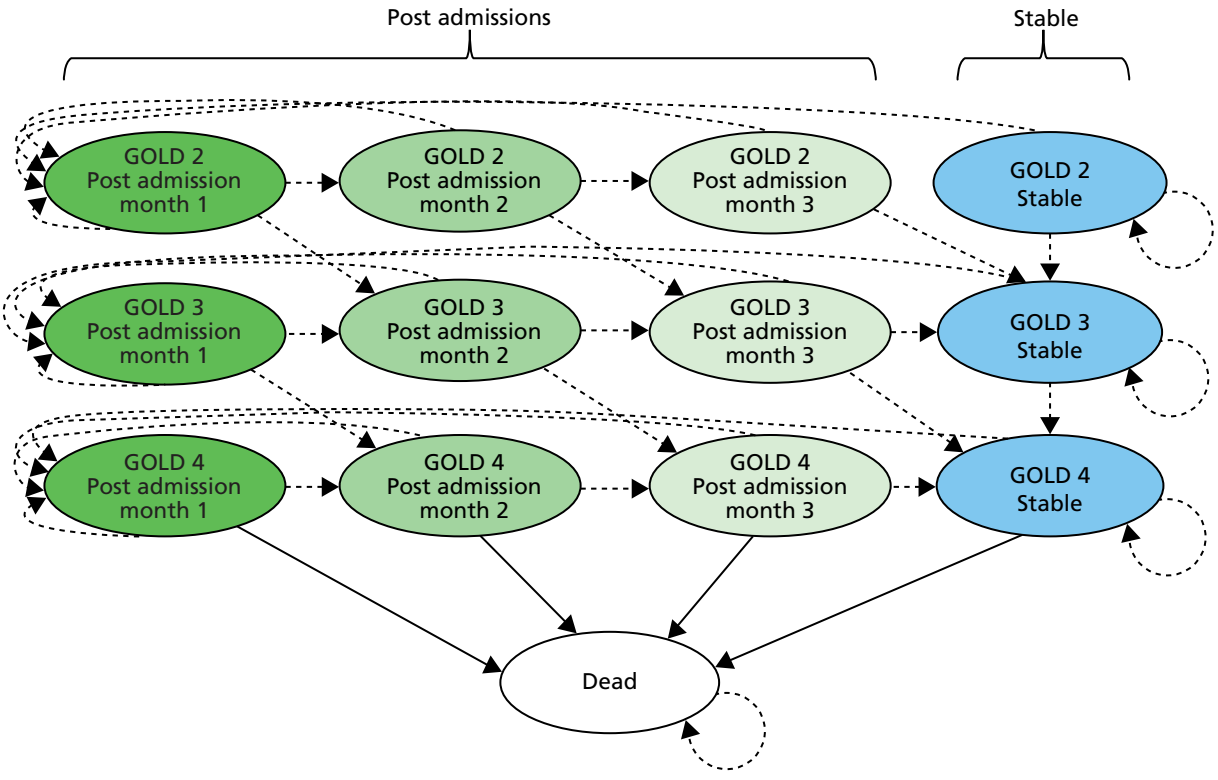


FIGURE 13 Markov model structure.

Severity of COPD was defined according to the GOLD classification. GOLD stage 2 was defined as having a forced expiratory volume in 1 second (FEV_1) of ≥ 50%, < 80% predicted; GOLD stage 3, a FEV_1 of ≥ 30%, < 50% predicted; and GOLD stage 4, a FEV_1 of < 30% predicted. GOLD stage 1 (mild COPD) was excluded, as < 16% of patients admitted to UK hospitals with COPD had a FEV_1 of ≥ 80% predicted.

A patient started in the model in one of three health states representing their first month post admission, taking into account their current GOLD severity stage. Those who continued to recover without further exacerbations moved to health states to represent the second and third month of recovery, again related to their GOLD stage. Within this 3-month recovery period, a patient could die from COPD or other causes or have a further exacerbation requiring readmission, which could be fatal. If the patient survived, they were discharged to restart the 3-month recovery period in a 'first month post-admission' health state. The patient pathway within each post-admission health state (*Figure 14*) was similar for each month and severity stage. The post-admission health states allowed the model to consider the immediate increased risk of readmission and COPD-related mortality for 3 months after discharge. Once a patient survived 3 months of recovery with no readmissions, they moved into a stable health state for their GOLD stage.

Once in the stable GOLD stage 2, 3 or 4, a patient could remain in that health state, deteriorate to the next more severe health state, have an exacerbation or die. An exacerbation could be moderate (managed in primary care) or severe (admitted to hospital). Patients who recovered from moderate exacerbations either remained in the same health state or deteriorated. Severe exacerbations could result in death, and surviving patients moved to the relevant 'first month post-admission' health state. It was assumed that no patients could improve into a better GOLD stage health state. *Figure 15* illustrates the patient pathway in a stable health state.

Base-case cohort

For the base-case analysis, the characteristics of the cohort were taken from the 2011 report by the European Audit[84] of UK patients with COPD admitted to hospital (*Table 11*). The proportions of men and current smokers were assumed to remain constant. The baseline distribution of patients entering the model was 35% in GOLD stage 2, 35% in GOLD stage 3 and 30% in GOLD stage 4.

Estimation of model parameters

This section outlines the assumptions applied, and sources used, to populate the base-case, usual-care arm.

Transition probabilities within post-admission health states

Published data on exacerbation rates in patient cohorts who had been admitted to hospital demonstrated an elevated risk of readmission and mortality immediately after discharge.[84,85] In addition, exacerbation rates and severity of exacerbations increased with disease severity. The risk of a mild or moderate exacerbation was not considered in the post-admission health states.

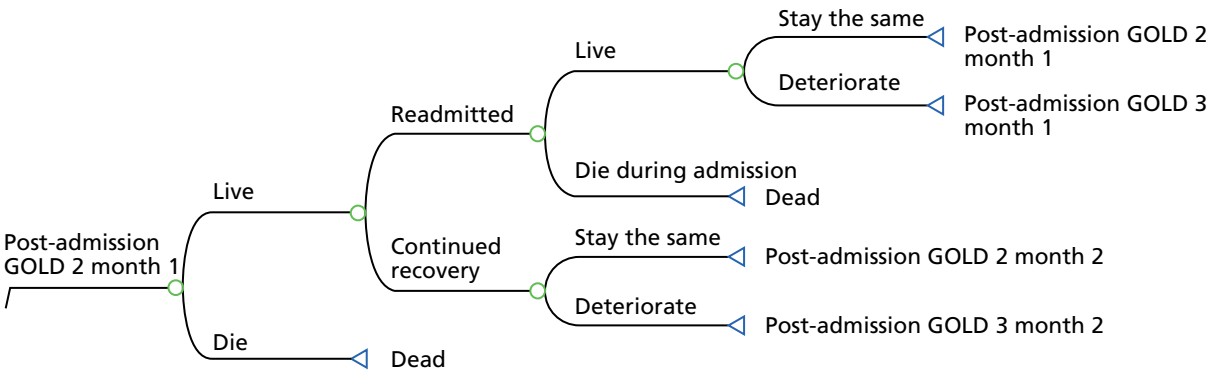


FIGURE 14 Pathways within post-admission states.

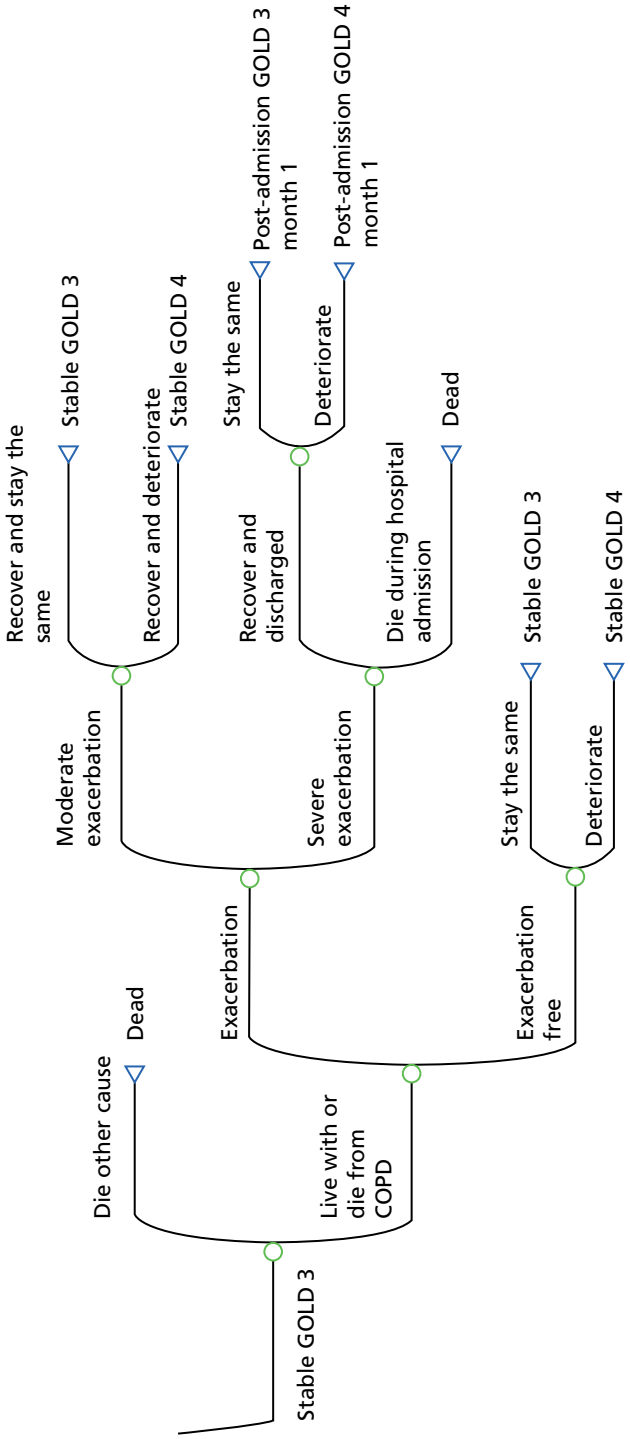


FIGURE 15 Pathways within stable health states.

TABLE 11 Base-case characteristics

Characteristic	Median or %
Age (median)	72
Sex (% male)	47.4
Smoking status (% current smokers)	39.4
GOLD stage (%): 2; 3; 4	35; 35; 30

Source: European Audit 2012.[84]

The majority of the transition probabilities for post-admission health states were obtained from the European Audit[84] and are reported in *Table 12*. Risks of readmission and mortality were the same for each of the three post-admission months and did not differ by GOLD stage. Post-admission COPD-related mortality and readmission risks were assumed to be evenly distributed over the 3-month period.

Age- and sex-specific all-cause mortality rates were obtained from Office for National Statistics life tables and adjusted to avoid double counting of COPD-related mortality. *Appendix 18* lists the COPD adjusted all-cause mortality rates applied in the economic model. Age- and smoking-related disease progression rates were obtained from a published model[86] (see *Appendix 19*). All annual rates were converted to monthly probabilities.

Transition probabilities within stable health states

The patient pathways for each GOLD stage health state were assumed to be the same (see *Figure 15*); however, the probabilities, costs and utilities differed by COPD severity. The probability of progressing to a more severe GOLD stage was not assumed to vary by exacerbation history; thus, the transition probabilities for movement between stable health states were the same as those described above.

The probabilities for exacerbations and hospitalisations were obtained from the TORCH (TOwards a Revolution in COPD Health)[85] and ECLIPSE (Evaluation of COPD Longitudinally to Identify Predictive Surrogate Endpoints)[13] studies, respectively. Patients who survived, exacerbation free, for the 3-month

TABLE 12 Mortality and exacerbation risks applied in post-admission states

Definition	Probability	Beta distribution[a]
COPD-related death during admission[b]		
Men	0.050	$\alpha = 118$, $\beta = 2243$
Women	0.051	$\alpha = 133$, $\beta = 2490$
90-day COPD-related death post admission[b]		
Men	0.047	$\alpha = 104$, $\beta = 2097$
Women	0.049	$\alpha = 120$, $\beta = 2324$
90-day COPD-related readmission[b]		
Men	0.323	$\alpha = 705$, $\beta = 1496$
Women	0.295	$\alpha = 721$, $\beta = 1723$

a A beta distribution is a family of continuous probability distributions defined on the interval (0,1) denoted by α and β, where 'α' is the number of successes in a trial and 'β' is the number of failures.
b Mortality and readmission rates were adjusted to include only those for which the primary cause was COPD or respiratory failure. These were not differentiated by GOLD stage in the post-admission health states.
Source: European Audit 2012.[84]

post-admission period were assumed to have exacerbation and hospitalisation rates similar to those reported in stable cohorts for each severity stage. As the exacerbation rates from the TORCH trial[85] were reported by type of treatment, assumptions were required in the model regarding the proportion of patients on each type of treatment in each GOLD stage health state. These proportions were obtained from unpublished data collected from a cohort of UK patients with COPD who were recruited as part of BLISS (Birmingham Lung Improvement Studies) in the West Midlands. Exacerbation rates were then weighted by the proportion of patients on each treatment in each GOLD stage severity group. As the TORCH study[85] did not report the proportion actually admitted to hospital for an exacerbation, this was obtained from the ECLIPSE study.[13]

The base-case proportions on each type of treatment, annual exacerbation rates and the proportion resulting in a hospital admission are reported in *Tables 13* and *14*. Probabilities for inpatient mortality, all-cause mortality and disease progression are as described previously for the post-admission states.

Estimate for effectiveness of self-management support

Data and assumptions regarding the effectiveness of SM were based on the results of the review presented in *Chapter 3*. As previously highlighted, although evidence suggested a potential reduction in readmissions, there was considerable uncertainty around the point estimate of effect as the 95% CI crossed 1 (see *Chapter 3*, *Hospital admissions: no evidence of effect*). The HR used for the base-case model was the weighted ratio of the more intense SM interventions. Two alternative HRs reported were subsequently applied in a one-way sensitivity analysis. The estimate of effect was applied to all monthly probabilities for readmission for severe exacerbation in the SM strategy in the model (*Table 15*).

TABLE 13 Proportion of each type of treatment and exacerbation rate

	Treatment type			
Severity stage	Other[a]	ICS	LABA	ICS/LABA
GOLD 2				
Proportion on treatment (%) (BLISS)	42.92	0.02	6.31	50.75
Annual exacerbation rate (TORCH)[85]	0.82	0.68	0.71	0.57
GOLD 3				
Proportion on treatment (%) (BLISS)	26.27	0.85	5.08	67.80
Annual exacerbation rate (TORCH)[85]	1.24	0.99	1.08	0.91
GOLD 4				
Proportion on treatment (%) (BLISS)	16.28	4.65	2.33	76.74
Annual exacerbation rate (TORCH)[85]	1.79	1.53	1.40	1.54

ICS, inhaled corticosteroids; LABA, long-acting beta-agonist; ICS/LABA, combined therapy (combined ICS and LABA).
a Patients may have been on other treatments, such as long-acting muscarinic antagonists (LAMAs) and short-acting muscarinic antagonists (SAMAs).

TABLE 14 Exacerbation and hospitalisation rates applied in stable health states

		Proportion of exacerbations hospitalised[13]	
Severity stage	Overall weighted exacerbation rate[85]	%	Beta distributions
GOLD 2	0.68	11	$\alpha = 104$, $\beta = 841$
GOLD 3	1.00	25	$\alpha = 225$, $\beta = 675$
GOLD 4	1.57	54	$\alpha = 158$, $\beta = 135$

TABLE 15 Adjusted HRs applied to admissions for the SM strategy

Analysis		HR	95% CI	Meta-analysis inclusion criteria
Base case		0.83	0.50 to 1.36	Review 1: More supported SM interventions
One-way sensitivity analysis	Low	0.96	0.49 to 1.90	Review 1: Less supported SM interventions
	High	0.78	0.52 to 1.17	Review 1: All studies, including those with an exercise component

Source: outcomes reported in *Chapter 3* (review 1).

Although the effectiveness estimate was estimated over a short period of time in the trials, the model assumed that the effect of the SM intervention would last for 2 years.

The results of the review indicated no evidence of higher all-cause mortality associated with SM, as the HR reported was very close to 1. As the model takes into account a reduced risk of readmission, which leads to improved survival, no further adjustment to mortality was undertaken.

Estimation of quality-adjusted life-years

Utility values were required for all health states and exacerbation events, and were combined with information on survival in order to calculate quality-adjusted life-years (QALYs). The model health states were based on COPD severity defined by GOLD stages 2–4. Utility values for these health states were calculated from unpublished data collected from the BLISS cohort. Utility scores for GOLD stages 2–3 were derived from the EQ-5D-5L (a revised version of the EQ-5D questionnaire). The five dimensions (mobility, self-care, usual activities, pain and discomfort, and anxiety and depression) have five levels, compared with the older version, which used three levels. The addition of two more levels may have made the EQ-5D more sensitive to differences in health states and avoid ceiling effects.[87]

The EQ-5D-5L was completed by 917 participants enrolled in the BLISS study, with a confirmed diagnosis of COPD, at GOLD stage 2, 3 or 4, and converted to utility scores using the interim crosswalk value set for a UK population reported by EuroQoL.[88] Data from this cohort were deemed suitable for stable health states in the model for two reasons. First, participants were not recovering from an exacerbation at the time of questionnaire completion, therefore the utility scores were expected to reflect QoL in the stable condition. Second, > 80% of patients in each GOLD stage had been admitted to hospital at least once in the past year, therefore presenting a population who suffered exacerbations. EQ-5D-5L responses were converted to utility scores and are reported in *Table 16*.

The utility scores were compared with values applied in other COPD models that defined health states by GOLD severity stage. The utility values obtained from the BLISS cohort study were similar to those reported in other studies.[83,89–91] Data on utility loss suffered immediately after a moderate or severe exacerbation were extracted from previously published models; however, estimates varied greatly and the evidence underpinning these was poor.[83,89,92–94] It was assumed that there was a loss of utility for 1 month for moderate exacerbations and a utility loss for 3 months for severe exacerbations due to full recovery taking a longer period of time.[95–97] However, in line with other studies, the utility loss for severe exacerbations

TABLE 16 Utility scores for stable GOLD health states

Descriptor	GOLD 2	GOLD 3	GOLD 4
Sample size (*n*)	650	229	38
Mean utility score (SE)	0.7041 (0.0102)	0.6765 (0.0174)	0.6014 (0.0415)

SE, standard error.
Source: BLISS cohort study (unpublished data).

was assumed to be greatest in the first month, with improvement in QoL in the second and third months post admission.

The utility loss estimate of 15% for moderate exacerbation and 50% for severe exacerbation was obtained from Rutten-van Mölken *et al.*[89] This was applied to the mean utility score across all three severity stages (as opposed to each individually) to ensure that the utility loss suffered in stage 2 or 3 was not greater than loss experienced by stage 4 patients. The mean utility score found in the BLISS cohort across stages 2–4 was 0.693; therefore, a moderate exacerbation was assumed to result in a loss of 0.104 QALYs for 1 month and a severe exacerbation was assumed to result in a 0.346 loss of QALYs in the first month, reducing to a loss of 0.173 QALYs for months 2 and 3. A summary of all the utilities applied in the base-case analysis is provided in *Table 17*.

The review presented in *Chapter 3* found evidence that SM may have a positive impact on QoL; however, the results were highly uncertain. As the model takes into account reduced rates of readmissions in the SM strategy, which leads to reduced loss of QoL, no further utility gains were applied in the model.

Resource use and costs

The resource use considered within the model was broadly concerned with the SM intervention, primary and secondary health-care professional contacts, and pharmacotherapy. Health-care contacts for each GOLD severity group were estimated with reference to National Institute of Health and Care Excellence (NICE) guidelines and expert opinion. Use of pharmacotherapy was estimated from data provided by the BLISS cohort. Unit costs were primarily obtained from NHS Reference costs[98] and Unit Costs of Health and Social Care.[99] When appropriate, unit costs were inflated to 2012 prices using NHS Health Index inflation rates. Annual costs were divided by 12 to derive a monthly cost. Moderate and severe exacerbations were treated as additional one-off costs and assumed to be the same, irrespective of the underlying GOLD stage.

Routine health-care visits

It is recommended by NICE[10] that stable patients with COPD are followed up at least once a year and those with very severe COPD at least twice a year, with rapid access to hospital assessment as necessary. Based on these guidelines it was assumed that patients at GOLD stages 2, 3 and 4 would attend 1, 2 and 2.5 assessments per year, respectively, and that spirometry tests were conducted once per year in GOLD stage 2 and twice in GOLD stage 3 and 4 patients. As follow-up arrangements in primary or secondary care were not specified within the guidelines, an even split between both types of services was assumed for each severity group.

The cost of follow-up and spirometry in secondary care were obtained from NHS Reference Costs.[98] Costs for follow-up in primary care were based on the cost of a home visit by a community nurse, as published by the Personal Social Services Research Unit (PSSRU)[99] and the cost of spirometry was extracted from a costing document published by NHS Commissioning Support for London.[100] Additional health-care costs

TABLE 17 Utility scores including loss of quality of life with exacerbations

	Base case		
Severity of COPD	GOLD 2	GOLD 3	GOLD 4
Stable condition[a]	0.7041	0.6765	0.6014
Moderate exacerbation	0.6001 (1 month)	0.5725 (1 month)	0.4974 (1 month)
Severe exacerbation	0.3581 (first month)	0.3305 (first month)	0.347 (first month)
	0.5311 (months 2 and 3)	0.5035 (months 2 and 3)	0.4284 (months 2 and 3)

a Source: BLISS cohort; assumptions extracted from Rutten-van Mölken *et al.*[89] and applied to mean scores obtained from BLISS.

included were the provision of annual influenza vaccinations, home oxygen therapy and the cost of prescribing. As the median age of the population was > 70 years, it was assumed that 75%[101] of patients in each severity group received the vaccination at the current estimated cost of £6.21.[101] The average number of days and cost of home oxygen therapy received in each severity group was obtained from estimates reported in Hertel *et al.*,[92] derived from expert opinion.

Smoking cessation advice and pulmonary rehabilitation are also recommended by NICE as UC for patients with COPD.[10] However, these costs were assumed to be the same for both strategies, thus cancelling each other out, and were omitted from the model.

The total annual costs of health-care visits in GOLD stages 2, 3 and 4 were estimated to be £180, £332 and £453, respectively. A summary of the assumptions and reference costs applied to derive these estimates is provided in *Table 18*.

Routine pharmacotherapy

The NICE guidance is not prescriptive for each GOLD stage, and suggests that the number and type of treatments prescribed should be determined by patient symptoms and response. Therefore, the model utilised data from the previously described BLISS cohort for the proportion of patients on each line of therapy, by GOLD stage (*Table 19*).[10] As 100% of patients were reported to be on an inhaled short-acting β_2-agonist (SABA), assumptions on the number of delivery devices in each severity stage were made by clinical experts. Drug reference costs reported by NICE 2011[102] (*Table 20*) were compared with current unit costs listed on the NHS Drug Tariff database[103] in 2014. Most of the drug prices were consistent with those listed in the NICE 2011 report; however, some were higher and some were lower.[102] As there did not appear to be a consistent drug inflation rate during this period (2011–14), it was not appropriate to inflate the 2011 prices or deflate the 2014 prices to estimate the costs in 2012 prices, thus the prices listed in the NHS Drug Tariff database[103] for 2014 were applied. Annual and monthly costs were calculated by applying the same unit cost to annual costs reported by NICE. When there was more than one drug in each treatment class, an overall average cost was applied.

TABLE 18 Annual routine health-care utilisation and costs by GOLD stage

Health care	GOLD 2	GOLD 3	GOLD 4	Unit cost (£)	Source
Secondary care follow-up	0.5 visit	1 visit	1.25 visits	139	NHS Reference Costs 2010/11,[98] inflated to 2012
Primary care follow-up	0.5 visit	1 visit	1.25 visits	57	PSSRU 2012;[99] hourly cost of a community nurse home visit
Secondary care spirometry	0.5 test	1 test	1 test	52	NHS Reference Costs 2010–11,[98] inflated to 2012 prices
Primary care spirometry	0.5 test	1 test	1 test	18	North Central London costing report for a community-led COPD pathway[100]
Influenza vaccination	75% uptake	75% uptake	75% uptake	6.21	Department of Health 2011[101]
Oxygen therapy	0 days	1.22 days	6.08 days	15	Hertel *et al.*[92]
Prescription costs per consultation (£)	42.70 (assuming one per annum)				PSSRU 2012[99]
Annual cost (£)	180.20	331.88	453.40		
Monthly cost (£)	15.02	26.12	37.78		

TABLE 19 Proportion on type of pharmacotherapy and monthly cost by severity

Severity stage	Assumed no. of SABAs used per month	Proportion on type of pharmacotherapy					
		SABA	ICS	LABA	Combination[a]	LAMA	SAMA
GOLD 2 ($n = 599$)	1	1.00	0.04	0.06	0.51	0.46	0.05
GOLD 3 ($n = 216$)	2	1.00	0.01	0.05	0.68	0.62	0.04
GOLD 4 ($n = 37$)	2.5	1.00	0.05	0.02	0.77	0.65	0.05
Monthly cost (£)	GOLD stage 2	43.72					
	GOLD stage 3	60.91					
	GOLD stage 4	67.57					

ICS, inhaled corticosteroids; LABA, long-acting beta-agonist; LAMA, long-acting muscarinic antagonist; SAMA, short-acting muscarinic antagonist.
a Combination therapy whereby two or more types of pharmacotherapy were prescribed.

TABLE 20 Unit costs of pharmacotherapy

Class	Drug formulation and dose	Price (£) per pack (NICE 2011)[102]	Price (£) per pack (NHS 2012)[103]	Annual cost (£) estimated by NICE[102]	Annual cost in 2012 prices (£)	Monthly cost (£)
SABA	Salbutamol 100 µg metered inhalation (generic)	3.52	3.31	25.70	24.17	2.01
	Terbutaline 500 µg metered inhalation (Bricanyl®, AstraZeneca)	6.92	6.92	101.03	101.03	8.42
	SABA average cost					*5.22*
ICS	Beclometasone 250 µg metered inhalation (generic)	18.74	12.31	34.20	22.45	1.87
SAMA	Ipratropium 20 µg metered inhalation (Atrovent®, Boehringer Ingelheim)	5.05	5.05	27.65	27.65	2.30
LABA	Salmeterol 25 µg metered inhalation (Serevent)	29.26	29.26	356.00	356.00	29.67
LAMA	Tiotropium 18 µg inhalation capsule (Spiriva)	32.49	33.50	395.30	407.58	33.97
LABA and ICS	Budesonide 200 µg + formoterol 6 µg metered inhalation (Symbicort® turbohaler, Astrazeneca)	38.00	11.84 + 24.80	462.33	445.78	37.15
	Budesonide 400 µg + formoterol 12 µg metered inhalation (Symbicort turbohaler)	38.00	13.86 + 30.06	462.33	534.36	44.53
	Fluticasone propionate 500 µg + salmeterol 50 µg metered inhalation (Seretide® accuhaler, Allen & Hanburys Ltd)	40.92	40.92	497.86	497.92	41.49
	LABA + ICS average cost					*41.06*

ICS, inhaled corticosteroids; LABA, long-acting beta-agonist; LAMA, long-acting muscarinic antagonist; SAMA, short-acting muscarinic antagonist.
Source: NICE 2011[102] and NHS Drug Tariff database.[103]

Cost of exacerbations

Moderate exacerbations were assumed to be predominantly managed in primary care through GP appointments, with a proportion attending accident and emergency (A&E) without admission. As no data were found on the split between GP and A&E visits, assumptions were derived from expert opinion reported in Hertel *et al.*,[92] which assumed that two out of three patients would see a GP, and one out of three patients would attend A&E. Prescribed additional medication for a moderate exacerbation was assumed to be a course of prednisolone (5 mg tablets, six times per day for 5 days) and antibiotics when exacerbations were associated with a history of purulent sputum (NICE[10]). The total cost of treating a moderate exacerbation was estimated to be £114, and a breakdown of how this cost was calculated is presented in *Table 21*.

The majority of severe exacerbations were assumed to be managed in hospital but 20% were assumed to be managed through hospital-at-home or early discharge schemes. The 2011 NICE[102] costing study estimated the average cost of a COPD hospital admission to be £1978. These costs were not inflated as the NHS tariff prices[98] applied appeared similar to those listed in 2012. No data were available on the tariffs for hospital-at-home or early discharge schemes; however, a UK-based cost analysis estimated the costs incurred in a similar scheme to be £1653 in 2009 prices,[104] inflated to £1769 for 2012. Following discussion with our clinical experts, it was assumed that 20% of those who suffered an exacerbation requiring admission accessed the non-inpatient type of service.

Guidance from NICE also recommends that patients should be followed up after discharge therefore this cost was included in the average cost of a severe exacerbation and was assumed to include one follow-up visit, 30% seen by a community nurse, 30% attending a GP appointment and 40% attending an outpatient appointment. The total cost of managing a severe exacerbation was estimated to be £2053 (*Table 22*).

TABLE 21 Cost of moderate exacerbation

Resource-use item	% requiring resource	Unit cost (£)	Source of cost estimate
GP visit (12 minutes)	66.7	44.40	PSSRU[99]
A&E visit without admission	33.3	112.00	PSSRU[99]
Prednisolone (5-mg tablets, six times per day for 5 days)	100	0.11	NHS Drug Tariff database[103]
Amoxicillin (Amoxil®, GlaxoSmithKline) (500-mg capsules, three times a day for 5 days)	100	0.09	NHS Drug Tariff database[103]
Prescription costs per consultation	100	42.70	PSSRU[99]
Estimated cost (£) of moderate exacerbation		*114.28*	

TABLE 22 Cost of severe exacerbation

Resource-use item	Proportion requiring resource (%)	Unit cost (£)	Source
Average cost of COPD hospital stay	80	1978	NICE 2011[102]
Average cost of hospital-at-home programme	20	1769	Bakerley *et al.*,[104] inflated to 2012 prices
Community nurse follow-up	30	57	PSSRU[99]
GP follow-up (12-minute visit)	30	44	PSSRU[99]
Outpatient appointment follow-up	40	139	NHS tariff prices[98]
Estimated cost (£) of severe exacerbation		2053	

Cost of self-management

The cost of providing a SM programme to patients with COPD post discharge was estimated with reference to the activities described in a sample of studies selected from review 1 in *Chapter 3*. Studies were chosen to reflect different levels of intensity of SM. The estimated cost of delivering a SM programme of low, moderate/high and high intensity is detailed in *Tables 23–25*. The costs estimated for Wong *et al.*[74] and Bucknall *et al.*[63] were estimates based on the resource use described.

TABLE 23 Cost estimates for low-intensity SM

Description of activity	Resource required	Unit cost (£)	Total cost per patient (£)	Source
Two 10- to 20-minute telephone calls within 4 weeks of discharge; each telephone call was assumed to take 45 minutes of staff nurse time, taking into account missed calls and processing information before and after	Staff nurse time	43	64.50	Hour of staff nurse time (PSSRU 2012[99])
A senior nurse specialist supervised this service; this was 15 minutes of time per patient	Senior staff nurse time	81	20.25	Hour of senior nurse specialist (PSSRU 2012[99])
Total cost			84.75	

Source: Wong *et al.*[74]

TABLE 24 Resource use and cost of moderate- to high-intensity SM

Description of activity	Resource required	Unit cost (£)	Total cost per patient (£)	Source
Two 1-hour one-to-one education sessions by specialist respiratory nurse	Specialist nurse	91	182	Hour of clinical nurse specialist patient contact time (PSSRU 2012[99])
Care plan development, sharing plan with primary care team (30 minutes of nurse specialist and 30 minutes of community nurse time)	Specialist nurse	58	50	Hour of clinical nurse specialist and community nurse (PSSRU 2012[99])
	Community nurse	42		
One follow-up by respiratory care team including respiratory specialist, GP, nurse and social worker (30 minutes of each health-care professional's time)	Specialist nurse home visit	91	2440	Hour of specialist nurse home visit time; hour of GP home visiting time; hour of community nurse time; hour of social worker for adult services time (PSSRU 2012[99])
	GP home visit	282		
	Community nurse	61		
	Social worker	54		
Four weekly telephone calls in the first month (10 minutes per call, plus 10 minutes follow-up administration)	Specialist nurse	58	77.33	Hour of clinical nurse specialist time (PSSRU 2012[99])
Two follow-up telephone calls (10 minutes per call, plus 10 minutes' follow-up administration)	Specialist nurse	58	38.67	Hour of clinical nurse specialist time (PSSRU 2012[99])
0.03 telephone calls per patient triggered through access to specialist case manager via telephone service (20 minutes each)	Specialist nurse	58	0.58	Hour of clinical nurse specialist time (PSSRU 2012[99])
0.05 follow-up home visits per patient triggered by telephone calls	Specialist nurse	91	3.05	Hour of home visit by community nurse (PSSRU 2012[99])
Total cost			597.13	

Source: Casas *et al.*[71]

TABLE 25 Estimated cost of high-intensity SM

Description of activity	Resource required	Unit cost (£)	Total cost per patient (£)	Source
Four 40-minute training sessions at home from study nurse (each visit is 60 minutes community nurse specialist time)	Community nurse	61.00	244.00	Hour of community nurse home visiting time (PSSRU 2012[99])
Seven home visits every 6 weeks for 12 months (each visit takes an hour of community nurse specialist time)	Community nurse	61.00	427.00	Hour of community nurse home visiting time (PSSRU 2012[99])
Total cost			671.00	

Source: Bucknall *et al.*[63]

Calculated costs were compared with estimates of other SM programmes that are targeted at patients with COPD but not delivered at discharge (see *Appendix 20*).The majority of SM programmes cost between £500 and £600, and are therefore similar to the estimate of the SM programme described by Casas *et al.*;[71] thus this was chosen for the base case for the moderate- to high-intensity programme. Sensitivity analyses were conducted to evaluate the cost-effectiveness of SM assuming low- and high-intensity programmes and are outlined in the sensitivity analysis subsection.

Assessment of cost-effectiveness

The incremental analysis was designed to generate the cost per additional QALY gained for SM delivered within 6 weeks of discharge when compared with UC in a cohort of patients with COPD. In summary, the key assumptions for the base case were as follows:

- The starting cohort was assumed to be aged 72 years, 47.4% male with 39.4% current smokers (see *Chapter 6*, *Base-case cohort*).
- The starting distribution of COPD severity was 35% GOLD stage 2, 35% GOLD stage 3 and 30% GOLD stage 4 (see *Chapter 6*, *Base-case cohort*).
- Mortality and readmission risks during admission and immediately after discharge were taken from the European Audit[84] and applied for 3 months' post-admission (see *Chapter 6*, *Transition probabilities within post-admission health states*).
- Long-term exacerbation, hospitalisation risk and disease progression were taken from large cohort studies of three years or more (see *Chapter 6*, *Transition probabilities within stable health states*).
- The estimate for reduction in risk of admission with SM was taken from moderate- to high-intensity programmes (see *Chapter 6*, *Estimate for effectiveness of self-management report*).
- Utility values were obtained from the BLISS cohort and an estimate was applied for the utility loss associated with exacerbation (see *Chapter 6*, *Estimation of quality-adjusted life-years*).
- The cost of UC was estimated with reference to pharmacotherapy use amongst the BLISS cohort, best practice guidance, expert opinion and NHS reference prices (see *Chapter 6, Resource use and costs*).
- The cost of SM was estimated to be £597, incurred in the first month and the effect was assumed to last for 2 years (see *Chapter 6*, *Cost of self-management*).

Where available, data were entered into the model as distributions so as to fully incorporate the uncertainty around parameter values in order that a probabilistic sensitivity analysis could be undertaken. Beta distributions were applied to the proportion on different treatments and accessing services in primary and secondary care; they were also applied to annual exacerbation rates and the proportion resulting in hospital admissions, as well as the risk reduction expected in the SM arm. Normal distributions were applied to utilities and utility losses. The probabilistic sensitivity analysis was run with 1000 simulations, and cost-effectiveness planes and acceptability curves were produced.

Sensitivity analysis

Additional model runs were undertaken to determine the impact of changing key parameters on the model results. Those parameters for which the incremental cost-effectiveness ratio (ICER) was demonstrated to be particularly sensitive to change were explored in more detail. The following analyses were undertaken:

1. The time horizon was varied, changing from the base-case assumption of 30 years to 6 months, 2 years, 10 years and 20 years.
2. The effect of SM on admissions was varied by substituting the base-case HR of 0.83 (95% CI 0.50 to 1.36) with two alternative HRs reported in *Chapter 3*. This included a HR derived from a meta-analysis of two low-intensity programmes of 0.96 (95% CI 0.49 to 1.90) and a meta-analysis that included exercise interventions representing a high-intensity programme of 0.78 (95% CI 0.52 to 1.17).
3. The duration of effect was tested for the base-case moderate-high-intensity SM programme, assuming the effect lasted for only (1) 6 months and (2) the lifetime of the cohort (see *Chapter 6*, *Duration of effect*).
4. The cost of SM was tested applying a low estimate of £85 and a high estimate of £671 (see *Chapter 6*, *Cost of self-management*).
5. An alternative set of utility scores obtained from Borg *et al.*[83] were applied (higher utility scores for GOLD stages 2 and 3, lower utility scores for GOLD stage 4 and a proportional deduction in utility for each severity stage lasting for 1 month in both moderate or severe exacerbation); see *Table 26* (see also *Utility values for chronic obstructive pulmonary disease*).
6. Subgroup analysis was conducted to test if the decision rules changed if targeted at different subpopulations. This was tested by assuming that (1) all patients were GOLD stage 2; (2) all patients were GOLD stage 3; (3) all patients were GOLD stage 4; (4) there were different start ages; (5) all of the cohort were male; (6) all of the cohort were female; (7) all were smokers; (8) and all were non-smokers (see *Chapter 6*, *Subgroup analysis*).
7. Two scenario analyses were conducted: scenario 1 applied the highest estimate of effect 0.78 (95% CI 0.52 to 1.17) and the highest estimate of SM costs, £671; scenario 2 applied the lowest estimate of effect 0.96 (95% CI 0.49 to 1.90) and the lowest estimate of costs of £85 (see *Chapter 6*, *Scenario analysis*).

TABLE 26 Alternative utility values applied in one-way sensitivity analysis

Sensitivity analysis 1			
Stable condition	0.7551	0.7481	0.5493
Moderate exacerbation	0.6418 (1 month)	0.6359 (1 month)	0.4669 (1 month)
Severe exacerbation	0.378 (1 month)	0.374 (1 month)	0.2747 (1 month)

Assumptions on proportion effect for utility loss during exacerbation taken from Rutten-van Mölken[89] and applied to mean utilities found in Borg *et al.*[83]

Results

Base-case analysis

The base-case results presented in *Table 27* show that, compared with UC, SM (delivered within 6 weeks of discharge) was more costly and resulted in better outcomes, with a £683 cost difference and gain of 0.0831 QALYs. The ICER was £8218 per QALY gained – well below the threshold values of £20,000–30,000 per QALY gained as recommended by NICE.[10]

Results from the probabilistic sensitivity analysis are shown in the cost-effectiveness plane in *Figure 16*, which shows the distribution of 1000 resampled cost–effect difference pairs. The probabilistic sensitivity analysis clearly shows that SM is the more expensive strategy; however, the effectiveness is less certain, with a number of points indicating that SM may give fewer QALYs. The cost-effectiveness acceptability curve in *Figure 17* shows that the intervention has a 68% probability of being cost-effective at £20,000 per QALY gained and 71% at a £30,000 threshold.

TABLE 27 Base-case results

Strategy	Mean cost (£)	Cost difference (£)	Mean QALYs	QALY difference	ICER (£/QALY)	Probability cost-effective at a specified threshold (%)[a]	
						£20,000/QALY	£30,000/QALY
UC	18,872		5.767				
SM	19,556	683	5.850	0.0831	8218	68	71

a Refers to the proportion of samples drawn from the probabilistic sensitivity analysis that could be considered cost-effective, based on what NICE is willing to pay for an additional QALY gained.

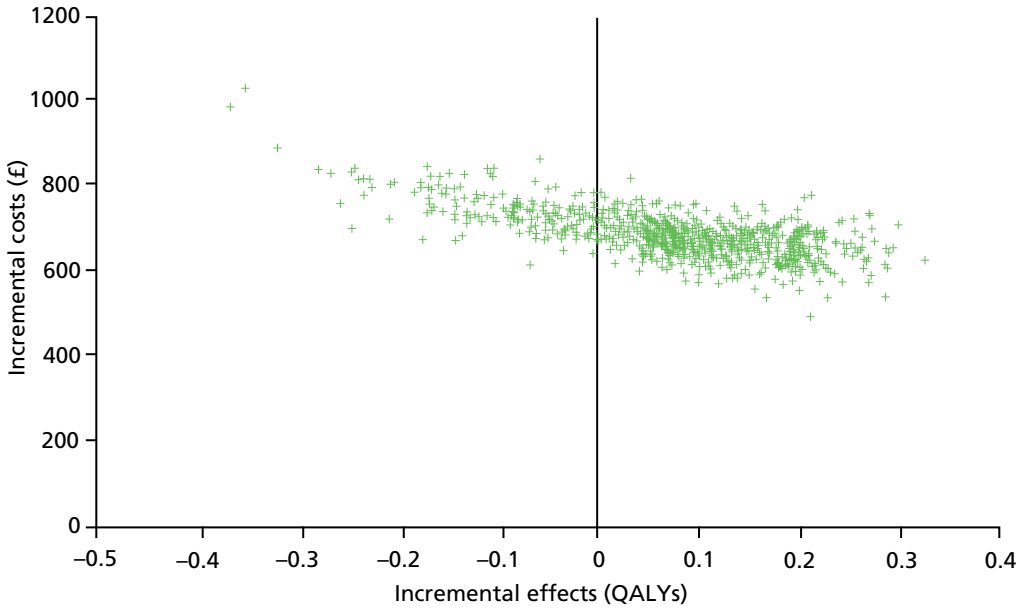


FIGURE 16 Base-case cost-effectiveness plane.

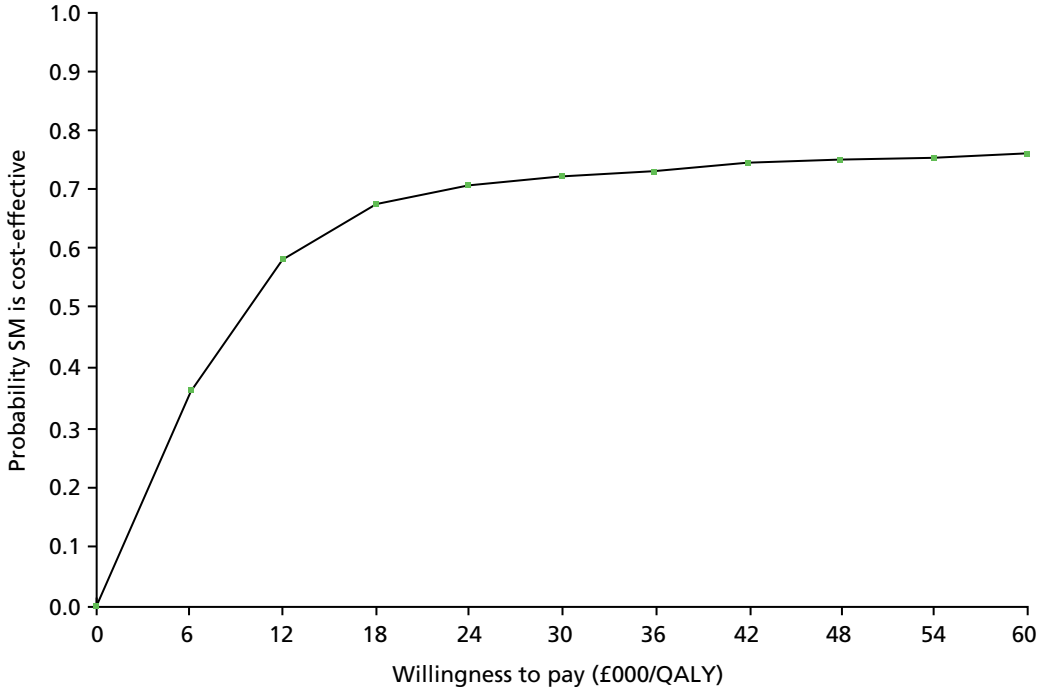


FIGURE 17 Base-case cost-effectiveness acceptability curve.

Sensitivity analysis

Alternative model time horizon

Table 28 presents the results of the model when varying the time horizon of the model. At a short time horizon of 6 months, when the intervention has been effective for 6 months, the ICER was £52,487 – above the NICE thresholds for cost-effectiveness; however, this is unlikely to represent a realistic time frame. At 2 years, the ICER reduces to £5954 as a result of most of the additional cost of implementing a SM programme being offset by savings from a reduction in hospital admissions. This changes over time, as higher costs are incurred in the surviving arm as a result of lower mortality. The probability of SM being cost-effective at £20,000/QALY remains > 62% beyond 2 years but no longer dominates UC.

Alternative hazard ratios for readmissions in the self-management strategy

Owing to the considerable uncertainty around the effectiveness estimate (HR) for readmissions, this model parameter was expected to be the biggest driver of the cost-effectiveness results. To test this, two alternative HRs reported in the meta-analysis for review 1 were applied in the model and the results are shown in *Table 29*. The first alternative HR applied was a higher estimate of the effect. This was derived from a meta-analysis that included SM interventions with an exercise component. Applying the higher estimate of effect, the ICER decreased to £6249, and the likelihood of SM being cost-effective at a

TABLE 28 Sensitivity analysis: alternative model time horizons

Time horizons	Cost difference (£)	QALY difference	ICER (£/QALY)	Probability cost-effective at £20,000/QALY (%)	Probability cost-effective at £30,000/QALY (%)
6 months	175	0.0033	52,487	32	39
2 years	95	0.0160	5954	62	65
10 years	489	0.0624	7838	65	72
20 years	664	0.0812	8180	68	71
Base case (30 years)	683	0.0831	8218	68	71

TABLE 29 Sensitivity analysis: alternative HRs for admissions in SM support

HR	Cost difference (£)	QALY difference	ICER (£/QALY)	Probability cost-effective at £20,000/QALY (%)	Probability cost-effective at £30,000/QALY (%)
Base case (0.83, 95% CI 0.50 to 1.36)	683	0.0831	8218	68	71
High estimate (0.78, 95% CI 0.52 to 1.17)	676	0.1082	6249	82	84
Low estimate (0.96, 95% CI 0.49 to 1.90)	703	0.0184	38,265	41	45

threshold value of £20,000 per QALY increased to 82%. The second alternative HR applied was a lower estimate of effect derived from a meta-analysis of two low-intensity SM programmes. This increased the ICER to £38,265. This was above the threshold value of £30,000/QALY and hence the probability of SM being cost-effective at £30,000/QALY reduced to 45%.

Figure 18 illustrates the relationship between changing the point estimates of the HR and the mean ICER. At values of < 1 the ICERs are positive, and at all values of < 0.95 the ICERs are below the threshold of £30,000 per QALY. As the HR approaches 0.5, the ICER decreases and the benefits increase. At all values of > 1, SM is a less favourable option. If SM has no effect or increases the risk of hospital admission, it is dominated by UC (negative ICERs in *Figure 18*) hence why the ICER drops sharply. As the ratio increases to 1.5 the ICER decreases as UC becomes less cost-effective due to lower mortality in the UC arm. The 95% CIs for all three reported estimates crossed 1.

Duration of effect

Table 30 presents the results applying different assumptions regarding the duration of effect of SM support. In the base case it was assumed that the effect of SM would last for 2 years. The values were varied in the sensitivity analysis from 6 months to 30 years. When a shorter duration of effect was applied, the ICER increased and the probability of SM being cost-effective decreased. Conversely, applying a higher duration of effect decreased the ICER and increased the likelihood of SM being cost-effective.

Figure 19 illustrates the relationship between changing the duration of effect and the ICER. At between 6 and 24 months the ICERs drop sharply and the decision rule changes. Most of the studies identified in the effectiveness review were short term in nature, resulting in uncertainty on the duration of this effect.

Cost of self-management

The impact of changing the cost of SM is presented in *Table 31*. Applying the high estimate of £671 increases the ICER to £9257 and the probability of SM being cost-effective at a threshold of £20,000 per QALY is similar at 69%. Applying the low estimate of £85 decreases the ICER to £1033 and increases the probability that SM is cost-effective at a threshold of £20,000 per QALY to 76%.

Figure 20 shows the relationship between SM costs and the ICER. At all values for the cost of SM between £50 and £2200 the ICER is below a willingness-to-pay threshold of £30,000. At costs above £2200 the mean ICER in the base-case scenario is not cost-effective.

Utility values for chronic obstructive pulmonary disease

The effect of applying alternative utility scores and assumptions is shown in *Table 32*, demonstrating that QALYs are gained in both strategy arms, irrespective of the changes in utility values for stable health states and utility loss associated with exacerbation changes. Therefore, there is little impact on QALY differences between strategies, and all estimates of the utility values for stable and exacerbating health states give similar results.

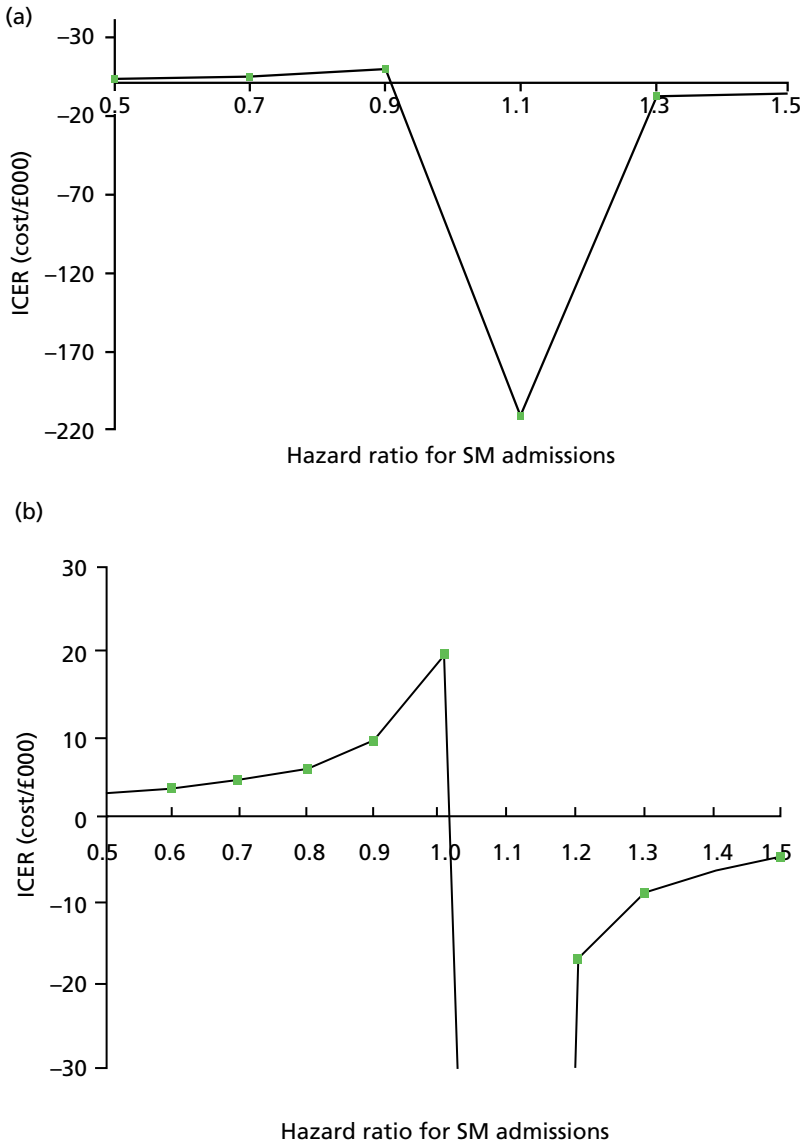


FIGURE 18 Sensitivity analysis: relationship between HR for readmissions and ICER. a, Illustration of how the ICER changes by varying the HR between 0.5 and 1.5; and (b) magnification of how the ICER changes within the boundaries of a threshold of plus or minus £30,000 per QALY.

TABLE 30 Sensitivity analysis: alternative durations of effect

Duration of effect	Cost difference (£)	QALY difference	ICER (£/QALY)	Probability cost-effective at £20,000/QALY (%)	Probability cost-effective at £30,000/QALY (%)
Base case (2 years)	683	0.0831	8218	68	71
High estimate: 30 years	383	0.2876	1333	77	77
Low estimate: 6 months	686	0.0414	16,570	55	63

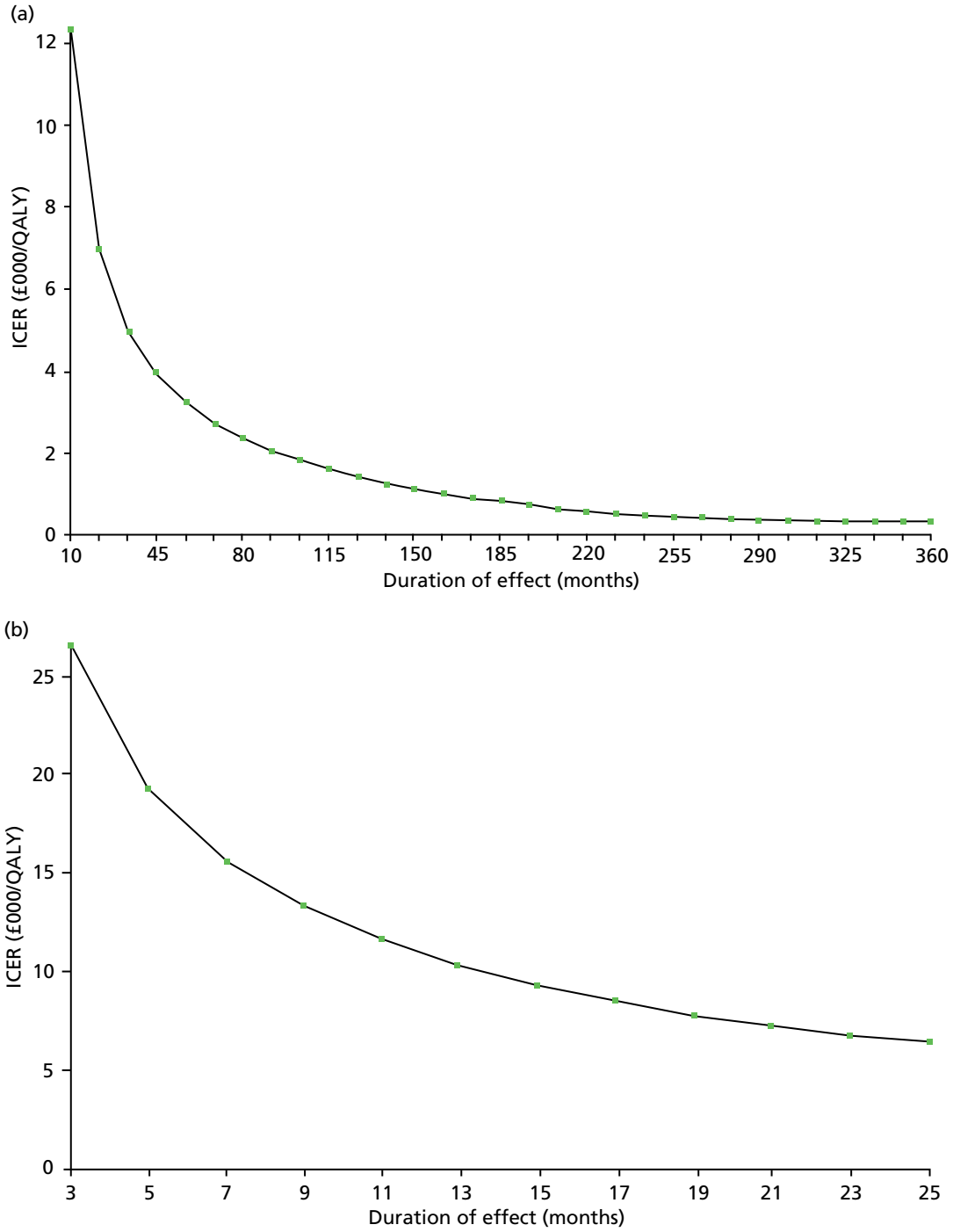


FIGURE 19 Sensitivity analysis: relationship between ICER and duration of effect of SM. (a) Illustration of how the ICER changes between 10 months and 30 years; and (b) magnification of how the ICER changes between 3 and 25 months.

TABLE 31 Sensitivity analysis: alternative assumptions for cost

Cost of SM (£)	Cost difference (£)	QALY difference	ICER (£/QALY)	Probability cost-effective at £20,000/QALY (%)	Probability cost-effective at £30,000/QALY (%)
Low estimate: 85	86	0.083	1033	76	77
High estimate: 671	768	0.0831	9257	69	69

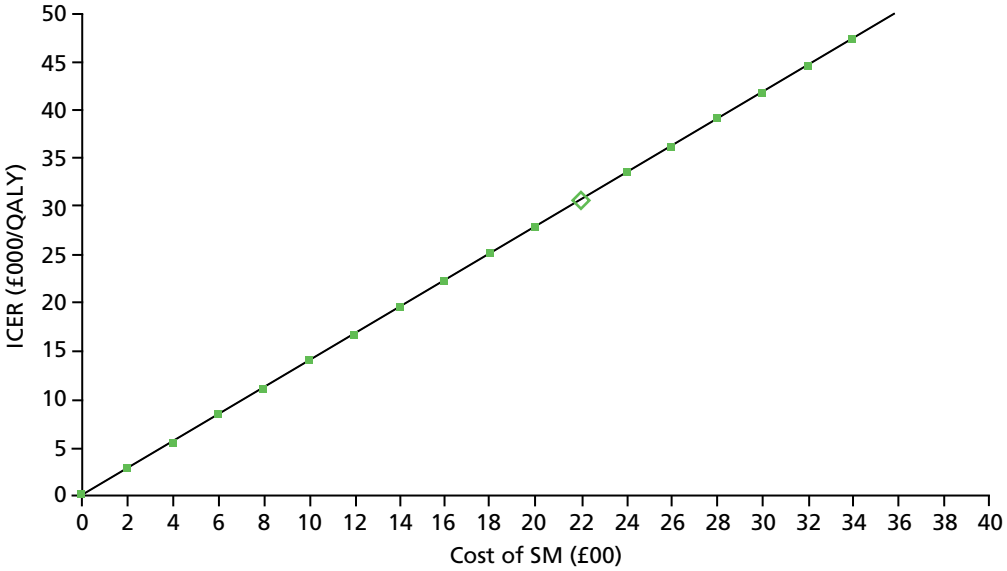


FIGURE 20 Relationship between cost of SM and ICER.

TABLE 32 Sensitivity analysis: alternative utility values and assumptions

Analysis	Cost difference (£)	Mean QALYs		QALY difference	ICER (£/QALY)
		SM + UC	UC		
Base case	683	5.850	5.767	0.083	8218
Values obtained in Borg *et al.*[83]	680	6.126	6.044	0.082	8304

Subgroup analysis

GOLD severity stage

Table 33 presents the ICERs when assuming that only one GOLD stage severity group entered the model. The mean difference (MD) in QALYs gained between SM and UC increased in more severe groups. The lowest ICER is £3323 per QALY gained in GOLD stage 4, with a 73% likelihood that SM is cost-effective at £20,000 per QALY. There is greater uncertainty around the cost-effectiveness of SM in patients entering the model at GOLD stage 2 or 3, with the probability of being cost-effective at £20,000 per QALY 64% or 62%, respectively.

TABLE 33 Subgroup analysis: alternative GOLD stage cohorts

Cohort enter at:	Mean cost (£)		Cost difference (£)	Mean QALYs		QALY difference	ICER (£/QALY)	% cost-effectiveness at:	
	SM	UC		SM	UC			£20,000/QALY	£30,000/QALY
GOLD 2	15,835	15,245	591	7.437	7.367	0.069	8511	64	68
GOLD 3	21,078	19,989	1089	5.783	5.697	0.086	12,629	62	68
GOLD 4	22,120	21,803	317	4.078	3.983	0.0955	3323	73	75

Age

The starting age of the model cohort was varied and results are presented in *Table 34*. The probability of SM being cost-effective does not change by age but the ICERs are lower in the older cohort. Therefore, although the ICERs are different for different start ages, the decision rules are similar at all start ages and the probability of being cost-effective is similar.

Gender

The results for separate male and female cohorts are shown in *Table 35*. There was very little difference in the ICERs or probability of SM being cost-effective when targeted at solely men or women.

Smoking status

Table 36 presents the results for current smokers and ex-/non-smokers. Again, there was very little difference in the ICERs or probability of SM being cost-effective when targeted at only smokers or ex-smokers.

Scenario analysis

Table 37 presents the results of the scenario analysis. The first scenario applied the highest effect on reducing admissions (HR 0.78) and the highest cost estimate of SM (£671). The second scenario applied the lowest effect (HR 0.96) and the lowest estimate of the cost of SM (£85). This suggests that the likelihood of SM being cost-effective is greater in the higher cost, higher-effect scenario, relative to the lower-cost, lowest-effect scenario, but still < £20,000 per QALY.

TABLE 34 Subgroup analysis: alternative cohort start ages

	Mean cost (£)			Mean QALYs				% cost-effectiveness at:	
Start age (years)	SM (£)	UC (£)	Cost difference (£)	SM	UC	QALY difference	ICER (£/QALY)	£20,000/QALY	£30,000/QALY
55	28,747	27,738	1009	8.5814	8.464	0.1174	8591	66	71
85	10,409	10,045	364	3.1137	3.0681	0.0456	7980	67	71

TABLE 35 Subgroup analysis: male and female cohorts

				% cost-effectiveness at:	
Gender	Cost difference (£)	QALY difference	ICER (£/QALY)	£20,000/QALY	£30,000/QALY
Male	642	0.0814	7895	70	73
Female	725	0.085	8534	68	71

TABLE 36 Subgroup analysis: cohorts of smokers and ex-smokers

				% cost-effective at:	
Smoking status	Cost difference (£)	QALY difference	ICER (£/QALY)	£20,000/QALY	£30,000/QALY
Smoker	679	0.0829	8188	67	71
Ex-/non-smoker	679	0.0829	8189	67	71

TABLE 37 Scenario analysis: alternative combinations of cost and effect of SM on admission

Scenario	Cost difference (£)	QALY difference	ICER (£/QALY)	% cost-effectiveness at:	
				£20,000/QALY	£30,000/QALY
Cost applied: £671, HR applied: (0.78)	758	0.108	7007	78	81
Cost applied: £85, HR applied: (0.96)	107	0.018	5832	54	55

Discussion

Key results

This is the first economic model to consider the cost-effectiveness of SM support compared with UC in patients with COPD within 6 weeks of discharge from hospital admission for an exacerbation. Owing to the considerable uncertainty on the impact on readmissions, and the heterogeneity of the trial results, this model-based analysis should be viewed as speculative, and therefore providing only estimates of the potential impact of a SM programme.

The base-case model results suggested that SM support was a cost-effective intervention at the threshold at which NICE is willing to pay at £20,000 per QALY gained, if the assumption that the provision of SM support leads to a reduction in hospital admissions is met. The impact of reduced readmissions in the model led to lower mortality and morbidity from severe exacerbations over the long term. There were fewer costly hospital admissions, and intervention costs were relatively low compared with the cost of a readmission.

The probabilistic sensitivity analysis, which considers parameter uncertainty in the model, suggested that SM had a probability of 68% of being cost-effective at a threshold of £20,000/QALY, demonstrating the uncertainty around the impact of SM on readmissions. The remaining probability, when SM was not cost-effective, was due to the intervention potentially having worse outcomes while being more costly. Furthermore, the one-way sensitivity analyses undertaken were informative in highlighting the key drivers of the model results. As expected, cost-effectiveness was affected by the estimate of effect on readmissions, duration of effect and cost of a SM programme. The base case considered the intervention to have an impact for 2 years; however, the data from trials were collected only over the short term, for example 6 months. The results demonstrated that if the effect lasts for only 6 months then at a threshold of £20,000 per QALY gained the SM support was unlikely to be cost-effective. Currently, the model suggests that as long as the cost of the intervention is < £2200 then it is likely to be cost-effective; however, this threshold value will drop if the intervention is less effective.

Subgroup analysis, changing by considering different cohorts with regards to gender, age or smoking status, *found no evidence of effect on the overall result*. There was some evidence that SM might be more cost-effective in GOLD stage 4 patients. This is most likely to be due to a higher baseline risk of exacerbation and a higher proportion of exacerbations resulting in hospital admission. Therefore, a risk reduction is likely to have a greater effect.

Strengths and limitations

A key strength of this analysis is that this is the first economic model to consider the cost-effectiveness of SM in this particular patient group and illustrates the key variables that impact on the results. Although no good-quality, long-term data currently exist on the effectiveness of SM, a model structure exists for reanalysis once additional data become available.

The model structure applied was a further strength of this study. It is a modified version of previously published decision models whereby additional post-admission health states were added to incorporate emerging evidence on the higher risks in patients with COPD immediately after discharge.[13] This was thought to be particularly important for measuring costs and outcomes in this model, as the patient population were assumed to receive the intervention within 6 weeks of discharge.

Although there are concerns about the effectiveness estimates, robust data were included in the model to represent the natural history of the condition. The risks applied in the first 3 months were obtained from the UK cohort included in the European Audit[84] of patients with COPD admitted to hospital. The model also captures long-term outcomes by disease severity, applying data on long-term exacerbation risks, mortality and disease progression from large longitudinal studies – TORCH[85] and ECLIPSE.[13] This study also applies patient-level utility data obtained from a representative sample of UK patients (unpublished data obtained from BLISS cohort). Finally, although there was a great deal of uncertainty around effectiveness data and assumptions applied to this model, distributions were applied to reflect this uncertainty. The probabilistic sensitivity analysis was also supplemented by a one-way sensitivity analysis of all key parameters, thus demonstrating which parameters were mostly likely to influence decisions to implement SM.

There are a number of caveats when considering the results of this economic model. Most importantly, this is a speculative decision model and therefore can be considered as indicative of only the potential cost-effectiveness of SM. As highlighted in the clinical effectiveness and cost-effectiveness review, there is a dearth of high-quality evidence on the long-term costs and outcomes associated with this intervention. This model was based on this weak evidence of effect and thus incorporates considerable uncertainty when assumptions from the literature and estimates from clinical experts were applied in the absence of better-quality data.

In addition to the uncertainty around the effect of SM, there was also some uncertainty around parameters and assumptions applied in the base case for UC. Although the model was able to reflect mortality and readmission risks in the first 3 months after discharge, it was assumed that after those 3 months, those who were not readmitted would move to a stable health state. It is unclear if this really reflects natural history or if the risk of readmissions and mortality remain higher beyond 3 months among those with recent history of exacerbation. Similarly, the data extracted from the TORCH[85] and ECLIPSE[13] studies represent average exacerbation and hospitalisation rates in stable COPD cohorts over a 3-year period and these data were applied over a 30-year time horizon. In reality this may change over time.

The model highlights a number of areas in which further research is required. Crucially, further evidence is needed on the effectiveness of SM support to confirm if it is indeed cost-effective and with greater certainty. Longer-term evidence beyond 6 months is also required. Follow-up data on cohorts of patients admitted to hospital is needed to provide better estimates of long-term outcomes. A review of costs applied of other SM programmes in patients with COPD suggests that the cost of implementing SM support are likely to range somewhere between £85[68] and £671.[63] Although more research is required to develop more accurate cost estimates for implementing SM programmes in this cohort, this is unlikely to change the outcome of this analysis. Finally, better data are required on utility values in COPD populations, particularly the utility loss associated with exacerbation.

Although outside the scope of this report – in light of the uncertainty around the effectiveness and cost-effectiveness of the intervention – it would be beneficial for a value of information analysis to be undertaken in the future. Value of information analysis allows a comparison of the potential benefits of additional research with the costs of further investigation. The value of any further research is based on how much this extra information will reduce the overall decision uncertainty.

Summary

- Currently, there is no published evidence on the cost-effectiveness of SM compared with UC in patients with COPD who have recently been discharged from hospital.
- This is the first economic model to attempt to estimate the cost-effectiveness of SM in this patient group.
- This speculative model indicates that SM is cost-effective if it is assumed that the intervention has a small positive effect on reducing admissions for a minimum of 6 months.
- The model has a number of limitations, the most important related to the large amount of uncertainty around the effectiveness estimate driving the model results.
- The analysis highlights the importance of conducting further research on the effect and duration of effect of the SM intervention delivered post discharge to allow a more robust analysis of cost-effectiveness.

Chapter 7 A systematic review to identify the features and elements of self-management support interventions that are most effective: review 4

The aim of this chapter is to present the findings from a broad systematic review to assess the effectiveness, and identify the most effective components, of self-management (SM) interventions.

Methods

A systematic review of the evidence of effectiveness of interventions to support SM among patients with chronic obstructive pulmonary disease (COPD), at any time point, to identify the features and elements that are most effective.

Definition of self-management

As described for review 1 and tabulated in *Table 2*.

Search strategy

A comprehensive search strategy described as for review 1. Only citation lists of relevant reviews were examined for additional relevant studies.

Study selection process

As described for review 1.

Selection criteria

In contrast with the first review, owing to the likely high volume of relevant studies, the selection criteria included only RCTs and a more limited range of outcomes (*Table 38*). Although RCTs purely of smoking cessation were excluded, trials described as 'pulmonary rehabilitation (PR)' were included, as many PR trials include components of SM and aim to enable participants to self-manage their condition after the PR programme ends. Furthermore, many interventions describe supported SM with a supervised structured exercise programme, which is similar to PR. There is a large overlap of intervention content even with different definitions and we wanted to include as complete a range of evidence as possible.

Risk of bias assessment

As for review 1, all of the RCTs were assessed using the Cochrane Risk of Bias tool.[56] Assessment was limited to primary outcomes. All studies were assessed by one independent reviewer, with a second reviewer independently checking at least 10% of studies, and a third reviewer overseeing the complete process.

Data extraction

Approach

Data extraction of study characteristics was undertaken by a single reviewer, except for key fields such as sample size, duration of intervention and duration of follow-up, which were extracted in duplicate on to a piloted table of characteristics. The components of interventions were mapped by a single reviewer after the research team had each mapped 30 studies and discussed discrepancies and component definitions/criteria. For the results, data were extracted only from papers that reported any of the three primary outcomes (QoL, hospital admissions/readmissions or exacerbations). The reporting in papers of secondary outcomes (mortality, anxiety, depression, exercise capacity, lung function, health-care utilisation, ED visits

TABLE 38 Selection criteria for review 4

Study designs	RCTs
Population	Any patients with moderate to severe COPD (defined clinically with or without spirometry) including those in the stable state (patients with mild or very severe COPD were included if they were a minority of the population group)
	> 90% of patients in studies had COPD
	The setting could be either hospital or community
Intervention	SM packages, larger packages of care that included a significant component of SM (e.g. PR) or important components of SM
	Excluding trials of smoking cessation
Comparator (where appropriate)	No intervention, usual care, control/sham, other SM intervention
Primary outcomes	Exacerbations
	Hospital admissions/readmissions
	HRQoL
Secondary outcomes	Mortality
	Anxiety, depression
	Exercise capacity
	Lung function
	Health service utilisation
	ED visits
	Dyspnoea

and breathlessness) was documented but the results were not extracted. Owing to high volume, one reviewer extracted all of the data on to piloted tables using Microsoft Excel version 2010 (Microsoft Corporation, Redmond, WA, USA), with at least 10% of the extracted data being checked by a statistician. If necessary any differences were resolved via discussion with a third reviewer. When relevant data were lacking or unclear, authors were contacted via e-mail.

Types of data extracted
As described for review 1.

Data manipulation
As described for review 1.

Analyses
Owing to a large volume of literature, only those papers that reported any one of the three primary outcomes were taken forward for further analyses:

(a) HRQoL scores including subdomain scores
(b) numbers of/time to first hospital admissions/readmissions
(c) numbers of/time to first exacerbation/s.

Papers with secondary, but no primary, outcomes were tabulated only.

Analyses consisted of mapping and description of the features and elements of the interventions from the included papers; presentation of the results of various combinations and comparisons of components on forest plots; meta-analysis of the data where appropriate; meta-regression; and subgroup analysis to explore heterogeneity.

Description of the features and elements of self-management interventions by simple categorisation and tabulation

To describe the features and elements of SM interventions, a mapping process was undertaken whereby interventions were broken down into a visual representation of components (defined in *Table 39*). Components included disease knowledge/education, exercise, breathing techniques, smoking cessation

TABLE 39 Definitions of components of SM

Component		Broad inclusion/definition
Disease knowledge		Education about disease, disease management, treatments, SM, chronic illness, activities of daily life, end of life, self-care tips, travel and COPD
SM unspecified		SM education/skills
RMT		IMT, EMT (pressure, threshold, resistance devices)
Action planning		Managing exacerbations, coping plan, management of COPD symptoms, recognising when to call a doctor
Breathing management and techniques		Breathing exercises, breathing retraining, respiratory biofeedback, managing breathlessness and coping with triggers for breathlessness, t'ai chi, vocal exercises
Smoking cessation		Advice, counselling, groups, interventions to help reduce/quit smoking as required
Medication/ adherence		Information about medication and adherence, promoting adherence (pharmacological or non-pharmacological)
Bronchial hygiene techniques		Postural drainage/coughing technique
Nutrition		Advice, counselling, groups, supplements as required
Psychological intervention		Psychosocial support, cognitive–behavioural therapy, cognitive training, relaxation (including exercises, e.g. progressive muscle relaxation), stress management, general goal-setting, mood disturbance, handling emotions (how to cope with the disease), psychosocial problems associated with respiratory disability, self-talk and panic control, health, qigong
Preventative		Avoiding exacerbations, pollution and environmental hazards, managing infections, personal hygiene
Inhaler technique and use		Assessing inhaler technique, teaching correct use and handling of inhalers
Energy conservation		Pacing and good posture, home modifications and ADL, work simplification
Support groups/ patient empowerment		Peer support self-help groups/networks, e.g. Breathe Easy, developing confidence to negotiate with clinicians
Exercise	Strength	Upper limb, lower limb strength/resistance exercises
	Aerobic	Cycling, walking, stair climbing as aerobic/endurance exercises
	Other	Flexibility and balance exercises, sham training, unspecified exercises
Enhanced access/ care		Access to health professionals, access to call centre/hotline, health professional home visits and/or telephone support
Other		Any miscellaneous uncommon components, e.g. sleep or other symptom control
Usual care		Usual medications and visits to GP or routine secondary care

ADL, activities of daily living; EMT, expiratory muscle training; IMT, inspiratory muscle training; RMT, respiratory muscle training.

and inhaler technique among others. Each component was subdivided into either an information element only or a support/training element. All treatment arms of the trials were mapped in this way. The numbers of components within intervention and control arms were identified.

Exploring significant components of self-management interventions in reducing exacerbations, hospital admissions/readmissions and improving quality of life

Planned analyses and comparisons

To explore the effectiveness of different SM components (or groups of components), a series of 18 analyses were planned (*Table 40*) in collaboration with the steering group to ensure clinical relevance. The analysis plan was developed prior to collation of any of the data and followed two main objectives:

To:

i. explore clinically relevant interventions
ii. avoid repeating any recent high-quality systematic review, such as a Cochrane review.

TABLE 40 Analyses planned to explore the effectiveness of SM components and interventions

Intervention	Comparator
1. Multicomponent interventions	UC/control
2. Addition of one component	
3. Exercise-only interventions	UC/control/sham intervention
4. Enhanced care	
5. Multicomponent interventions with supervised exercise	UC/control
6. Multicomponent interventions with structured unsupervised exercise	UC/control
7. Multicomponent interventions with exercise counselling only	UC/control
8. Multicomponent interventions without an exercise element	UC/control
9. Multicomponent interventions including an exercise component consisting of aerobic and strength training	UC/control
10. Strength and aerobic exercise training	Aerobic training only
11. Endurance/aerobic training	Strength/resistance training
12. Upper limb and lower limb training	Lower limb training only
13. Interval training	Continuous training
14. IMT or EMT	UC/control/sham intervention
15. More sessions/longer-duration interventions	Fewer sessions/shorter duration interventions
16. Hospital-based interventions	Home-based interventions
17. Pharmacist-delivered interventions	
18. Maintenance programme post PR	No maintenance programme post PR

EMT, expiratory muscle training; IMT, inspiratory muscle training; UC, usual care.

We explored the effectiveness of any single component interventions that were delivered either alone or as part of a wider package for which the only difference between the two arms was this single component. A multicomponent SM package was included in many analyses and we defined multicomponent as including three or more relevant components. The definition of three components was used because most exercise programmes would require some discussion of managing breathlessness. From a clinical perspective it seemed likely that some interventions would describe both components and others only the exercise component.

To avoid repeating current systematic reviews, we chose not to explore the effectiveness of integrated care but instead explored the effects of 'enhanced care'. We defined 'enhanced care' to be interventions that gave patients access to additional contact with health-care professionals through regular telephone contact or visits. This is distinct from integrated care, which required delivery by a multidisciplinary team.

The effectiveness of exercise-only interventions was explored by examining different combinations of exercise (e.g. strength, aerobic, and combined strength and aerobic exercises). The inclusion of these different modes of exercise is important for professionals developing and delivering SM and rehabilitation programmes for COPD. Exercise as part of multicomponent packages was categorised into groups of supervised exercise (which mirrors PR), unsupervised exercised (mirroring home-based rehabilitation programmes) and exercise education only.

As well as the components, we were also interested in delivery mechanisms. These were discussed and agreed by the steering group before any analyses were undertaken. We considered that the location of the intervention was an important delivery issue, for example hospital or centre-based compared with a home-based programme and the duration or intensity of programmes to be important delivery issues also. To explore these questions we sought trials that had direct comparisons.

Post hoc analyses were decided upon after mapping the content of the SM intervention components. Post hoc analyses included an exploration of the effectiveness of interventions delivered by pharmacists and the effectiveness of maintenance programmes post PR.

Presentation on forest plots

For each analysis, the first stage involved presenting extracted study results on forest plots alongside key study characteristics so that the wider team could determine whether it was sensible to perform meta-analysis. For each intervention, the effectiveness across each outcome was presented. Data were presented in forest plots when there were ≥ 10 studies. As there were multiple follow-up points, results were divided into three time periods: up to and including 3 months; above 3 months to 6 months; and beyond 6 months since the start of the study. If a study had more than one follow-up point within each time period, the latest follow-up within the period was used.

All forest plots were then ordered according to the number of components in the intervention arm, followed by the length of follow-up and then alphabetically by author name.

Owing to a large volume of different QoL measures used, only data from the disease-specific total SGRQ and CRQ were included in the forest plots. In this review, SGRQ is presented on a reversed scale (i.e. higher scores are better).

For QoL data, the numbers of patients followed up were displayed, as well as baseline differences between intervention and control arms, and whether or not ANCOVA was used to adjust for the baseline value. For plots of HRs, details were also displayed of whether or not the effect size was used directly from data within the trials or whether or not they were estimated using other available data.

Meta-analysis methods

As described for review 1, but in addition to the summary estimate and its 95% confidence interval (CI), each random-effects analysis was also summarised by reporting a 95% prediction interval. This predicts how the effectiveness of the intervention could vary from the average in different circumstances, for example for different contexts, populations and lengths of follow-up.[62,105] This is important to ascertain whether the intervention is likely to work in the majority of settings, or whether – due to unexplained heterogeneity – the intervention may work well in some settings but work less well (or not at all) in other settings. Prediction intervals were calculated where there were five or more studies per analysis and were tabulated separately from the forest plots.

Assessing publication bias

For each meta-analysis containing ≥ 10 studies, the likelihood of publication bias was investigated through the construction of funnel plots and Egger's test for 'small-study effects', i.e. the tendency for smaller studies to provide more positive findings. It is important to note that when heterogeneity exists, publication bias may be one of a number of reasons for any small-study effects identified. The restriction of 10 studies was due to the low power of identifying small-study effects with few studies.[106]

Meta-regression and subgroup or sensitivity analyses

For each meta-analysis, if there were sufficient numbers of studies (at least 10 per meta-analysis), meta-regression was considered to explore whether the following prespecified variables explained any of the heterogeneity: severity of disease in the study population, length of intervention, number of components of intervention and study quality.

Mixed-treatment comparisons

Although mixed-treatment comparison meta-analyses were planned, the assumptions to undertake the analysis were not considered to have been met. In particular, the large heterogeneity in follow-up time, the included patient population and the study design suggested that the consistency assumption required was unlikely to be sensible.[107] Therefore, no mixed-treatment comparisons were explored.

Patient advisory group

See review 1 for details.

Search results

Included studies

From 13,355 identified titles, 836 full papers were obtained and 283 papers were finally included. Of these, 174 RCTs from 194 papers reported one of the three primary outcomes: HRQoL, hospital admissions/readmissions and exacerbations (*Figure 21*). A total of 89 papers reported outcomes other than our three primary outcomes and are listed in *Appendix 21* alongside the secondary outcomes that they reported. Overall, 553 papers were excluded (see *Appendix 2* for full list with reasons for exclusion). Arbitration by a third reviewer was required for 5% of all full texts. In total, 40 ongoing studies were identified as relevant (see *Appendix 4*).

Within the 174 trials with primary outcomes several studies had multiple arms. Thus there were 229 comparisons of interventions compared with usual care (UC), control or another active intervention.

Characteristics of studies

The study and population characteristics of the 174 included RCTs with relevant primary outcomes are summarised in *Appendix 22*.

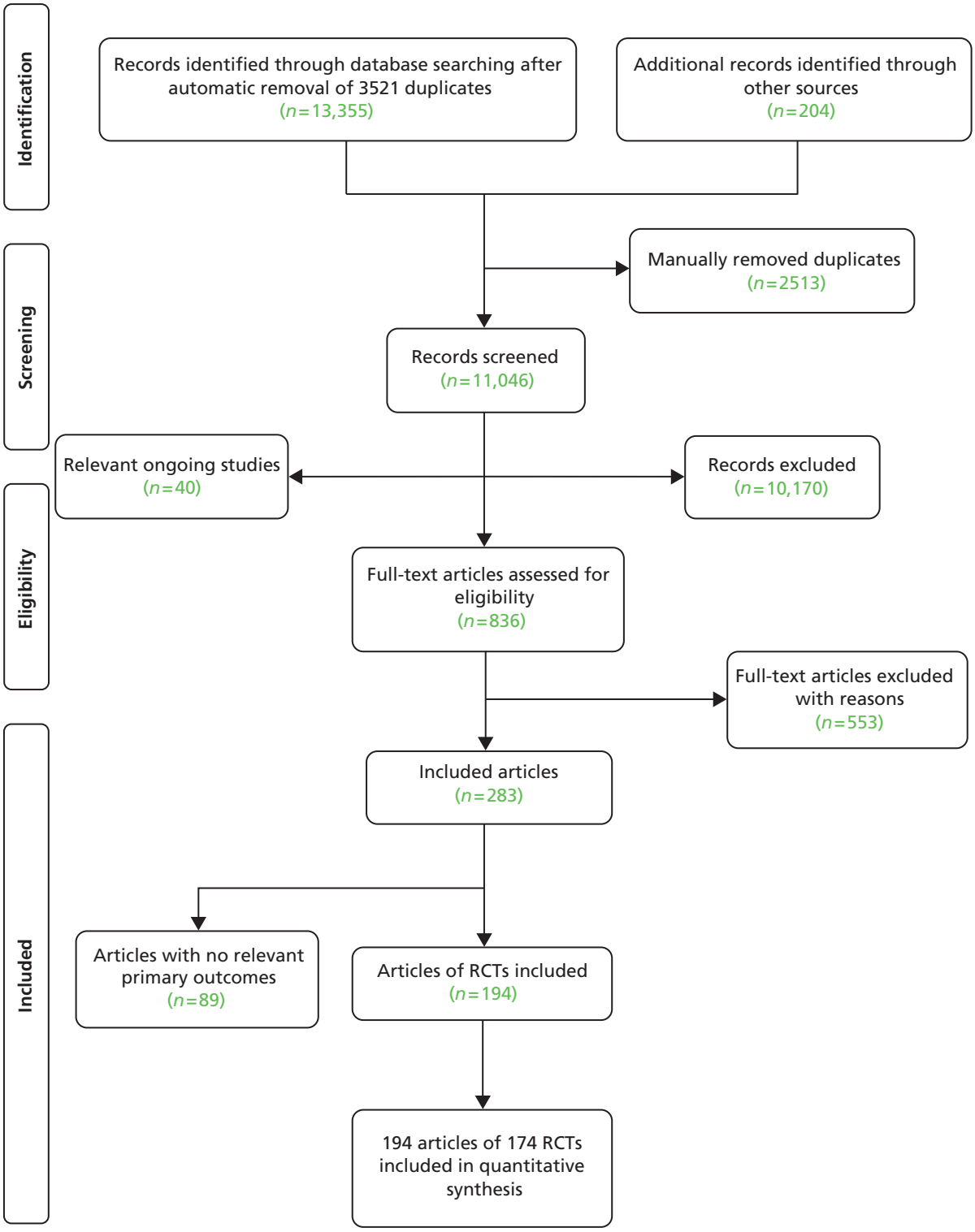


FIGURE 21 Summary of the selection process for clinical effectiveness studies.

Country/setting/recruitment

The majority of the trials were set in high-income countries, with 33 (19%) from the USA and 21 (12.1%) from the UK. However, trials were set in 31 different countries, including eight from China, six from Hong Kong, three from India and two from the Republic of Korea. A breakdown is given in *Table 41*.

TABLE 41 Setting of SM trials

Country	*n*	%
USA[108–140]	33	19.0
UK[63,73,141–159]	21	12.1
Australia[67,69,160–170]	13	7.5
Spain[68,171–180]	12	6.9
The Netherlands[181–190]	10	5.8
Canada[191–198]	8	4.6
China[74,199–205]	8	4.6
Germany[64,206–211]	7	4.0
Hong Kong[66,70,212–215]	6	3.4
Sweden[216–221]	6	3.4
Denmark[222–226]	5	2.9
New Zealand[227–231]	5	2.9
Brazil[232–235]	4	2.3
Turkey[236–239]	4	2.3
India[240–242]	3	1.7
Italy[75,243,244]	3	1.7
Austria[245,246]	2	1.1
Belgium[247,248]	2	1.1
France[249,250]	2	1.1
Ireland[251,252]	2	1.1
Israel[253,254]	2	1.1
Norway[255,256]	2	1.1
Switzerland[257,258]	2	1.1
Taiwan[259,260]	2	1.1
Japan[261,262]	2	1.1
Argentina[263]	1	0.6
Egypt[264]	1	0.6
Greece[265]	1	0.6
Jordan[266]	1	0.6
Korea[267]	1	0.6
Republic of Korea[268]	1	0.6
Spain and Belgium[70]	1	0.6
Venezuela[269]	1	0.6

Note
'*n*' refers to number of trials.

Size

The sample size of the 174 included trials ranged from 10 to 743 [median 53, interquartile range (IQR) 38–100]. Trials were generally small with 81 (46.6%) trials including < 50 participants, 47 (27.0%) with 50–99 participants, 34 (19.5%) with 100–199 participants, and 12 (6.9%) with ≥ 200 participants (*Table 42*).

Population characteristics

Table 43 summarises the characteristics of the populations in the trials. The characteristics reported were frequently of those who completed the trial rather than those who were randomised.

The mean age of the participants was between 52 and 80 years, with the majority of trials (72%) reporting a mean age of between 60 and 69 years. The proportion of male participants ranged from 15% to 100%. In the trials that provided data on the gender of the participants, males tended to be in the majority. Thirty-four trials[66,67,69,70,74,111,112,118,127,133,136,142,144,151–153,168,185,192,195,199,201–205,209,210,212,214,218,238,264,270–272] did not report the FEV_1% pred but reported the proportions within severity groups. Of the trials that did provide these data, the mean FEV_1% pred of the trial participants ranged from 26.3% to 69.0%. More than half of trials had a population mean in the 30–59% range, which is equivalent to GOLD stage 3 – severe COPD.

Recruitment of participants was mainly from secondary care or PR programmes.

TABLE 42 Number of participants in included studies

Size of trial	*n*	%
< 25	13	7.5
25–49	68	39.1
50–74	29	16.7
75–99	18	10.3
100–149	23	13.2
150–199	11	6.3
200+	12	6.9

Note
'*n*' refers to number of trials.

TABLE 43 Characteristics of the populations of included studies

Characteristic	*n* (%)
Age (mean, years)	
50–59	11 (6.3)
60–69	111 (63.8)
70–79	29 (16.7)
80+	1 (0.5)
NR	22 (12.6)
Males (*n*, %)	
1–25	4 (2.3)
26–50	36 (20.7)
51–75	62 (35.6)
75–100	51 (29.3)
NR	21 (12.1)
FEV_1% pred (mean)	
50–79	44 (25.3)
30–49	90 (51.7)
< 30	5 (2.9)
NR	35 (20.1)
Recruited from:	
Secondary care inpatient	15 (8.6)
Secondary care outpatient/unspecified	83 (47.7)
ED	1 (0.5)
PR programme/referred	21 (12.1)
Primary care	9 (5.2)
Primary and secondary care	3 (1.7)
Community	3 (1.7)
Primary or secondary care and advertisement	18 (10.3)
NR/unclear	21 (12.1)

NR, not reported.
Note
'*n*' refers to number of studies.

Follow-up of trial participants

Length of follow-up ranged from 4 weeks to 2 years from the start of the intervention. In 78 (44.8%), follow-up was ≤ 3 months, in 120 (69.0%) it was ≤ 6 months and in 174 (94.3%) it was ≤ 1 year. Twelve trials[65,116,155,166,172,182,190,248,271,273–277] had follow-up of > 1 year (*Table 44*).

Time from the end of intervention (delivery of last element of SM support) to last follow-up varied considerably (see *Table 44*). A total of 106 (60.9%) of the trials reported follow-up data only at the end of the intervention period (details provided within appendices). Only 18 trials[111,121,141,161,166,170,172,192,195,198,210,213,217,229,250,251,270,271,276–279] (10.9%) reported a follow-up of > 6 months after the end of the intervention.

Interventions

The interventions were very heterogeneous. They included structured group-based PR programmes; more limited one-to-one educational SM interventions delivered in an outpatient setting or at a patient's home, sometimes with telephone follow-up; integrated disease management with multidisciplinary input and often some element of monitoring by health professionals; exercise-only interventions (with some dyspnoea management) and respiratory muscle training (RMT) using threshold devices. Within these various broad categories, there was a range of individual SM components, including some that might be less traditionally part of SM, such as qigong, t'ai chi and singing. *Appendix 23* provides detailed descriptions of the intervention and comparator groups with intensity and frequency of interventions delivered.

Description of self-management components in intervention and comparator arms

Within the arms of the 174 trials we categorised 15 types of components (plus other and unspecified). In the intervention groups exercise was the most commonly reported component (76.9%), followed by breathing techniques and management of dyspnoea (64.2%), and general education about COPD and its management (47.2%). Details of the numbers of individual components for the intervention and comparator groups are shown in *Table 45*. *Appendix 24* displays which components were present within the intervention and comparator groups of each study.

TABLE 44 Duration of follow-up and time from end of intervention to follow-up

Time to last follow-up	*n* (studies)	%
Time to last follow-up (weeks)		
≤ 13	76	43.7
14–26	40	23.0
27–52	44	25.3
> 52	12	6.9
Unclear	2	1.1
Time from end of intervention to last follow-up (weeks)		
0	106	60.9
≤ 13	27	15.5
14–26	16	8.6
27–52	14	8.0
> 52	4	2.3
Unclear	7	4.0

TABLE 45 Self-management components reported in the interventions and comparator groups

Component	Intervention (no. of studies) *n* (%)	Comparator (no. of studies) *n* (%)
Exercise	176 (76.9)	96 (41.9)
Breathing techniques/dyspnoea management	147 (64.2)	52 (22.7)
Disease knowledge	108 (47.2)	68 (29.7)
Psychological including relaxation and stress management	77 (33.6)	34 (14.8)
Medication advice	77 (33.6)	43 (18.8)
Nutrition advice	51 (22.3)	28 (12.2)
Enhanced access	50 (21.8)	15 (6.6)
Action planning for self-treating exacerbations	43 (18.8)	9 (3.9)
Smoking cessation advice/support	44 (19.2)	18 (7.9)
Inhaler technique	36 (15.7)	19 (8.3)
Bronchial hygiene/secretion clearance techniques	30 (13.1)	16 (7.0)
Unspecified	24 (10.5)	9 (3.9)
RMT	32 (14.0)	11 (4.8)
Energy conservation	22 (9.6)	7 (3.1)
Other	18 (7.9)	5 (2.2)
Preventative measures to avoid infection	18 (7.9)	11 (4.8)
COPD support groups	7 (3.1)	3 (1.3)

Up to 13 different SM components were included in any one of the intervention arms, and up to 11 in any one of the comparator groups (*Table 46*). Seventy-three (31.9%) of the intervention arm interventions had six or more components. In the intervention group, 38 (16.6%) were single components with the vast majority of these being exercise-only interventions. In contrast, the majority of the comparators had two or fewer described components [167 (72.9%)], with 34.9% not providing any detail about the SM education or support provided to the comparator group as part of UC (see *Table 46*).

The content of the components of the intervention are shown according to the total number of components in the intervention in *Table 47*. Of the single-component interventions, 25 of 38 (65.8%) were exercise only, 9 of 38 (23.7%) were RMT and three (7.9%) were breathing exercises. In the two- and three-component interventions, exercise is frequently combined with breathing/dyspnoea management and disease knowledge. Overall, the most common components were exercise [176 (76.9%) of studies], breathing techniques and dyspnoea management [147 (64.2%)], disease knowledge [108 (47.2%)] and psychological interventions [77 (33.6%)].

In those interventions with six or more components, the most common components were exercise [69 (94.5%) of studies], breathing techniques and dyspnoea management [66 (90.4%)], disease knowledge [65 (89.0%)] and medication advice [60 (82.5%)]. Notably, smoking cessation was mentioned in only 38 (52.1%) of the interventions with six or more components.

Figure 22 displays the range of different interventions included.

TABLE 46 Numbers of components in intervention vs. comparator groups

		No. of components in the comparator groups												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	***Total, n (%)***
No. of components in the intervention groups	**1**	10	22	2	1	2	0	1	0	0	0	0	0	**38 (16.6)**
	2	20	18	13	0	0	0	2	0	1	0	0	0	**54 (23.6)**
	3	7	5	11	6	0	0	0	0	0	0	0	0	**29 (12.7)**
	4	6	3	2	6	2	0	0	0	0	0	0	0	**19 (8.3)**
	5	8	2	1	1	3	1	0	0	0	0	0	0	**16 (7.0)**
	6	7	3	0	0	3	1	6	1	0	0	0	0	**21 (9.2)**
	7	8	2	0	2	2	0	2	2	0	0	0	0	**18 (7.9)**
	8	6	0	0	1	2	0	0	2	3	0	0	0	**14 (6.1)**
	9	2	0	1	0	0	0	0	1	0	1	0	0	**5 (2.2)**
	10	4	1	0	0	0	0	0	1	0	1	0	0	**7 (3.1)**
	11	0	1	0	0	0	0	1	1	0	0	1	1	**5 (2.2)**
	12	1	0	0	0	0	0	0	0	0	0	0	1	**2 (0.9)**
	13	1	0	0	0	0	0	0	0	0	0	0	0	**1 (0.4)**
Total no. of studies		**80 (34.9)**	**57 (24.9)**	**30 (13.1)**	**17 (7.4)**	**14 (6.1)**	**2 (0.9)**	**12 (5.2)**	**8 (3.5)**	**4 (1.7)**	**2 (0.9)**	**1 (0.4)**	**2 (0.9)**	**229**

TABLE 47 Content of interventions by the number of components within the SM package

Intervention components	No. of SM components in intervention													Total no. of studies
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Action planning for self-treating exacerbations	0	3	2	2	4	2	7	6	4	7	3	3	1	43
Breathing techniques/dyspnoea management	3	37	16	15	10	18	16	12	5	7	5	24	1	147
Bronchial hygiene/secretion clearance techniques	0	0	0	4	2	3	5	4	1	3	5	2	1	30
Disease knowledge	0	8	11	10	14	17	16	13	4	7	5	2	1	108
Energy conservation	0	0	0	2	0	3	1	8	1	2	4	1	0	22
Enhanced access	0	4	6	3	6	4	8	7	3	4	3	1	1	50
Exercise	25	37	21	14	10	18	17	14	5	7	5	2	1	176
Inhaler technique	0	0	0	1	2	4	8	7	4	5	2	2	1	36
Medication advice	0	1	6	3	7	16	13	13	5	6	5	1	1	77
Nutrition advice	0	2	3	1	4	8	10	6	4	5	5	2	1	51
Preventative measures to avoid infection	0	0	3	0	0	2	2	3	2	2	2	1	1	18
Psychological including relaxation and stress management	1	3	8	14	8	14	8	7	2	4	5	2	1	77
RMT	9	7	7	1	0	3	4	0	0	0	1	0	0	32
Smoking cessation advice/support	0	0	0	1	5	6	9	8	4	5	3	2	1	44
COPD support groups	0	0	0	0	1	2	1	1	0	1	0	1	0	7
Unspecified	0	0	1	4	3	6	0	3	0	4	1	1	1	24
Other	0	6	3	1	4	0	1	0	1	1	1	0	0	18

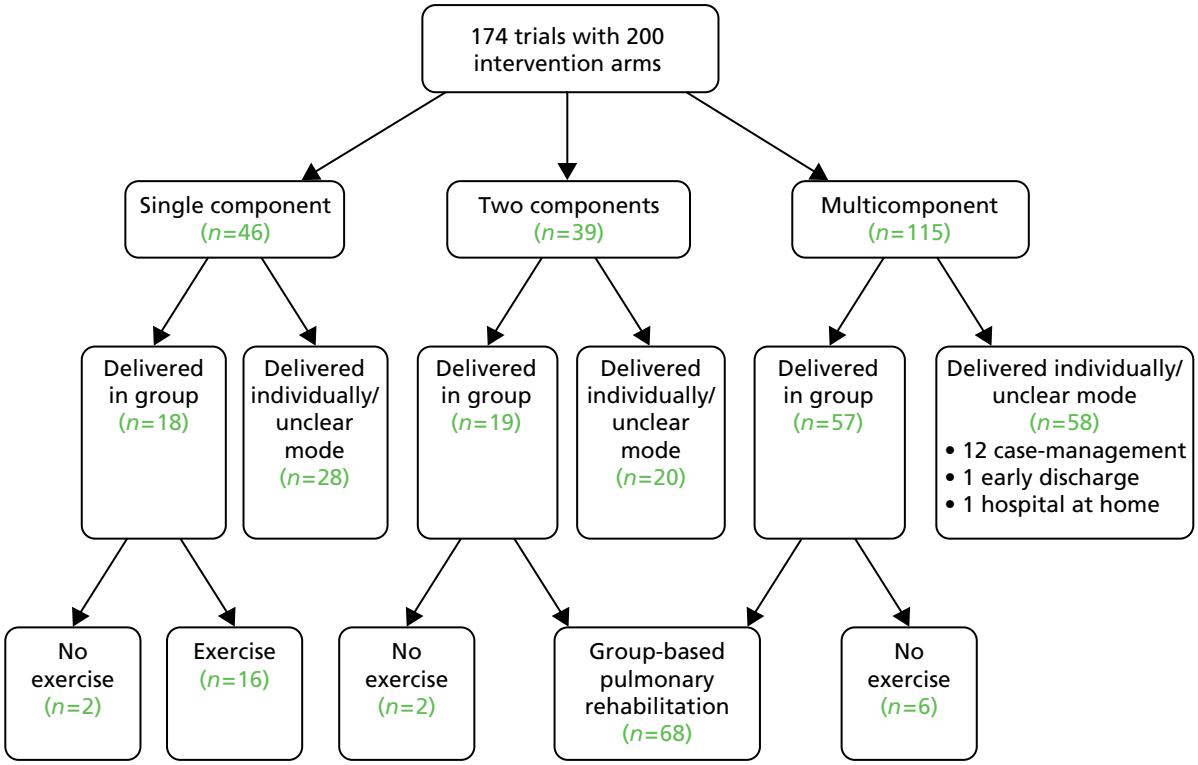


FIGURE 22 Range of interventions included across 174 trials.

Duration of the intervention

The duration of the intervention was measured to the last behavioural or supportive contact and ranged from 1 day to 2 years (*Table 48*). A total of 114 trials (58.8%) reported interventions of ≤ 3 months' duration, with nine trials (4.6%) being longer than 1 year. Five trials[71,72,117,142,215,255,280,281] did not report an intervention duration or had a variable duration intervention (*see Appendix 23*).

TABLE 48 Duration of intervention

Intervention duration (weeks)	No. of studies	%
< 1	2	1.1
4	19	10.9
5–8	59	33.9
9–13	34	19.5
14–26	29	16.7
27–52	22	12.6
53–104	4	2.3
NR/variable duration	5	2.9

NR, not reported.

Mode of delivery of the intervention

The majority of the interventions were delivered by nurses and respiratory physiotherapists. Half of the interventions had a group-based component; 63 (36.2%) were entirely group based; and an additional 24 (13.8%) had a group component followed by individual support. In 20 studies the mode of delivery was unclear. Details of the mode of delivery are in *Table 49* and in the detailed characteristics of intervention table in *Appendix 23*.

Comparator arms

There were 141 comparisons (from 127 trials) of an intervention compared with UC or a control group that was not an active intervention. The UC arm was frequently not described; in other cases it was the standard primary and/or secondary care for people with COPD.

A total of 107 comparisons (from 85 trials) were of two active interventions. Details are provided in *Appendix 23*.

Primary outcome measures

Most trials (163, 96.6%) reported HRQoL; 42 (24.1%) reported hospital admissions or readmissions and only 20 (11.5%) reported exacerbations.

Other outcome measures reported

The included studies reported a wide range of outcomes; 12 reported mortality, 103 dyspnoea, 34 anxiety and 41 depression outcomes. Exercise capacity was reported in 135 studies and lung function in 92 studies. Health service utilisation was reported in 41 trials and ED visits in 29 trials. The details of which trial reported which outcomes are displayed in *Appendix 25*.

Risk of bias of included studies

Table 50 summarises the risk of bias. Details of the risk of bias assessment for all of the included studies are tabulated in *Appendix 26*.

Reporting of the method of generating the randomisation sequence was generally poor, with only 71 (36%) of the trials providing adequate information. Where reported, the randomisation method was adequate to produce a low risk of bias. Similarly, the majority of studies [146 (84%)] did not provide sufficient information about allocation concealment to be able to determine the risk of bias. We considered the risk of bias for self-reported HRQoL to be high unless the participant was blinded to the intervention, either by randomisation to an active intervention in each study arm, or through a sham intervention. This resulted in a high rate of categorisation of high risk of bias for this outcome measure [117 (63%)].

TABLE 49 Mode of delivery of SM interventions

Mode of delivery	*n* (studies)	%
Group based	63	36.2
Individual	63	36.2
Mixed: group and one to one	24	13.8
Remote (internet/telemonitoring)	4	2.3
Unclear	20	11.5
Total	174	100.0

TABLE 50 Summary of risk of bias

Risk of bias	Low, *n* (%)	High, *n* (%)	Unclear, *n* (%)	Total
Sequence generation	66 (37.9)	0 (0)	108 (62.1)	174
Allocation concealment	27 (15.5)	1 (0.6)	146 (83.9)	174
Blinding of HRQoL outcome	34 (19.5)	117 (62.7)	23 (13.2)	174
Blinding of admission outcome	44	0	1	45
Incomplete outcome data	46 (26.4)	83 (47.7)	45 (25.8)	174
Selective outcome reporting	55 (31.6)	2 (1.1)	117 (67.2)	174
Other biases	44 (25.3)	86 (49.4)	44 (25.3)	174

Note
'*n*' refers to number of studies.

We also assumed that reporting of hospital admission would be unlikely to be influenced by knowledge of allocation; thus, the majority of trials reporting this outcome were categorised as at low risk of bias for this outcome. Loss to follow-up was frequently high, and authors often failed to adequately account for those with missing outcome data or did not describe their characteristics. Relatively few trials reported that they had published a protocol or were registered on a clinical trials database, so only 63 (30%) were categorised as at low risk of bias of selective outcome reporting; however, in most cases all the outcome measures described in the methods were reported in the results section.

A significant other potential cause of bias was due to authors reporting in the abstract the numbers completing the trial rather than randomised and the characteristics of only those who completed the trial. Furthermore, baseline imbalances (e.g. caused by small sample sizes) were not routinely adjusted for in statistical analyses, and thus differences at follow-up (e.g. in QoL) might (partly) be due to baseline differences.

Effectiveness results

Appendix 25 gives an overall summary of direction of effects for each trial for reference purposes.

The following sections refer to the results of specific analyses described previously in *Table 40*.

All trials

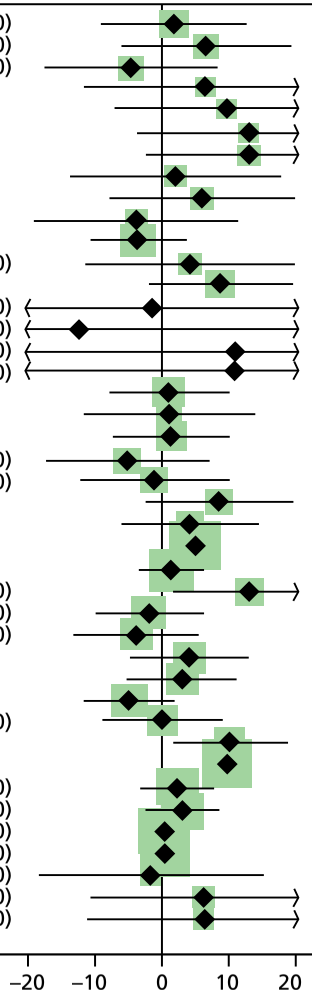
Figures 23–26 plot the outcomes at all reported time points for all trials for HRQoL measured by the SGRQ and the CRQ, hospital admission and exacerbations. These results have not been combined by meta-analysis due to the heterogeneity of the interventions and comparators.

The trials were ordered by the number of components, and upon visual inspection there does not appear to be any relationship between the size of the effect and the number of components. For HRQoL, many trials reported a large difference between the intervention and comparator group at baseline and, when present, this was rarely adjusted for in the analysis using ANCOVA.

At the last follow-up point, 11 of 56 (19.6%) resulted in a statistically significant reduction in hospital admissions and 4 of 28 (14.3%) a statistically significant reduction in exacerbations. A total of 22 of 87 (25.3%) comparisons showed a statistically significant improvement in total SGRQ score, 16 of 41 (39.0%) in total CRQ, 10 of 24 (41.7%) on the physical components of the Short Form questionnaire-36 items (SF-36) but only 2 of 21 (9.5%) on the mental component of the SF-36. For individual components, the CRQ 'dyspnoea' and 'mastery components had the highest proportions of reported significant improvements (26.4% and 25.8%, respectively).

(a)

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Bauldoff 2005[109] A	1	4	4	–2.2	No	10/10 (100)	10/10 (100)	1.70 (–8.86 to 12.26)
Bauldoff 2005[109] B	1	4	4	–4.6	No	10/10 (100)	10/10 (100)	6.50 (–6.02 to 19.02)
Bauldoff 2005[109] C	1	4	4	2.4	No	10/10 (100)	10/10 (100)	–4.80 (–17.51 to 7.91)
Beckerman 2005[253]	1	13	52	–2.1	No	17/21 (81)	14/21 (67)	6.40 (–11.62 to 24.42)
Beckerman 2005[253]	1	26	52	–2.1	No	17/21 (81)	14/21 (67)	9.70 (–6.86 to 26.26)
Beckerman 2005[253]	1	39	52	–2.1	No	17/21 (81)	14/21 (67)	13.00 (–3.56 to 29.56)
Beckerman 2005[253]	1	52	52	–2.1	No	17/21 (81)	14/21 (67)	13.00 (–2.25 to 28.25)
Dourado 2009[233] A	1	12	12	–3.0	No	11/14 (79)	11/15 (73)	2.00 (–13.51 to 17.51)
Dourado 2009[233] B	1	12	12	–5.0	No	11/14 (79)	13/19 (68)	6.00 (–7.65 to 19.65)
Dourado 2009[233] C	1	12	12	2.0	No	13/19 (68)	11/15 (73)	–4.00 (–19.00 to 11.00)
Mularski 2009[127]	1	8	8	–1.3	Yes	20/44 (45)	29/42 (69)	–3.70 (–10.50 to 3.10)
Murphy 2005[252]	1	6	6	4.9	No	13/13 (100)	13/13 (100)	4.10 (–11.28 to 19.48)
Probst 2011[234]	1	12	12	–4.9	No	20/32 (63)	20/31 (65)	8.70 (–1.72 to 19.12)
Vonbank 2012[246] A	1	12	12	–1.6	No	12/12 (100)	12/12 (100)	–1.50 (–41.70 to 38.70)
Vonbank 2012[246] B	1	12	12	12.8	No	12/12 (100)	12/12 (100)	–12.50 (–54.52 to 29.52)
Vonbank 2012[246] C	1	12	12	–14.4	No	12/12 (100)	12/12 (100)	11.00 (–27.58 to 49.58)
Yamaguti 2012[235]	1	4	4	–0.4	No	15/15 (100)	15/15 (100)	10.90 (–25.16 to 46.96)
Arnardotir 2006[216]	2	8	8	–1.4	No	20/31 (65)	22/32 (69)	1.00 (–7.78 to 9.78)
Arnardotir 2006[216]	2	26	8	–1.4	No	17/31 (55)	18/32 (56)	0.90 (–11.65 to 13.45)
Arnardotir 2006[216]	2	52	8	–1.4	No	17/31 (55)	15/32 (47)	1.30 (–7.02 to 9.62)
Bauldoff 2002[108]	2	4	8	6.8	No	12/12 (100)	12/12 (100)	–5.30 (–17.21 to 6.61)
Bauldoff 2002[108]	2	8	8	6.8	No	12/12 (100)	12/12 (100)	–1.20 (–12.01 to 9.61)
Gohl 2006[207]	2	52	52	2.5	No	10/10 (100)	9/9 (100)	8.50 (–2.29 to 19.29)
Hospes 2009[183]	2	12	12	2.5	No	18/20 (90)	17/19 (89)	4.10 (–6.03 to 14.23
Katiyar 2006[240]	2	13	13	1.0	No	23/24 (96)	22/24 (92)	5.00 (4.06 to 5.94)
McGeoch 2006[229]	2	52	1	6.5	No	84/86 (98)	70/73 (96)	1.27 (–3.16 to 5.70)
Paz-Diaz 2007[269]	2	9	8	3.0	No	10/10 (100)	14/14 (100)	13.00 (1.79 to 24.21)
Pomidori 2012[243]	2	26	52	5.0	No	18/18 (100)	18/18 (100)	–2.00 (–9.87 to 5.87)
Pomidori 2012[243]	2	52	52	5.0	No	18/18 (100)	18/18 (100)	–4.00 (–13.15 to 5.15)
Spencer 2010[169]	2	13	52	–5.0	No	24/31 (77)	24/28 (86)	4.00 (–4.51 to 12.51)
Spencer 2010[169]	2	26	52	–5.0	No	24/31 (77)	24/28 (86)	3.00 (–4.94 to 10.94)
Spencer 2010[169]	2	52	52	–5.0	No	24/31 (77)	24/28 (86)	–5.00 (–11.50 to 1.50)
Watson 1997[231]	2	26	1	4.0	No	29/29 (100)	27/27 (100)	0.00 (–8.64 to 8.64)
Weekes 2009[158]	2	52	26	–6.4	Yes	23/36 (64)	18/30 (60)	10.10 (1.70 to 18.50)
Barakat 2008[249]	3	14	14	1.1	No	35/40 (88)	36/40 (90)	9.70 (8.46 to 10.94)
Chan 2010[212] B	3	6	13	–2.4	No	69/69 (100)	67/67 (100)	2.20 (–3.03 to 7.43)
Chan 2010[212] B	3	13	13	–2.4	No	69/69 (100)	67/67 (100)	3.00 (–2.20 to 8.20)
Hynninen 2010[256]	3	9	7	–4.4	No	25/25 (100)	26/26 (100)	0.30 (–0.25 to 0.85)
Hynninen 2010[256]	3	35	7	–4.4	No	25/25 (100)	26/26 (100)	0.40 (–0.15 to 0.95)
Magadle 2007[254]	3	13	26	1.8	No	16/16 (100)	15/15 (100)	–1.80 (–18.32 to 14.72)
Magadle 2007[254]	3	26	26	1.8	No	16/16 (100)	15/15 (100)	6.20 (–10.32 to 22.72)
Magadle 2007[254]	3	39	26	1.8	No	16/16 (100)	15/15 (100)	6.30 (–11.16 to 23.76)



Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Seymour 2010[154]	3	13	8	6.7	Yes	23/30 (77)	26/30 (87)	8.20 (1.30 to 15.10)
de Blok 2006[181]	3	9	9	8.3	No	8/10 (60)	8/11 (73)	–11.60 (–29.69 to 6.49)
Bonilha 2009[232]	4	25	24	–9.3	No	15/23 (65)	15/20 (75)	0.90 (–4.02 to 5.82)
Chan 2010[212] A	4	6	13	3.3	No	70/70 (100)	67/67 (100)	0.30 (–4.92 to 5.52)
Chan 2010[212] A	4	13	13	3.3	No	70/70 (100)	67/67 (100)	1.60 (–3.42 to 6.62)
Chan 2010[212] C	4	6	13	5.7	No	70/70 (100)	69/69 (100)	–1.90 (–7.14 to 3.34)
Chan 2010[212] C	4	13	13	5.7	No	70/70 (100)	69/69 (100)	–1.40 (–6.61 to 3.81)
Hoogendorn 2009[182a]	4	17	104	1.0	Yes	87/102 (85)	88/97 (91)	4.10 (1.31 to 6.89)
Lamers 2010[185]	4	1	13	–1.9	No	42/96 (44)	49/91 (54)	5.14 (0.59 to 9.69)
Lamers 2010[185]	4	13	13	–1.9	No	38/96 (40)	44/91 (48)	6.97 (2.14 to 11.80)
Lamers 2010[185]	4	39	13	–1.9	No	42/96 (44)	42/91 (46)	7.94 (2.62 to 13.26)
Maltais 2008[198]	4	13	12		No	95/126 (75)	89/126 (71)	–1.40 (–4.25 to 1.45)
Maltais 2008[198]	4	52	12		No	95/126 (75)	89/126 (71)	–1.00 (–4.10 to 2.10)
Nguyen 2009[129]	4	13	26	–12.4	No	9/9 (100)	8/8 (100)	15.40 (1.95 to 28.85)
Nguyen 2009[129]	4	26	26	–12.4	No	9/9 (100)	8/8 (100)	3.50 (–10.24 to 17.24)
Brooks 2002[193]	5	13	52	0.5	No	36/37 (97)	48/48 (100)	–2.90 (–6.00 to 0.20)
Brooks 2002[193]	5	26	52	0.5	No	31/37 (84)	45/48 (94)	3.30 (–0.04 to 6.64)
Brooks 2002[193]	5	39	52	0.5	No	18/37 (49)	23/48 (48)	–2.70 (–7.97 to 2.57)
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)
Coultas 2005[112] A	5	26	26	–0.9	No	51/72 (71)	26/37 (70)[b]	2.60 (–4.30 to 9.50)
Coultas 2005[112] B	5	26	26	3.4	No	49/72 (68)	26/37 (70)[b]	2.90 (–4.05 to 9.85)
Coultas 2005[112] C	5	26	26	–4.3	No	51/72 (71)	25/36 (68)[b]	–0.30 (–6.75 to 6.15)
Jarab 2012[266]	5	26	1	0.4	No	63/66 (95)	64/67 (96)	0.80 (–3.84 to 5.44)
Lord 2010[147]	5	7	6	5.8	No	15/20 (75)	13/16 (81)	0.70 (–5.47 to 6.87)
Ringbaek 2000[226]	5	8	8	5.5	No	17/24 (71)	21/21 (100)	–0.10 (–10.00 to 9.80)
Romagnoli 2006[244]	5	4	52	1.0	No	17/17 (100)	18/18 (100)	1.00 (–8.15 to 10.15)
Romagnoli 2006[244]	5	26	52	1.0	No	16/17 (94)	16/18 (89)	2.00 (–6.83 to 10.83)
Romagnoli 2006[244]	5	52	52	1.0	No	14/17 (82)	15/18 (83)	1.00 (–6.48 to 8.48)
Romagnoli 2006[244]	5	56	52	1.0	No	14/17 (82)	15/18 (83)	–1.00 (–5.74 to 3.74)
Bucknall 2012[63]	6	52	52	0.8	Yes	69/232 (30)	53/232 (23)	4.52 (–0.03 to 9.07)
Cai 2006[199]	6	26	26	0.5	No	43/43 (100)	39/39 (100)	10.16 (2.20 to 18.12)
Dheda 2004[73]	6	26	26		No	10/15 (67)	15/18 (83)	15.00 (2.45 to 27.55)
Ko 2011[213]	6	13	8	3.9	No	30/30 (100)	30/30 (100)	6.76 (–2.68 to 16.20)
Ko 2011[213]	6	26	8	3.9	No	30/30 (100)	30/30 (100)	9.14 (–0.74 to 19.02)
Ko 2011[213]	6	52	8	3.9	No	30/30 (100)	30/30 (100)	1.81 (–9.42 to 13.04)
Koff 2009[120]	6	13	13	3.2	No	19/20 (95)	19/20 (95)	9.70 (0.43 to 18.97)
Linneberg 2012[224]	6	13	45	4.8	No	53/59 (90)	58/59 (98)	–0.10 (–4.10 to 3.90)
Linneberg 2012[224]	6	26	45	4.3	No	51/59 (86)	56/59 (95)	–2.90 (–7.05 to 1.25)
Linneberg 2012[224]	6	52	45	3.4	No	49/59 (83)	50/59 (85)	–3.40 (–7.20 to 0.40)
Man 2004[148]	6	13	8	–4.2	No	18/21 (86)	16/21 (76)	12.70 (4.65 to 20.75)
Petersen 2008[225]	6	7	7	–10.0	No	9/9 (100)	10/10 (100)	15.00 (1.14 to 28.86)

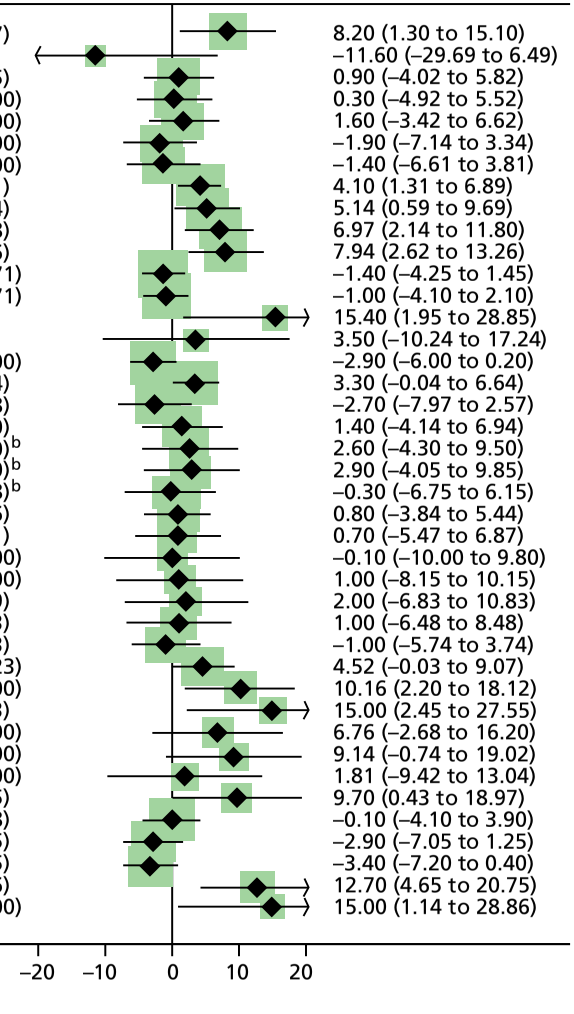
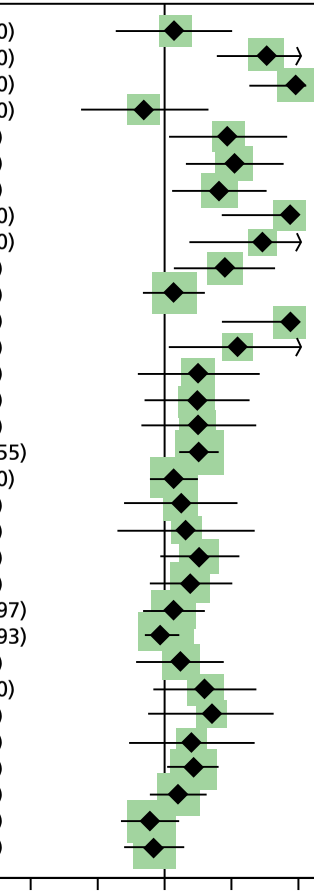


FIGURE 23 (a) Health-related quality of life as measured by the SGRQ at all reported follow-up points for all included studies; and (b) key for figure. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Indicates that the number in the control group has been halved, with half of the group used as control for one comparison (nurse-assisted medical management vs. UC) and half for the other comparison (nurse-assisted collaborative management vs. UC). (*continued*)

(a)

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Elci 2008[236]	7	4	13		No	39/39 (100)	39/39 (100)	1.39 (–7.07 to 9.85)
Elci 2008[236]	7	9	13		No	39/39 (100)	39/39 (100)	15.18 (8.08 to 22.28)
Elci 2008[236]	7	13	13		No	39/39 (100)	39/39 (100)	19.59 (13.03 to 26.15)
Engstrom 1999[219]	7	52	52	3.3	No	26/26 (100)	24/24 (100)	–3.10 (–12.39 to 6.19)
Fernandez 2009[171]	7	52	52	2.8	No	27/30 (90)	14/20 (70)	9.40 (0.95 to 17.85)
Finnerty 2001[143]	7	13	6	0.6	No	32/50 (64)	23/50 (46)	10.40 (3.55 to 17.25)
Finnerty 2001[143]	7	26	6	0.6	No	24/50 (48)	25/50 (50)	8.10 (1.35 to 14.85)
Kayahan 2006[238]	7	9	8	–5.6	No	26/26 (100)	19/19 (100)	18.71 (8.96 to 28.46)
Soler 2006[180]	7	52	52	–10.6	No	13/13 (100)	13/13 (100)	14.60 (3.90 to 25.30)
Boxall 2005[160]	8	12	12	–4.5	No	23/30 (77)	23/30 (77)	8.90 (1.63 to 16.17)
Hermiz 2002[67]	8	13	4	3.0	No	67/84 (80)	80/93 (86)	1.32 (–2.97 to 5.61)
Karapolat 2007[237]	8	8	8	–5.6	No	26/27 (96)	19/22 (86)	18.70 (8.97 to 28.43)
Karapolat 2007[237]	8	12	8	–5.6	No	26/27 (96)	19/22 (86)	10.90 (0.87 to 20.93)
Theander 2009[220]	8	12	12	8.0	No	12/15 (80)	14/15 (93)	5.00 (–3.84 to 13.84)
Wakabayashi 2011[262]	8	26	26	–4.2	No	50/52 (96)	48/50 (96)	4.80 (–2.67 to 12.27)
Wakabayashi 2011[262]	8	52	26	–4.2	No	42/52 (81)	43/50 (86)	5.00 (–3.28 to 13.28)
Rice 2010[140]	9	52	52		No	223/372 (60)	204/371 (55)	5.10 (2.55 to 7.65)
Trappenburg 2011[188]	9	26	17		Yes	86/111 (77)	97/122 (80)	1.30 (–1.85 to 4.45)
Casas 2006[71a]	10	52		–9.3	No	21/44 (48)	41/69 (59)	2.39 (–5.78 to 10.56)
Gallefoss 1999[255]	10	52			No	26/31 (84)	27/31 (87)	3.10 (–6.93 to 13.13)
Khdour 2009[251]	10	26	1	–0.6	No	71/86 (83)	72/87 (83)	5.20 (–0.30 to 10.70)
Khdour 2009[251]	10	52	1	–0.6	No	71/86 (83)	72/87 (83)	3.80 (–1.95 to 9.55)
Monninkhof 2003[186]	10	26	52	–0.9	No	124/127 (98)	117/121 (97)	1.30 (–3.00 to 5.60)
Monninkhof 2003[186]	10	52	52	–0.9	No	122/127 (96)	113/121 (93)	–0.60 (–2.85 to 1.65)
Wittmann 2007[210]	10	52	3	0.8	No	92/94 (98)	88/90 (98)	2.30 (–3.89 to 8.49)
Bestall 2003[141]	11	8	8	–2.0	No	29/29 (100)	27/27 (100)	6.00 (–1.38 to 13.38)
Bestall 2003[141]	11	26	8	–2.0	No	28/29 (97)	24/27 (89)	7.00 (–2.10 to 16.10)
Bestall 2003[141]	11	52	8	–2.0	No	26/29 (90)	21/27 (78)	4.00 (–5.05 to 13.05)
Bourbeau 2003[192]	12	17	8	–1.6	No	88/96 (92)	84/95 (88)	4.20 (0.70 to 7.70)
Bourbeau 2003[192]	12	52	8	–1.6	No	81/96 (84)	76/95 (80)	2.00 (–1.85 to 5.85)
Wood-Baker 2006[170]	12	26	1	–0.8	No	61/67 (91)	62/72 (86)	–2.30 (–6.19 to 1.59)
Wood-Baker 2006[170]	12	52	1	–0.8	No	54/67 (81)	58/72 (81)	–1.70 (–5.83 to 2.43)

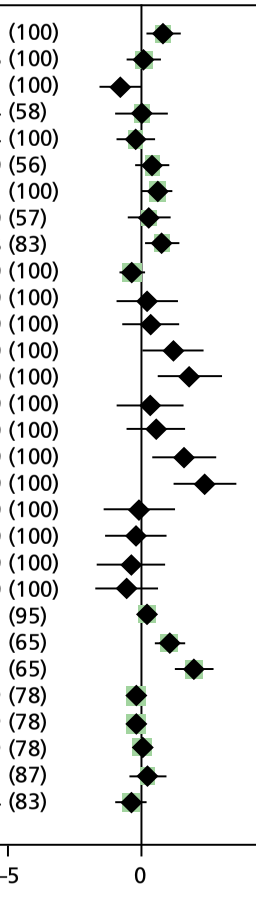


(b)

	A	B	C
Bauldoff 2005[109]	Moderate distractive auditory stimulation with music (DAS) vs. control	Slow DAS vs. control	Moderate DAS vs. slow DAS
Dourado 2009[233]	Strength training and low-intensity general training vs. strength training	Strength training and low-intensity general training vs. low-intensity general training	Low-intensity general training vs. strength training
Vonbank 2012[246]	Strength and endurance training vs. strength training	Strength and endurance training vs. endurance training	Endurance training vs. strength training
Chan 2010[212]	t'ai chi qigong vs. control	Exercise vs. control	t'ai chi qigong vs. exercise
Coultas 2005[112]	Nurse-assisted collaborative management vs. usual care	Nurse-assisted medical management vs. usual care	Nurse-assisted collaborative management vs. nurse-assisted medical management

FIGURE 23 (a) Health-related quality of life as measured by the SGRQ at all reported follow-up points for all included studies; and (b) key for figure. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Indicates that the number in the control group has been halved, with half of the group used as control for one comparison (nurse-assisted medical management vs. UC) and half for the other comparison (nurse-assisted collaborative management vs. UC).

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Hill 2006[163]	1	8	8	0.4	No	16/18 (89)	17/17 (100)	0.80 (0.25 to 1.35)
Koppers 2006[184]	1	5	5	–0.2	No	18/18 (100)	18/18 (100)	0.08 (–0.47 to 0.63)
Rooyackers 2003[187]	1	10	10	–0.9	No	12/12 (100)	12/12 (100)	–0.80 (–1.50 to –0.10)
Spruit 2002[247]	1	12	12	0.2	No	16/24 (67)	14/24 (58)	0.00 (–0.90 to 0.90)
Sívori 1998[263]	1	8	8	–0.6	No	14/14 (100)	14/14 (100)	–0.21 (–0.85 to 0.42)
Troosters 2000[248]	1	26	26	–0.3	No	34/50 (68)	28/50 (56)	0.40 (–0.15 to 0.95)
Green 2001[144]	2	7	7	0.5	No	21/21 (100)	23/23 (100)	0.61 (0.15 to 1.07)
Hernandez 2000[282]	2	12	12	–0.4	No	20/30 (67)	17/30 (57)	0.26 (–0.46 to 0.98)
Leung 2010[165]	2	8	8	0.6	No	17/18 (94)	15/18 (83)	0.75 (0.20 to 1.30)
Normandin 2002[131]	2	8	8	0.4	No	20/20 (100)	20/20 (100)	–0.37 (–0.77 to 0.04)
Xu 2010[204] B	2	4	52	–0.1	No	20/20 (100)	20/20 (100)	0.21 (–0.85 to 1.27)
Xu 2010[204] B	2	13	52	–0.1	No	20/20 (100)	20/20 (100)	0.32 (–0.65 to 1.29)
Xu 2010[204] B	2	26	52	–0.1	No	20/20 (100)	20/20 (100)	1.18 (0.14 to 2.22)
Xu 2010[204] B	2	52	52	–0.1	No	20/20 (100)	20/20 (100)	1.78 (0.66 to 2.90)
Xu 2010[204] C	2	4	52	–0.1	No	20/20 (100)	20/20 (100)	0.31 (–0.85 to 1.47)
Xu 2010[204] C	2	13	52	–0.1	No	20/20 (100)	20/20 (100)	0.54 (–0.49 to 1.57)
Xu 2010[204] C	2	26	52	–0.1	No	20/20 (100)	20/20 (100)	1.58 (0.47 to 2.69)
Xu 2010[204] C	2	52	52	–0.1	No	20/20 (100)	20/20 (100)	2.34 (1.23 to 3.45)
Xu 2010[204] F	2	4	52	0.0	No	20/20 (100)	20/20 (100)	–0.10 (–1.34 to 1.14)
Xu 2010[204] F	2	13	52	0.0	No	20/20 (100)	20/20 (100)	–0.22 (–1.28 to 0.84)
Xu 2010[204] F	2	26	52	0.0	No	20/20 (100)	20/20 (100)	–0.40 (–1.60 to 0.80)
Xu 2010[204] F	2	52	52	0.0	No	20/20 (100)	20/20 (100)	–0.56 (–1.64 to 0.52)
van Gestel 2012[208]	2	4	4		No	20/22 (91)	20/21 (95)	0.17 (–0.09 to 0.43)
Behnke 2000[64]	3	13	26	0.1	No	15/23 (65)	15/23 (65)	1.05 (0.56 to 1.54)
Behnke 2000[64]	3	26	26	0.1	No	15/23 (65)	15/23 (65)	1.95 (1.33 to 2.57)
Berry 2010[110]	3	13	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Berry 2010[110]	3	26	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Berry 2010[110]	3	52	48		No	61/87 (70)	69/89 (78)	0.00 (–0.28 to 0.28)
Mador 2009[124]	3	8	8	0.1	No	21/25 (84)	20/23 (87)	0.21 (–0.39 to 0.81)
Puente-Maestu 2000[177]	3	8	8	–0.2	No	21/25 (84)	20/24 (83)	–0.40 (–0.91 to 0.12)



Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Xu 2010[204] A	3	4	52	–0.1	No	20/20 (100)	20/20 (100)	0.60 (–0.46 to 1.66)
Xu 2010[204] A	3	13	52	–0.1	No	20/20 (100)	20/20 (100)	1.17 (0.13 to 2.21)
Xu 2010[204] A	3	26	52	–0.1	No	20/20 (100)	20/20 (100)	2.48 (1.42 to 3.54)
Xu 2010[204] A	3	52	52	–0.1	No	20/20 (100)	20/20 (100)	3.73 (2.76 to 4.70)
Xu 2010[204] D	3	4	52	–0.0	No	20/20 (100)	20/20 (100)	0.39(–0.76 to 1.54)
Xu 2010[204] D	3	13	52	–0.0	No	20/20 (100)	20/20 (100)	0.85 (–0.22 to 1.92)
Xu 2010[204] D	3	26	52	–0.0	No	20/20 (100)	20/20 (100)	1.30 (0.14 to 2.46)
Xu 2010[204] D	3	52	52	–0.0	No	20/20 (100)	20/20 (100)	1.95 (1.01 to 2.89)
Xu 2010[204] E	3	4	52		No	20/20 (100)	20/20 (100)	0.29 (–0.95 to 1.53)
Xu 2010[204] E	3	13	52		No	20/20 (100)	20/20 (100)	0.63 (–0.49 to 1.75)
Xu 2010[204] E	3	26	52		No	20/20 (100)	20/20 (100)	0.90 (–0.32 to 2.12)
Xu 2010[204] E	3	52	52		No	20/20 (100)	20/20 (100)	1.39 (0.46 to 2.32)
Janaudis-Ferreira 2011[197]	4	6	6	–0.4	No	13/17 (76)	18/19 (95)	0.10 (–0.36 to 0.56)
Puhan 2006[257]	4	5	5	–0.2	No	44/49 (90)	46/51 (90)	–0.08 (–0.42 to 0.26)
Nguyen 2008[128]	6	13	26	–0.4	No	19/24 (79)	19/26 (73)	–0.47 (–1.09 to 0.15)
Nguyen 2008[128]	6	26	26	–0.4	No	20/24 (83)	18/26 (69)	–0.27 (–0.90 to 0.36)
Waterhouse 2010[277]	6	6	6		No	87/129 (67)	71/111 (64)	0.00 (–0.33 to 0.33)
Waterhouse 2010[277]	6	26	6		No	87/129 (67)	70/111 (63)	0.50 (–0.86 to 1.86)
Waterhouse 2010[277]	6	52	6		No	86/129 (67)	63/111 (57)	–0.20 (–1.60 to 1.20)
Waterhouse 2010[277]	6	78	6		Yes	84/129 (65)	66/111 (59)	–0.02 (–0.94 to 0.90)
Vogiatzis 2002[265]	7	13	12		No	18/22 (82)	18/23 (78)	–0.21 (–0.43 to 0.01)
du Moulin 2009[206]	7	13	3	0.4	No	10/10 (100)	10/10 (100)	0.80 (0.16 to 1.44)
du Moulin 2009[206]	7	26	3	0.4	No	10/10 (100)	10/10 (100)	1.10 (0.39 to 1.81)
Sridhar 2008[155]	8	104	104	0.3	No	47/61 (77)	40/61 (66)	2.04 (0.37 to 3.71)
Bendstrup 1997[222]	9	6	12	0.2	No	16/22 (73)	16/20 (80)	0.34 (–0.14 to 0.82)
Bendstrup 1997[222]	9	12	12	0.2	No	16/22 (73)	16/20 (80)	0.40 (–0.11 to 0.91)
Bendstrup 1997[222]	9	24	12	0.2	No	16/22 (73)	16/20 (80)	0.85 (0.19 to 1.50)
White 2002[159]	9	13	6	–0.1	No	45/54 (83)	43/49 (88)	0.17 (–0.10 to 0.44)
Bestall 2003[141]	11	8	8	–0.3	No	29/29 (100)	27/27 (100)	0.20 (–0.28 to 0.68)
Bestall 2003[141]	11	26	8	–0.3	No	28/29 (97)	24/27 (89)	0.30 (–0.29 to 0.89)
Bestall 2003[141]	11	52	8	–0.3	No	26/29 (90)	21/27 (78)	0.10 (–0.50 to 0.70)
Oh 2003[283]	11	8	8	–0.4	No	15/19 (79)	8/15 (53)	0.61 (–0.18 to 1.41)

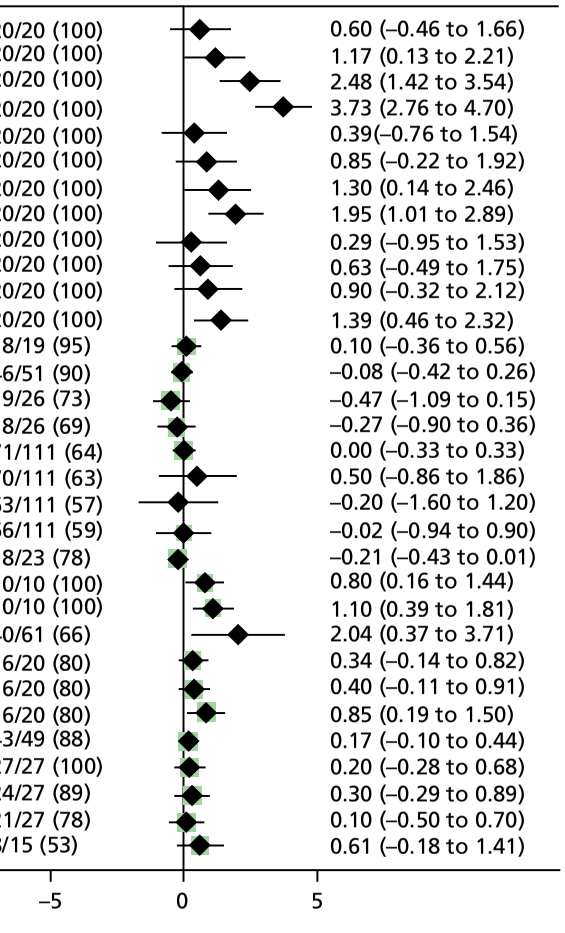


FIGURE 24 Health-related quality of life as measured by the CRQ at all reported follow-up points for all included studies. A = rehabilitation (traditional and modern) + qigong + breathing training + limb training vs. UC. B = modern rehabilitation + breathing training + limb training vs. UC. C = traditional rehabilitation + qigong vs. UC. D = rehab (traditional and modern) + qigong + breathing training + limb training vs. modern rehabilitation + breathing training + limb training. E = rehab (traditional and modern) + qigong + breathing training + limb training vs. traditional rehabilitation + qigong. F = rehab (traditional and modern) + qigong + breathing training + limb training vs. traditional rehabilitation + qigong.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Beckerman 2005[253]	1	52	52	No	21	11	21	13	0.77 (0.34 to 1.72)
Spruit 2002[247]	1	12	12	No	24	5	24	7	0.68 (0.22 to 2.13)
McGeoch 2006[229]	2	52	1	No	84	7	70	6	0.97 (0.33 to 2.89)
Behnke 2000[64a]	3	78	78	No	14	3	12	9	0.17 (0.05 to 0.64
Chan 2010[212a] B	3	13	13	No	69	3	67	3	0.97 (0.20 to 4.81)
Cockcroft 1987[142]	3			No	42	25	33	17	1.25 (0.67 to 2.31)
Seymour 2010[154]	3	13	8	No	30	2	30	10	0.17 (0.04 to 0.78)
Chan 2010[212a] A	4	13	13	No	70	4	67	3	1.28 (0.29 to 5.74)
Chan 2010[212a] C	4	13	13	No	70	4	69	3	1.32 (0.30 to 5.91)
Jarab 2012[266]	5	26	1	No	66	3	67	11	0.26 (0.07 to 0.93)
Littlejohns 1991[146]	5	52	52	No	68	12	65	14	0.80 (0.37 to 1.73)
Liu 2008[260]	5	52	52	No	24	2	24	8	0.21 (0.05 to 1.01)
Bucknall 2012[63]	6	52	52	Yes	232	88	232	92	0.94 (0.70 to 1.27)
Dheda 2004[73]	6	26	26	No	10	2	15	9	0.24 (0.05 to 1.15)
Ko 2011[213]	6	52	8	No	30	16	30	13	1.03 (0.62 to 1.73)
Koff 2009[120]	6	13	13	No	20	1	20	3	0.32 (0.03 to 3.03)
Man 2004[148]	6	13	8	Yes					0.66 (0.30 to 1.48)
Rea 2004[230]	7	52	52	No	83	29	52	26	0.62 (0.37 to 1.05)
Smith 1999[168]	7	52	52	No	48	34	48	28	1.56 (0.79 to 3.09)
Boxall 2005[160]	8	13	12	No	23	5	23	5	1.00 (0.29 to 3.45)
Boxall 2005[160]	8	26	12	No	23	11	23	16	0.55 (0.25 to 1.18)
Hermiz 2002[67]	8	13	4	No	67	16	80	14	1.42 (0.69 to 2.91)
Kwok 2004[70]	8	4	26	No	70	33	79	29	1.39 (0.85 to 2.30)
Kwok 2004[70]	8	26	26	No	70	53	79	49	1.46 (0.99 to 2.16)
Sridhar 2008[155]	8	104	104	No	55	29	49	24	1.11 (0.65 to 1.91)
Aimonino Ricauda 2008[75]	9	26	2	No	52	17	52	34	0.37 (0.21 to 0.67)
Rice 2010[140]	9	52	52	Yes	372		371		0.72 (0.55 to 0.95)
Casas 2006[71]	10	52		Yes	65	29	90	60	0.55 (0.35 to 0.87)
Hernandez 2003[68]	10	8	8	No	121	23	101	26	0.71 (0.40 to 1.24)
Wittmann 2007[210]	10	52	3	No	94	9	90	10	0.85 (0.35 to 2.10)
Eaton 2009[227]	11	13	8	No	47	36	50	34	0.78 (0.49 to 1.25)
Bourbeau 2003[192]	12	52	8	No	96	31	95	48	0.55 (0.35 to 0.87)

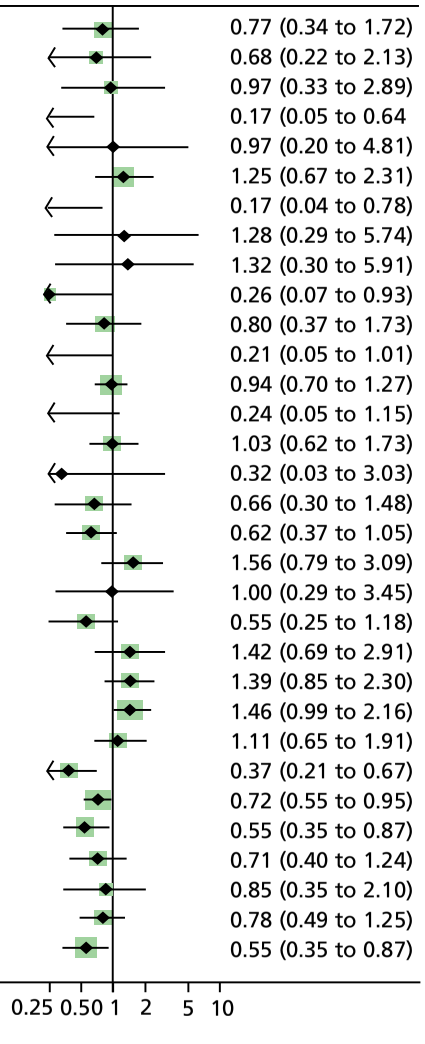


FIGURE 25 Hospital admissions at all reported follow-up points for all included studies. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Murphy 2005[252]	1	13	6	No	13	0	13	3	0.02 (0.00 to 28.17)
Murphy 2005[252]	1	26	6	No	13	2	13	5	0.34 (0.07 to 1.77)
Seymour 2010[154]	3	13	8	No	30	8	30	17	0.37 (0.16 to 0.86)
Hoogendoorn 2009[182a]	4	17	104	No	87		88		1.01 (0.57 to 1.79)
Hoogendoorn 2009[182a]	4	104	104	Yes	87		88		1.29 (0.89 to 1.87)
Dheda 2004[73]	6	26	26	No	10	2	15	3	1.00 (0.17 to 5.98)
Ko 2011[213]	6	52	8	No	30	11	30	10	0.91 (0.61 to 1.35)
du Moulin 2009[206]	7	26	3	No	10	0	10	1	0.09 (0.00 to 55.93)
Moore 2009[284]	8	6	6	No	14	3	13	1	3.01 (0.31 to 28.96)
Sridhar 2008[155]	8	104	104	No	61	53	61	53	1.00 (0.68 to 1.46)
Trappenburg 2011[188]	9	26	17	No	103	55	113	56	1.12 (0.77 to 1.62)

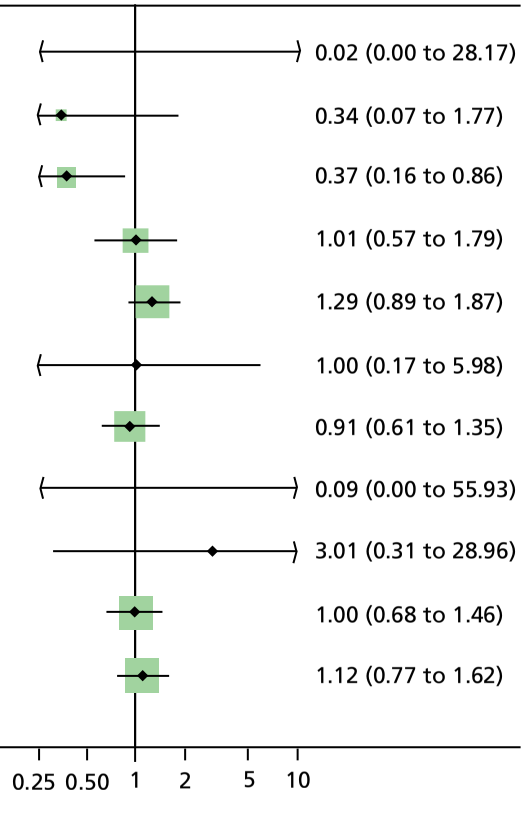


FIGURE 26 Exacerbations at all reported follow-up points for all included studies. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

Multicomponent interventions compared with usual care

Health-related quality of life

Multicomponent interventions were defined as those with three or more components. Forty-one trials reporting 44 interventions compared with UC reported usable total SGRQ or CRQ results; 31 trials reported hospital admissions, of which 18 could be used in meta-analysis; and 12 trials reported exacerbations of which three could be used in the meta-analysis (see *Appendix 25*).

The meta-analysis findings are reported for three time periods: up to and including 3 months, greater than 3 months but up to 6 months (hereafter described as 3–6 months) and greater than 6 months.

For SGRQ followed up to 3 months, most trials reported a greater improvement from baseline to follow-up in favour of the intervention group.[68,121,142,144,148,149,161,186,194,213,214,221,226,227,237–239,257] The summary meta-analysis result reveals that on average the multicomponent arm had a SGRQ score of 6.50 points (95% CI 3.62 to 9.39 points) higher than the UC arm. However, this is the average of a distribution of trial effects and this distribution is wide due to high heterogeneity ($I^2 = 82.4\%$). The prediction interval reports the range in which 95% of the distribution of the effects lies. The majority of the interval is > 0 and thus mainly in favour of multicomponent interventions; however, it does overlap zero (95% CI –4.66 to 17.67) indicating that the interventions are not always effective. At the longer follow-up point of 3–6 months, the estimate of the average effect was 4.47 points on the SGRQ (95% CI 1.93 to 7.02 points; $I^2 = 79.6\%$) and at > 6 months it was 2.40 points (95% CI 0.75 to 4.04 points; $I^2 = 57.9\%$), both favouring the intervention group. There is some suggestion that the size of the effect was smaller as follow-up was longer, but loss to follow-up was also a more significant problem at the longest follow-up point, which may have biased the effect estimate. The upper boundary of the prediction intervals also lowers with the longer follow-up time.

There were fewer trials reporting the CRQ. At all three time points the estimate of the average effect was in favour of the intervention group, suggesting that, on average, multicomponent SM interventions were more effective than UC at up to 6 months' follow-up. However, heterogeneity was high and the prediction intervals at all three time points included zero. The results for HRQoL are summarised in *Figures 27* and *28* and *Table 51*.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Chan 2010[212] B	3	13	13	–2.4	No	69/69 (100)	6767 (100)	3.00 (–2.20 to 8.20)
Hynninen 2010[256]	3	9	7	–4.4	No	25/25 (100)	26/26 (100)	0.30 (–0.25 to 0.85)
Lamers 2010[185]	4	13	13	–1.9	No	38/96 (40)	44/91 (48)	6.97 (2.14 to 11.80)
Brooks 2002[193]	5	13	52	0.5	No	36/37 (97)	48/48 (100)	–2.90 (–6.00 to 0.20)
Lord 2010[147]	5	7	6	5.8	No	15/20 (75)	13/16 (81)	0.70 (–5.47 to 6.87)
Ringbaek 2000[226]	5	8	8	5.5	No	17/24 (71)	21/21 (100)	–0.10 (–10.00 to 9.80)
Ko 2011[213]	6	13	8	3.9	No	30/30 (100)	30/30 (100)	6.76 (–2.68 to 16.20)
Koff 2009[120]	6	13	13	3.2	No	19/20 (95)	19/20 (95)	9.70 (0.43 to 18.97)
Man 2004[148]	6	13	8	–4.2	No	18/21 (86)	16/21 (76)	12.70 (4.65 to 20.75)
Petersen 2008[225]	6	7	7	–10.0	No	9/9 (100)	10/10 (100)	15.00 (1.14 to 28.86)
Elci 2008[236]	7	13	13		No	39/39 (100)	39/39 (100)	19.59 (13.03 to 26.15)
Finnerty 2001[143]	7	13	6	0.6	No	32/50 (64)	23/50 (46)	10.40 (3.55 to 17.25)
Kayahan 2006[238]	7	9	8	–5.6	No	26/26 (100)	19/19 (100)	18.71 (8.96 to 28.46)
Boxall 2005[160]	8	12	12	–4.5	No	23/30 (77)	23/30 (77)	8.90 (1.63 to 16.17)
Hermiz 2002[67]	8	13	4	3.0	No	67/84 (80)	80/93 (86)	1.32 (–2.97 to 5.61)
Karapolat 2007[237]	8	12	8	–5.6	No	26/27 (96)	19/22 (86)	10.90 (0.87 to 20.83)
Theander 2009[220]	8	12	12	8.0	No	12/15 (80)	14/15 (93)	5.00 (–3.84 to 13.84)
Bestall 2003[141]	11	8	8	–2.0	No	29/29 (100)	27/27 (100)	6.00 (–1.38 to 13.38)
Total (I^2=82.4%, p<0.001)								6.50 (3.62 to 9.39)

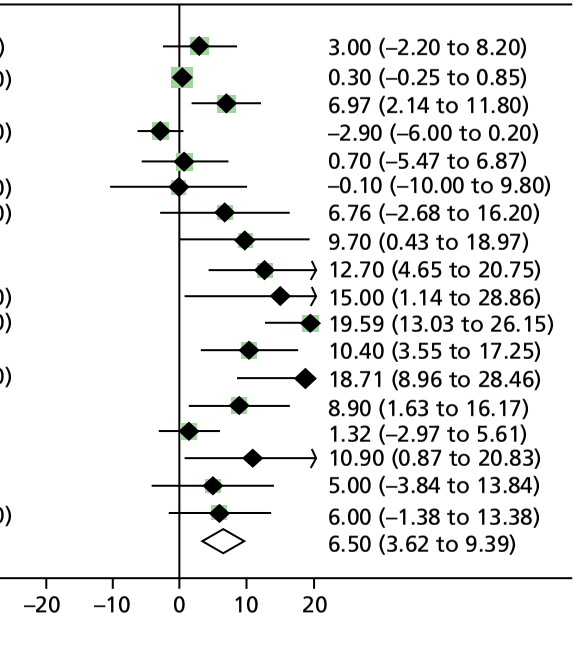


FIGURE 27 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM intervention vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Number in the control group has been halved with half of the group used as control for one comparison (nurse-assisted medical management vs. UC) and half for the other comparison (nurse-assisted collaborative management vs. UC). Chan 2010[212] B = exercise vs. control; Coultas 2005[112] A = nurse-assisted collaborative management vs. UC; Coultas 2005[112] B = nurse-assisted medical management vs. UC. (*continued*)

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 26 weeks or less but over 13 weeks								
Barakat 2008[249]	3	14	14	1.1	No	35/40 (88)	36/40 (90)	9.70 (8.46 to 10.94)
Hoogendoorn 2009[182a]	4	17	104	1.0	Yes	87/102 (85)	88/97 (91)	4.10 (1.31 to 6.89)
Brooks 2002[193]	5	26	52	0.5	No	31/37 (84)	45/48 (94)	3.30 (–0.04 to 6.64)
Coultas 2005[112] A	5	26	26	–0.9	No	51/72 (71)	26/37 (70)[b]	2.60 (–5.85 to 11.05)
Coultas 2005[112] B	5	26	26	3.4	No	49/72 (68)	26/37 (70)[b]	2.90 (–5.58 to 11.38)
Jarab 2012[266]	5	26	1	0.4	No	63/66 (95)	64/67 (96)	0.80 (–3.84 to 5.44)
Dheda 2004[73]	6	26	26		No	10/15 (67)	15/18 (83)	15.00 (2.45 to 27.55)
Ko 2011[213]	6	26	8	3.9	No	30/30 (100)	30/30 (100)	9.14 (–0.74 to 19.02)
Finnerty 2001[143]	7	26	6	0.6	No	24/50 (48)	25/50 (50)	8.10 (1.35 to 14.85)
Wakabayashi 2011[262]	8	26	26	–4.2	No	50/52 (96)	48/50 (96)	4.80 (–2.67 to 12.27)
Khdour 2009[251]	10	26	1	–0.6	No	71/86 (83)	72/87 (83)	5.20 (–0.30 to 10.70)
Monninkhof 2003[186]	10	26	52	–0.9	No	124/127 (98)	117/121 (97)	1.30 (–3.00 to 5.60)
Bestall 2003[141]	11	26	8	–2.0	No	28/29 (97)	24/27 (89)	7.00 (–2.10 to 16.10)
Bourbeau 2003[192]	12	17	8	–1.6	No	88/96 (92)	84/95 (88)	4.20 (0.70 to 7.70)
Wood-Baker 2006[170]	12	26	1	–0.8	No	61/67 (91)	62/72 (86)	–2.30 (–6.19 to 1.59)
Total (I^2=79.6%, p<0.001)								4.47 (1.93 to 7.02)

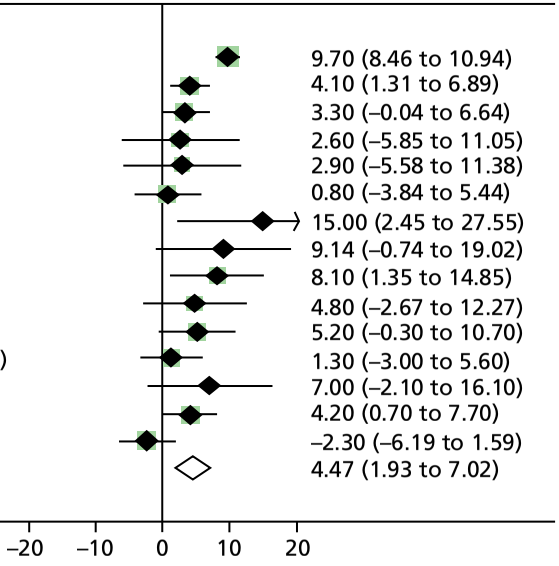


FIGURE 27 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM intervention vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Number in the control group has been halved with half of the group used as control for one comparison (nurse-assisted medical management vs. UC) and half for the other comparison (nurse-assisted collaborative management vs. UC). Chan 2010[212] B = exercise vs. control; Coultas 2005[112] A = nurse-assisted collaborative management vs. UC; Coultas 2005[112] B = nurse-assisted medical management vs. UC. (*continued*)

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up over 26 weeks								
Hynninen 2010[256]	3	35	7	–4.4	No	25/25 (100)	26/26 (100)	0.40 (–0.15 to 0.95)
Lamers 2010[185]	4	39	13	–1.9	No	42/96 (44)	42/91 (46)	7.94 (2.62 to 13.26)
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)
Bucknall 2012[63]	6	52	52	0.8	Yes	69/232 (30)	53/232 (23)	4.52 (–0.03 to 9.07)
Ko 2011[213]	6	52	8	3.9	No	30/30 (100)	30/30 (100)	1.81 (–9.42 to 13.04)
Engstrom 1999[219]	7	52	52	3.3	No	26/26 (100)	24/24 (100)	–3.10 (–12.39 to 6.19)
Soler 2006[180]	7	52	52	–10.6	No	13/13 (100)	13/13 (100)	14.60 (3.90 to 25.30)
Wakabayashi 2011[262]	8	52	26	–4.2	No	42/52 (81)	43/50 (86)	5.00 (–3.28 to 13.28)
Rice 2010[140]	9	52	52		No	223/372 (60)	204/371 (55)	5.10 (2.55 to 7.65)
Casas 2006[71a]	10	52		–9.3	No	21/44 (48)	41/69 (59)	2.39 (–5.78 to 10.56)
Gallefoss 1999[255]	10	52			No	26/31 (84)	27/31 (87)	3.10 (–6.93 to 13.13)
Khdour 2009[251]	10	52	1	–0.6	No	71/86 (83)	72/87 (83)	3.80 (–1.95 to 9.55)
Monninkhof 2003[186]	10	52	52	–0.9	No	122/127 (96)	113/121 (93)	–0.60 (–2.85 to 1.65)
Bestall 2003[141]	11	52	8	–2.0	No	26/29 (90)	21/27 (78)	4.00 (–5.05 to 13.05)
Bourbeau 2003[192]	12	52	8	–1.6	No	81/96 (84)	76/95 (80)	2.00 (–1.85 to 5.85)
Wood-Baker 2006[170]	12	52	1	–0.8	No	54/67 (81)	58/72 (81)	–1.70 (–5.83 to 2.43)
Total (I^2=57.9%, p=0.002)								2.40 (0.75 to 4.04)

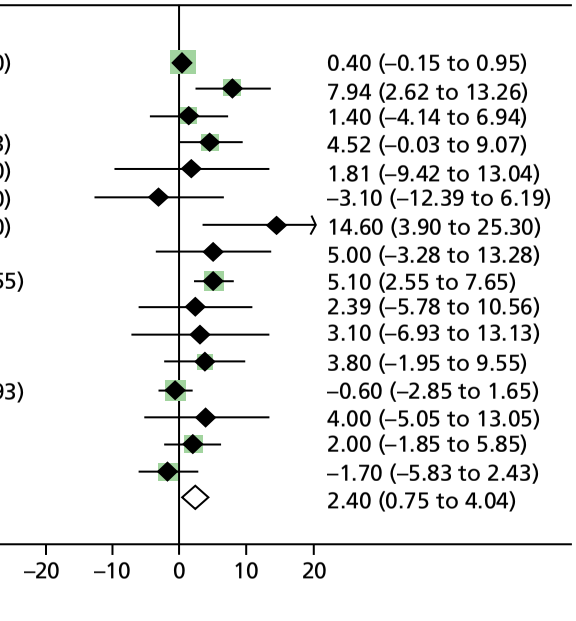


FIGURE 27 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM intervention vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Number in the control group has been halved with half of the group used as control for one comparison (nurse-assisted medical management vs. UC) and half for the other comparison (nurse-assisted collaborative management vs. UC). Chan 2010[212] B = exercise vs. control; Coultas 2005[112] A = nurse-assisted collaborative management vs. UC; Coultas 2005[112] B = nurse-assisted medical management vs. UC.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Behnke 2000[64]	3	13	26	0.1	No	15/23 (65)	15/23 (65)	1.05 (0.56 to 1.54)
Berry 2010[110]	3	13	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Xu 2010[204] A	3	13	52	–0.1	No	20/20 (100)	20/20 (100)	1.17 (0.13 to 2.21)
Janaudis-Ferreira 2011[197]	4	6	6	–0.4	No	13/17 (76)	18/19 (95)	0.10 (–0.36 to 0.56)
Bendstrup 1997[222]	9	12	12	0.2	No	16/22 (73)	16/20 (80)	0.40 (–0.11 to 0.91)
Bestall 2003[141]	11	8	8	–0.3	No	29/29 (100)	27/27 (100)	0.20 (–0.28 to 0.68)
Oh 2003[283]	11	8	8	–0.4	No	15/19 (79)	8/15 (53)	0.61 (–0.18 to 1.41)
Total (I^2=75.7%, p<0.001)								0.40 (0.01 to 0.79)
Follow-up 26 weeks or less but over 13 weeks								
Behnke 2000[64]	3	26	26	0.1	No	15/23 (65)	15/23 (65)	1.95 (1.33 to 2.57)
Berry 2010[110]	3	26	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Xu 2010[204] A	3	26	52	–0.1	No	20/20 (100)	20/20 (100)	2.48 (1.42 to 3.54)
Bendstrup 1997[222]	9	24	12	0.2	No	16/22 (73)	16/20 (80)	0.85 (0.19 to 1.50)
Bestall 2003[141]	11	26	8	–0.3	No	28/29 (97)	24/27 (89)	0.30 (–0.29 to 0.89)
Total (I^2=93.2%, p<0.001)								1.02 (0.05 to 1.98)
Follow-up over 26 weeks								
Berry 2010[110]	3	52	48		No	61/87 (70)	69/89 (78)	0.00 (–0.28 to 0.28)
Xu 2010[204] A	3	52	52	–0.1	No	20/20 (100)	20/20 (100)	3.73 (2.76 to 4.70)
Bestall 2003[141]	11	52	8	–0.3	No	26/29 (90)	21/27 (78)	0.10 (–0.50 to 0.70)
Total (I^2=96.2%, p<0.001)								1.21 (–0.47 to 2.88)

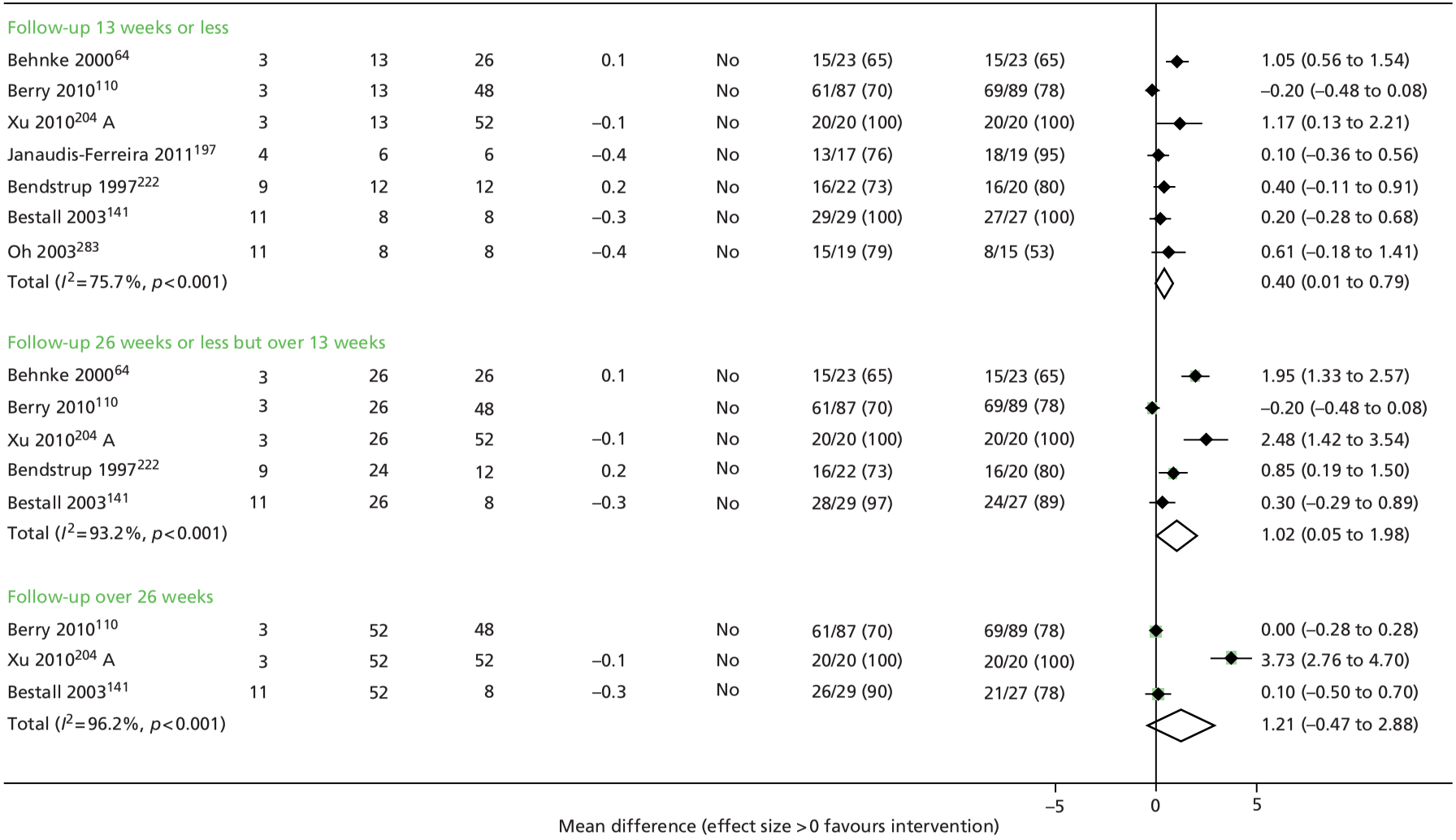


FIGURE 28 Health-related quality-of-life (CRQ) outcomes for multicomponent SM intervention vs. UC. Xu 2010[204] A = rehabilitation (traditional and modern) + qigong + breathing training + limb training vs. UC.

TABLE 51 Health-related quality-of-life outcomes for multicomponent interventions vs. UC

Outcome	Time frame	No. of studies (comparisons)	Summary MD (95% CI)	I^2 (%)	95% prediction interval
SGRQ	≤ 3 months	18	6.50 (3.62 to 9.39)	82.4	–4.66 to 17.67
	> 3 to ≤ 6 months	14 (15)	4.47 (1.93 to 7.02)	79.6	–4.71 to 13.65
	> 6 months	16	2.40 (0.75 to 4.04)	57.9	–2.38 to 7.17
CRQ	≤ 3 months	7	0.40 (0.01 to 0.79)	75.7	–0.84 to 1.64
	> 3 to ≤ 6 months	5	1.02 (0.05 to 1.98)	93.2	–2.66 to 4.70
	> 6 months	3	1.21 (–0.47 to 2.88)	96.2	

Hospital admissions

The results of 18 studies[63,65,67,68,70,71,73,120,140,142,148,160,168,212,213,227,266,270] of multicomponent interventions compared with UC which reported hospital admissions have been analysed; eight with follow-up at ≤ 3 months,[67,68,70,120,148,160,212,227] four with follow-up to 6 months;[70,73,160,266] and eight with follow-up at ≥ 1 year.[63,65,71,140,142,168,213,270] Although the summary HRs from meta-analysis favoured the intervention groups at all three follow-up periods, there was much uncertainty leading to only weak statistical evidence of an effect and heterogeneity was high at follow-up times of > 3 months. Details are given in *Figure 29* and *Table 52*.

Exacerbations

Exacerbations were reported in an analysable format by only four studies.[73,182,213,284] The multicomponent interventions had no evident effect – details in *Figure 30* and *Table 52*. At the last follow-up point, only 2 of 12 studies that reported exacerbations reported a statistically significant effect in favour of the multicomponent SM intervention.[140,172]

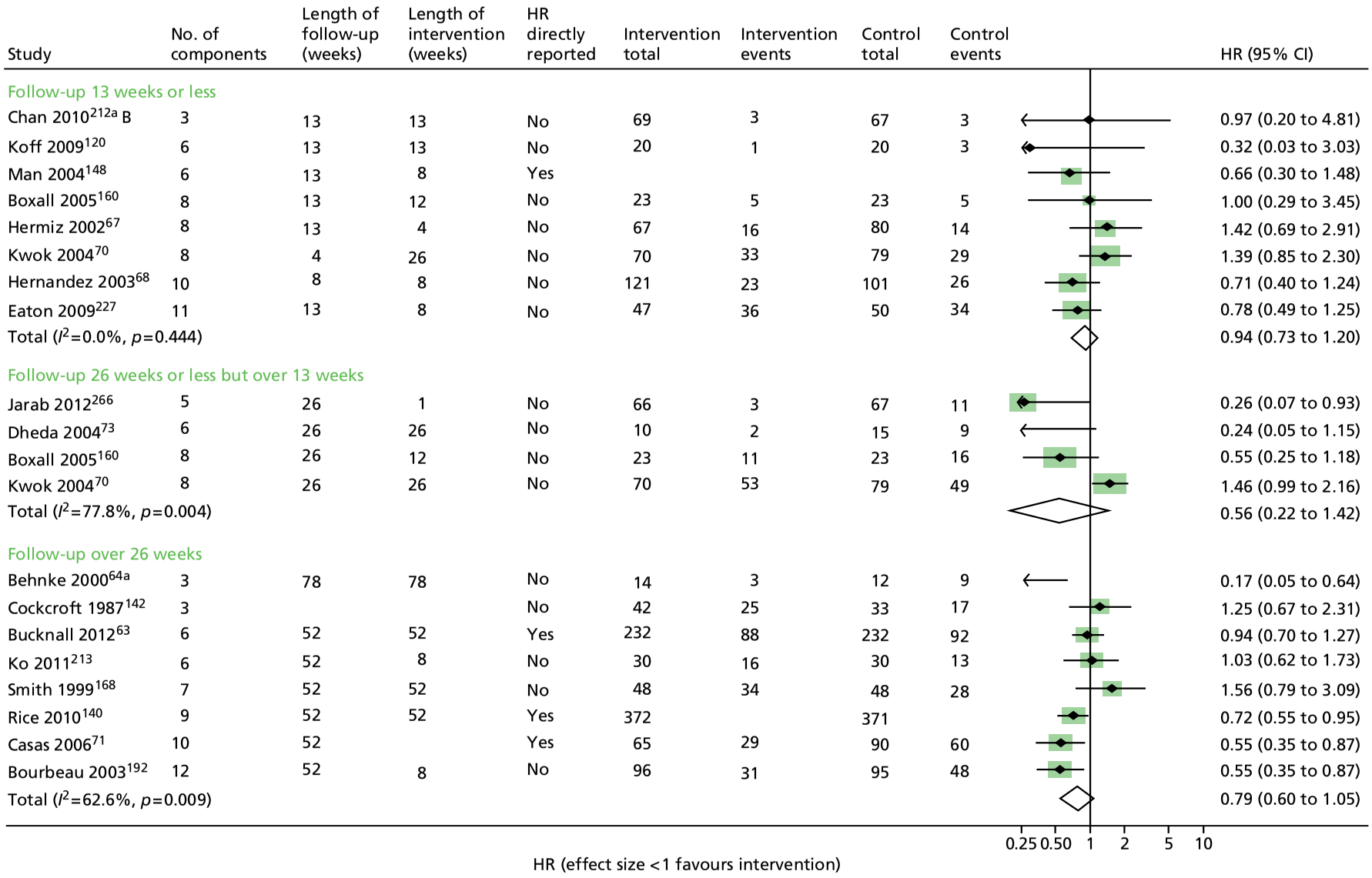


FIGURE 29 Hospital admissions for multicomponent SM interventions vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. Chan 2010[212] B = exercise vs. control.

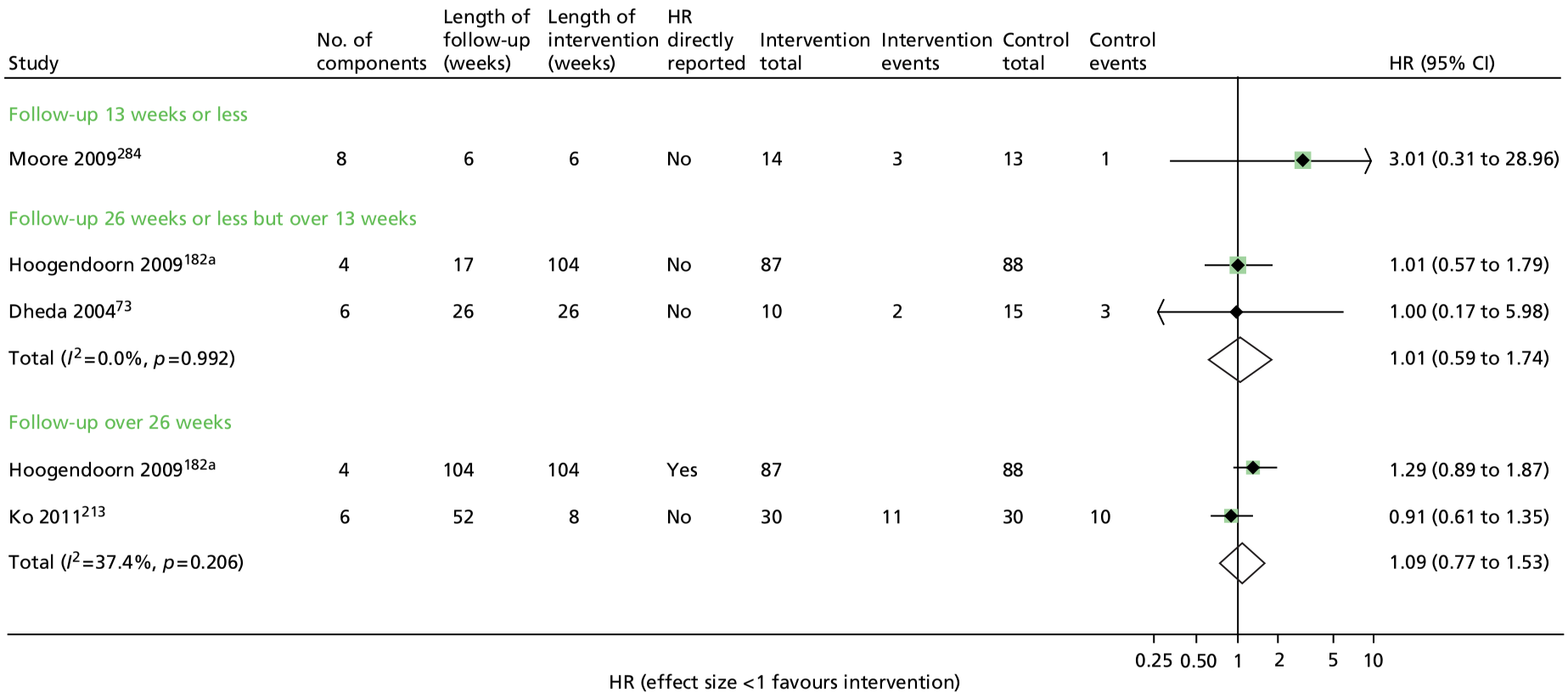


FIGURE 30 Exacerbations for multicomponent SM interventions vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

TABLE 52 Multicomponent interventions vs. UC: hospital admissions and exacerbations

Outcome	Time frame	No. of studies	Summary HR (95% CI)	I^2 (%)	95% prediction interval
Admissions	≤ 3 months	8	0.94 (0.73 to 1.20)	0.0	0.69 to 1.28
	> 3 to ≤ 6 months	4	0.56 (0.22 to 1.42)	77.8	–
	> 6 months	8	0.79 (0.60 to 1.05)	62.6	0.36 to 1.77
Exacerbations	≤ 3 months	1	3.01 (0.31 to 28.96)	n/a	–
	> 3 to ≤ 6 months	2	1.01 (0.59 to 1.74)	0.0	–
	> 6 months	2	1.09 (0.77 to 1.53)	37.4	–

n/a, not applicable.

Summary: multicomponent interventions

Evidence of effectiveness of multicomponent interventions on HRQoL, but considerable uncertainty for hospital admissions and exacerbations.

Exploring specific individual components of self-management interventions

We aimed to explore the effectiveness of specific individual components of SM interventions by examining the trials for which there was a difference in one component between intervention and control arms.

Action plans

Four trials[170,188,229,231] reported the addition of an action plan to a SM package. There was no difference in the average effect on HRQoL of the arms including action plans compared with the comparator groups (SGRQ 0.43, 95% CI –1.69 to 2.54; $I^2 = 0\%$) (*Figure 31*).

McGeoch *et al.*[229] further undertook 1-year follow-up of people who were given an action plan and reported no effect on hospital admissions (HR 0.97, 95% CI 0.33 to 2.89) (*Figure 32*). At 6 months' follow-up, a large trial by Trappenburg *et al.*[188] found no additional effect of action plans on exacerbations (HR 1.12, 95% CI 0.77 to 1.62) (*Figure 33*).

Breathing techniques

Two trials[235,240] reported breathing training or techniques. On average, the breathing training groups had a SGRQ score that was 5.0 points (95% CI 4.06 to 5.94 points) higher than the comparison groups. Although the trials were of a small size, the heterogeneity was low ($I^2 = 0\%$). Van Gestal *et al.*[208] reported no difference in the CRQ at 4 weeks' follow-up (0.17, 95% CI –0.09 to 0.43 points) (*Figure 34*; see also *Figure 31*).

Distraction auditory therapy during exercise

Bauldoff *et al.*[108] reported no significant difference in SGRQ between the group with distraction auditory therapy and a group with an exercise intervention only (see *Figure 31*).

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Action plan								
Watson 1997[231]	2	26	1	4.0	No	29/29 (100)	27/27 (100)	0.00 (–8.64 to 8.64)
Trapperburg 2011[188]	9	26	17		Yes	86/111 (77)	97/122 (80)	1.30 (–1.85 to 4.45)
McGeoch 2006[229]	2	52	1	6.5	No	84/86 (98)	70/73 (96)	1.27 (–3.16 to 5.70)
Wood-Baker 2006[170]	12	52	1	–0.8	No	54/67 (81)	58/72 (81)	–1.70 (–5.83 to 2.43)
Total (I^2=0.0%, p=0.691)								0.43 (–1.69 to 2.54)
Breathing training/technique								
Yamaguti 2012[235]	1	4	4	–0.4	No	15/15 (100)	15/15 (100)	10.90 (–25.16 to 46.96)
Katiyar 2006[240]	2	13	13	1.0	No	23/24 (96)	22/24 (92)	5.00 (4.06 to 5.94)
Total (I^2=0.0%, p=0.749)								5.00 (4.06 to 5.94)
Distraction auditory therapy during exercise								
Bauldoff 2002[108]	2	8	8	6.8	No	12/12 (100)	12/12 (100)	–1.20 (–12.01 to 9.61)
Exercise								
Petersen 2008[225]	6	7	7	–10.0	No	9/9 (100)	10/10 (100)	15.00 (1.14 to 28.86)
Bestall 2003[141]	11	52	8	–2.0	No	26/29 (90)	21/27 (78)	4.00 (–5.05 to 13.05)
Total (I^2=41.1%, p=0.193)								8.20 (–2.28 to 18.67)
Food fortification								
Weekes 2009[158]	2	52	26	–6.4	Yes	23/36 (64)	18/30 (60)	10.10 (1.70 to 18.50)
Support group								
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)

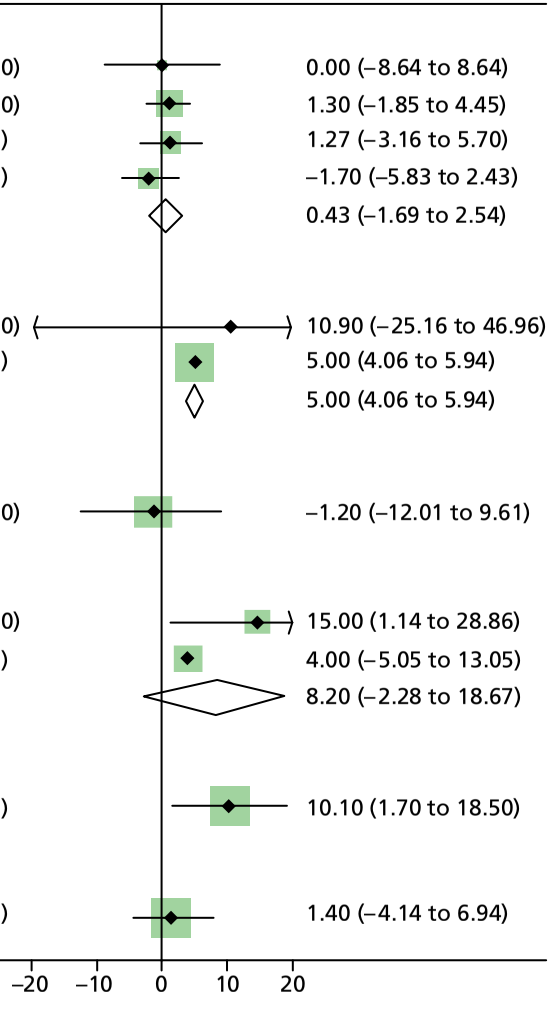


FIGURE 31 Health-related quality of life (SGRQ) at final follow-up for comparisons assessing the effects of one additional component of SM.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Action plan									
McGeoch 2006[229]	2	52	1	No	84	7	70	6	0.97 (0.33 to 2.89)

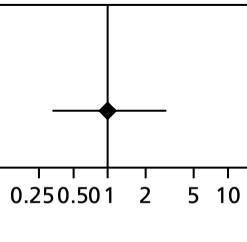


FIGURE 32 Admissions at final follow-up for comparisons assessing the effects of one additional component of SM.

FIGURE 33 Exacerbations at final follow-up for comparisons assessing the effects of one additional component of SM.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Breathing training/technique								
van Gestel 2012[208]	2	4	4		No	20/22 (91)	20/21 (95)	0.17 (–0.09 to 0.43)
Exercise								
Hernandez 2000[282]	2	12	12	–0.4	No	20/30 (67)	17/30 (57)	0.26 (–0.46 to 0.98)
Xu 2010[204] D	3	52	52	–0.0	No	20/20 (100)	20/20 (100)	1.95 (1.01 to 2.89)
Bestall 2003[141]	11	52	8	–0.3	No	26/29 (90)	21/27 (78)	0.10 (–0.50 to 0.70)
Total (I^2=82.4%, p=0.003)								0.71 (–0.30 to 1.73)

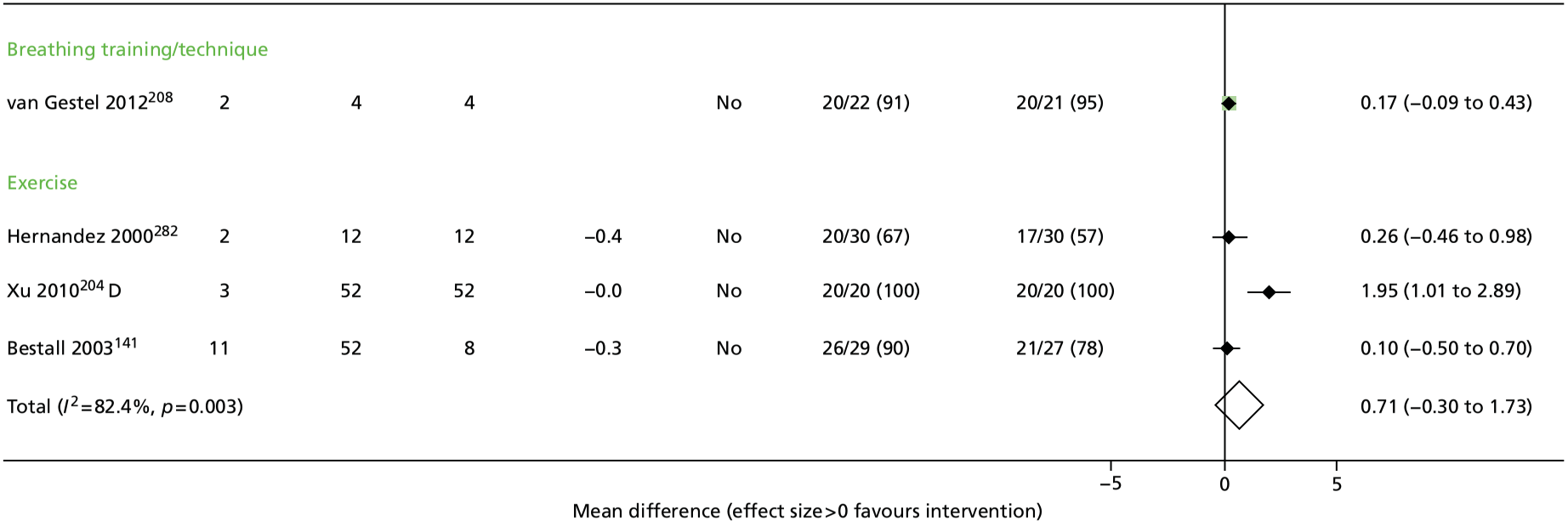


FIGURE 34 Health-related quality of life (CRQ) at final follow-up for comparisons assessing the effects of one additional component of SM. Xu 2010[204] D = rehabilitation (traditional and modern) + qigong + breathing training + limb training vs. modern rehabilitation + breathing training + limb training.

Exercise techniques/dyspnoea management

We did not include the exercise-only interventions in this analysis, as these have been separately analysed and are described in the next section. This analysis investigates the effect of adding exercise to other SM components.

Two trials[141,225] reported HRQoL using the SGRQ, with an average effect of 8.20 points (95% CI –2.28 to 18.67 points). The trial by Petersen *et al.*[225] was small ($n = 19$), with a difference at baseline not accounted for and short follow-up. Three trials[141,204,272] reported the CRQ with the exercise group achieving an average of 0.71 points (95% CI –0.30 to 1.73 points) more improvement than the comparison group (see *Figures 31* and *34*).

A small trial by Moore *et al.*,[271] which investigated exacerbations, reported no evidence of a reduction at 6 weeks' follow-up (see *Figure 33*).

Patient support groups

Brooks *et al.*[193] investigated the effect of the addition of a patient support group to a multicomponent SM package, but although only half of the participants completed the trial, no difference in HRQoL was found at 1-year follow-up (SGRQ 1.40, 95% CI –4.14 to 6.94) (see *Figure 31*).

Exercise-only interventions compared with usual care or a sham intervention

We further examined the effect of individual components by reviewing trials in which exercise was a single component. The exercise could be supervised or unsupervised, but there were no other SM components.

Eight trials[64,183,207,212,240,248,252,282] reported the effects of exercise-only interventions on HRQoL, with no other SM components in a way through which the data could be incorporated in the meta-analyses. The four trials[183,212,240,252] with five comparator groups, which reported SGRQ at up to 3 months, reported a significant benefit from the exercise-only intervention (4.87 points, 95% CI 3.96 to 5.79). The prediction interval (3.39–6.36) provides strong evidence that exercise-only interventions are effective in improving the SGRQ score at up to 13 weeks' follow-up. Only Gohl *et al.*[207] reported the SGRQ at 1-year follow-up with a large but non-significant effect in favour of exercise, although the sample size was very small with only 19 participants. Three trials[64,248,282] reported the CRQ outcome, although all had low rates of follow-up, so results must be interpreted with caution. At 3 months' follow-up there was a modest effect in favour of the exercise group but not statistically significant, and at 6 months there was a larger, non-significant effect, with a high level of heterogeneity. Details are shown in *Figures 35* and *36*, and *Table 53*.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Murphy 2005[252]	1	6	6	4.9	No	13/13 (100)	13/13 (100)	4.10 (–11.28 to 19.48)
Hospes 2009[183]	2	12	12	2.5	No	18/20 (90)	17/19 (89)	4.10 (–6.03 to 14.23)
Katiyar 2006[240]	2	13	13	1.0	No	23/24 (96)	22/24 (92)	5.00 (4.06 to 5.94)
Chan 2010[212] B	3	13	13	–2.4	No	69/69 (100)	34/34 (100)[a]	3.00 (–3.38 to 9.38)
Chan 2010[212] A	4	13	13	3.3	No	70/70 (100)	34/34 (100)[a]	1.60 (–4.58 to 7.78)
Total (I^2=0.0%, p=0.824)								4.87 (3.96 to 5.79)
Follow-up over 26 weeks								
Gohl 2006[207]	2	52	52	2.5	No	10/10 (100)	9/9 (100)	8.50 (–2.29 to 19.29)

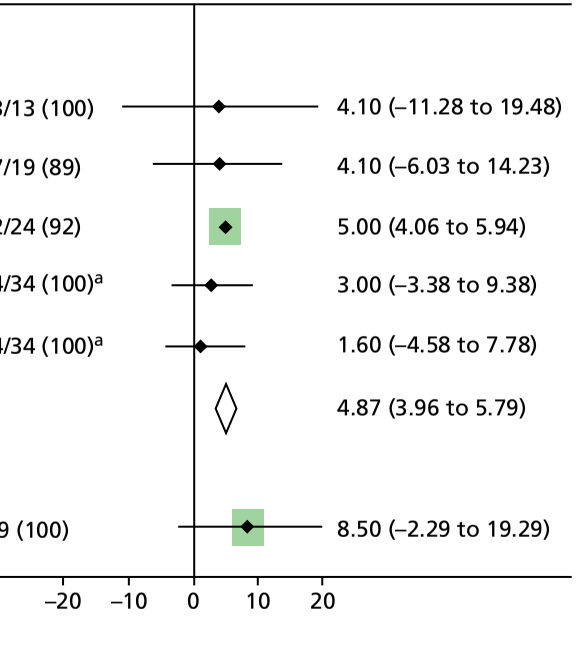


FIGURE 35 Health-related quality-of-life (SGRQ) outcomes for exercise-only interventions vs. UC/sham intervention. a, Refers to the fact that number in the control group has been halved with half of the group used as control for one comparison (t'ai chi qigong vs. control) and half for the other comparison (exercise vs. control). Chan 2010[212] A = t'ai chi qigong vs. control. Chan 2010[212] B = exercise vs. control.

Study	No. of components	Length of follow-up	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Hernandez 2000[282]	2	12	12	–0.4	No	20/30 (67)	17/30 (57)	0.26 (–0.46 to 0.98)
Behnke 2000[64]	3	13	26	0.1	No	15/23 (65)	15/23 (65)	1.05 (0.56 to 1.54)
Total (I^2=68.6%, p=0.074)								0.70 (–0.07 to 1.47)
Follow-up 26 weeks or less but over 13 weeks								
Troosters 2000[248]	1	26	26	–0.3	No	34/50 (68)	28/50 (56)	0.40 (–0.15 to 0.95)
Behnke 2000[64]	3	26	26	0.1	No	15/23 (65)	15/23 (65)	1.95 (1.33 to 2.57)
Total (I^2=92.5%, p<0.001)								1.17 (–0.35 to 2.69)

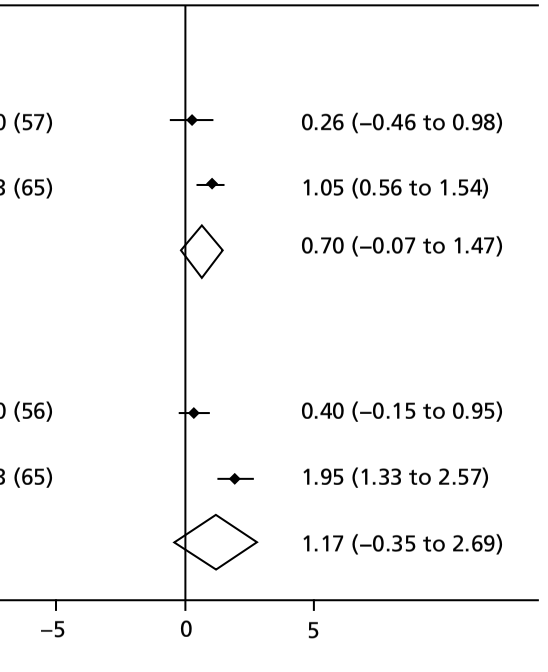


FIGURE 36 Health-related quality-of-life (CRQ) outcomes for exercise-only interventions vs. UC/sham intervention.

TABLE 53 Health-related quality of life and admissions outcomes for exercise-only interventions compared with UC or a sham intervention

Outcome	Time frame	No. of trials (comparisons)	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	4 (5)	4.87 (3.96 to 5.79)	0
	> 6 months	1	8.50 (–2.29 to 19.29)	n/a
CRQ	≤ 3 months	2	0.70 (–0.07 to 1.47)	68.6
	> 3 to ≤ 6 months	2	1.17 (–0.35 to 2.69)	92.5
			Summary HR (95% CI)	
Admissions	≤ 3 months	1 (2)	1.12 (0.29 to 4.36)	0
Exacerbations	≤ 3 months	1	0.02 (0.00 to 28.17)	n/a
	> 3 to ≤ 6 months	1	0.34 (0.07 to 1.77)	n/a

n/a, not applicable.

Chan *et al.*[212] compared t'ai chi and exercise to UC in separate comparisons and reported no effects on hospital admission rates (*Figure 37*). Behnke *et al.*[64] undertook follow-up at the end of an 18-month exercise-only intervention and showed a significantly lower hospital admission rate in the intervention group (3/14) compared with 9 of 12 in the UC group (HR 0.17, 95% CI 0.05 to 0.64). In addition, Hernandez *et al.*[282] reported no statistical difference in admission rates between the exercise group and comparator at last follow-up. A small trial by Murphy *et al.*[252] reported exacerbations at 3 and 6 months, with a suggestion of lower rates, but participant numbers were very small (HR at 3 months 0.02, 95% CI 0.00 to 28.17; HR at 6 months 0.34, 95% CI 0.07 to 1.77) (*Figures 37* and *38*). Chan *et al.*[212] reported no difference on exacerbations between groups at 3 months' follow-up.

Summary: individual components

For individual components we are limited by insufficient evidence. There is no evidence of effectiveness of action plans, there was only one trial[193] of support groups showing no difference when added to a multicomponent package; breathing management and techniques may have a positive effect.

There is strong evidence that exercise-only interventions increase HRQoL in the short-term, but limited evidence on hospital admissions and exacerbations.

Enhanced care

We wanted to explore the general effects of providing support to patients over just giving simple information approaches, which we termed 'enhanced care'. It included regular telephone contact to reinforce information or behaviour change techniques, provided encouragement or included scheduled home visits for assessment with reinforcement or encouragement.

Fifteen studies[63–65,67,71,72,110,120,140,155,180,188–190,192,193,206,251,270,271,283] provided information in the form of the total SGRQ or CRQ and were included in the meta-analyses. Only three studies[67,120,193] reported the SGRQ at 3 months' follow-up with very heterogeneous results; estimate of average effect was 1.27 points (95% CI –4.28 to 6.82 points, $I^2 = 73.8$). At 3–6 months' and 12 months' follow-up the enhanced-care arm had a higher SGRQ score than the UC arm – details are given in *Figure 39* and *Table 54*. The estimates of the average CRQ at the three follow-up times all favoured the enhanced-care arm but were not statistically significant and heterogeneity was very high (*Figure 40*).

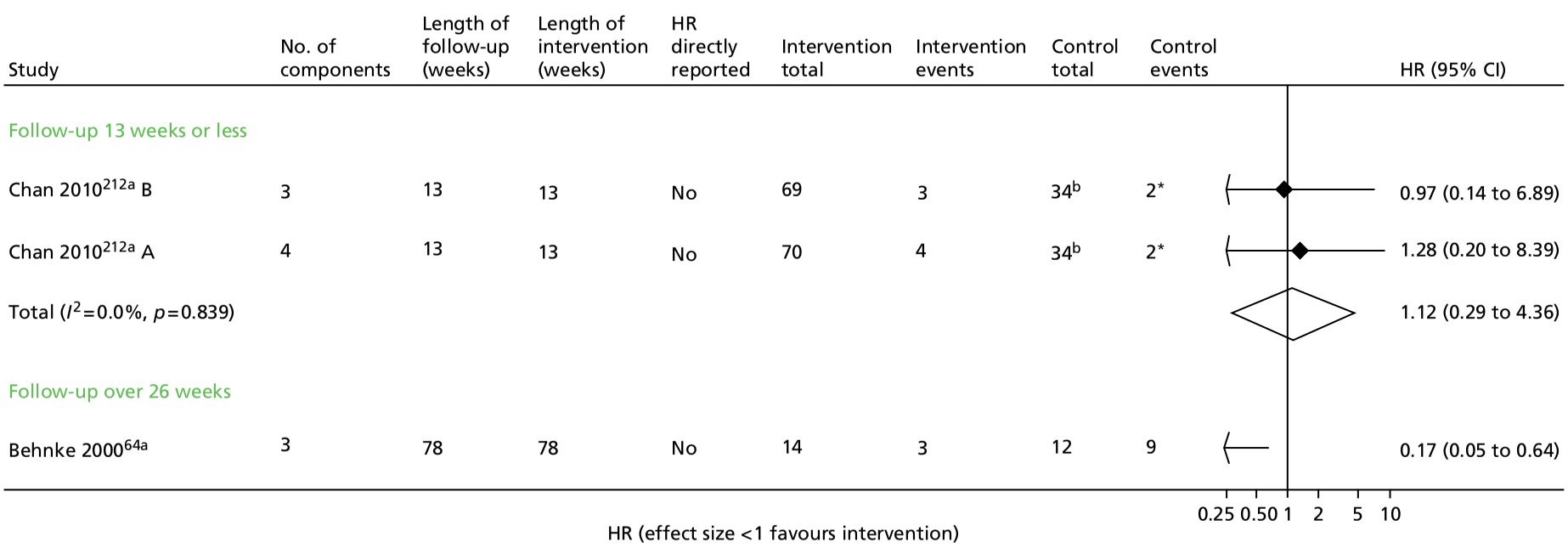


FIGURE 37 Admission outcomes for exercise-only interventions vs. UC/sham intervention. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. b, Refers to the fact that number in the control group has been halved with half of the group used as control for one comparison (t'ai chi qigong vs. control) and half for the other comparison (exercise vs. control). Chan 2010[212] A = t'ai chi qigong vs. control; Chan 2010[212] B = exercise vs. control.

FIGURE 38 Exacerbation outcomes for exercise-only interventions vs. UC/sham intervention.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95%CI)
Follow-up 13 weeks or less								
Brooks 2002[193]	5	13	52	0.5	No	36/37 (97)	48/48 (100)	–2.90 (–6.00 to 0.20)
Koft 2009[120]	6	13	13	3.2	No	19/20 (95)	19/20 (95)	9.70 (0.43 to 18.97)
Hermiz 2002[67]	8	13	4	3.0	No	67/84 (80)	80/93 (86)	1.32 (–2.97 to 5.61)
Total (I^2=73.8%, p=0.022)								1.27 (–4.83 to 6.82)
Follow-up 26 weeks or less but over 13 weeks								
Brooks 2002[193]	5	26	52	0.5	No	31/37 (84)	45/48 (94)	3.30 (–0.04 to 6.64)
Trappenburg 2011[188]	9	26	17		Yes	86/111 (77)	97/122 (80)	1.30 (–1.85 to 4.45)
Khdour 2009[251]	10	26	1	–0.6	No	71/86 (83)	72/87 (83)	5.20 (–0.30 to 10.70)
Bourbeau 2003[192]	12	17	8	–1.6	No	88/96 (92)	84/95 (88)	4.20 (0.70 to 7.70)
Total (I^2=0.0%, p=0.530)								3.09 (1.28 to 4.90)
Follow-up over 26 weeks								
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)
Bucknall 2012[63]	6	52	52	0.8	Yes	69/232 (30)	53/232 (23)	4.52 (–0.03 to 9.07)
Soler 2006[180]	7	52	52	–10.6	No	13/13 (100)	13/13 (100)	14.60 (3.90 to 25.30)
Rice 2010[140]	9	52	52		No	223/372 (60)	204/371 (55)	5.10 (2.55 to 7.65)
Casas 2006[71a]	10	52		–9.3	No	21/44 (48)	41/69 (59)	2.39 (–5.78 to 10.56)
Khdour 2009[251]	10	52	1	–0.6	No	71/86 (63)	72/87 (83)	3.80 (–1.95 to 9.55)
Bourbeau 2003[192]	12	52	8	–1.6	No	81/96 (94)	76/95 (80)	2.00 (–1.85 to 5.85)
Total (I^2=8.4%, p=0.364)								4.05 (2.23 to 5.87)

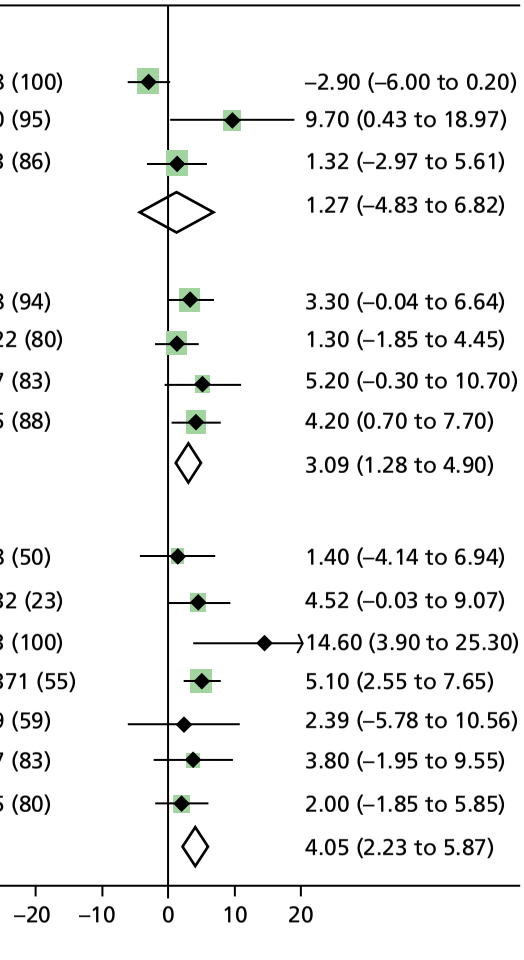


FIGURE 39 Health-related quality-of-life (SGRQ) outcomes for enhanced care (± SM package) vs. UC/SM package. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

TABLE 54 Outcomes for enhanced interventions compared with UC/SM package

Outcome	Time frame	No. of studies (comparisons)	Summary MD (95% CI)	I^2 (%)	95% prediction interval
SGRQ	≤ 3 months	3	1.27 (–4.28 to 6.82)	73.8	–
	> 3 to ≤ 6 months	4	3.09 (1.28 to 4.90)	0.0	–
	> 6 months	7	4.05 (2.23 to 5.87)	8.4	1.00 to 7.10
CRQ	≤ 3 months	4	0.54 (–0.18 to 1.26)	87.5	–2.18 to 8.12
	> 3 to ≤ 6 months	3	0.93 (–0.49 to 2.35)	95.5	–3.40 to 8.28
	> 6 months	2	0.85 (–1.12 to 2.82)	82.1	–
			Summary HR (95% CI)		
Admissions	≤ 3 months	4	1.05 (0.67 to 1.66)	38.3	–
	> 3 to ≤ 6 months	2	0.75 (0.20 to 2.86)	93.2	–
	> 6 months	10	0.78 (0.62 to 0.99)	55.1	0.40 to 1.54
Exacerbations	> 3 to ≤ 6 months	2	1.11 (0.76 to 1.60)	0.0	
	> 6 months	1	1.00 (0.68 to 1.46)	n/a	

n/a, not applicable.

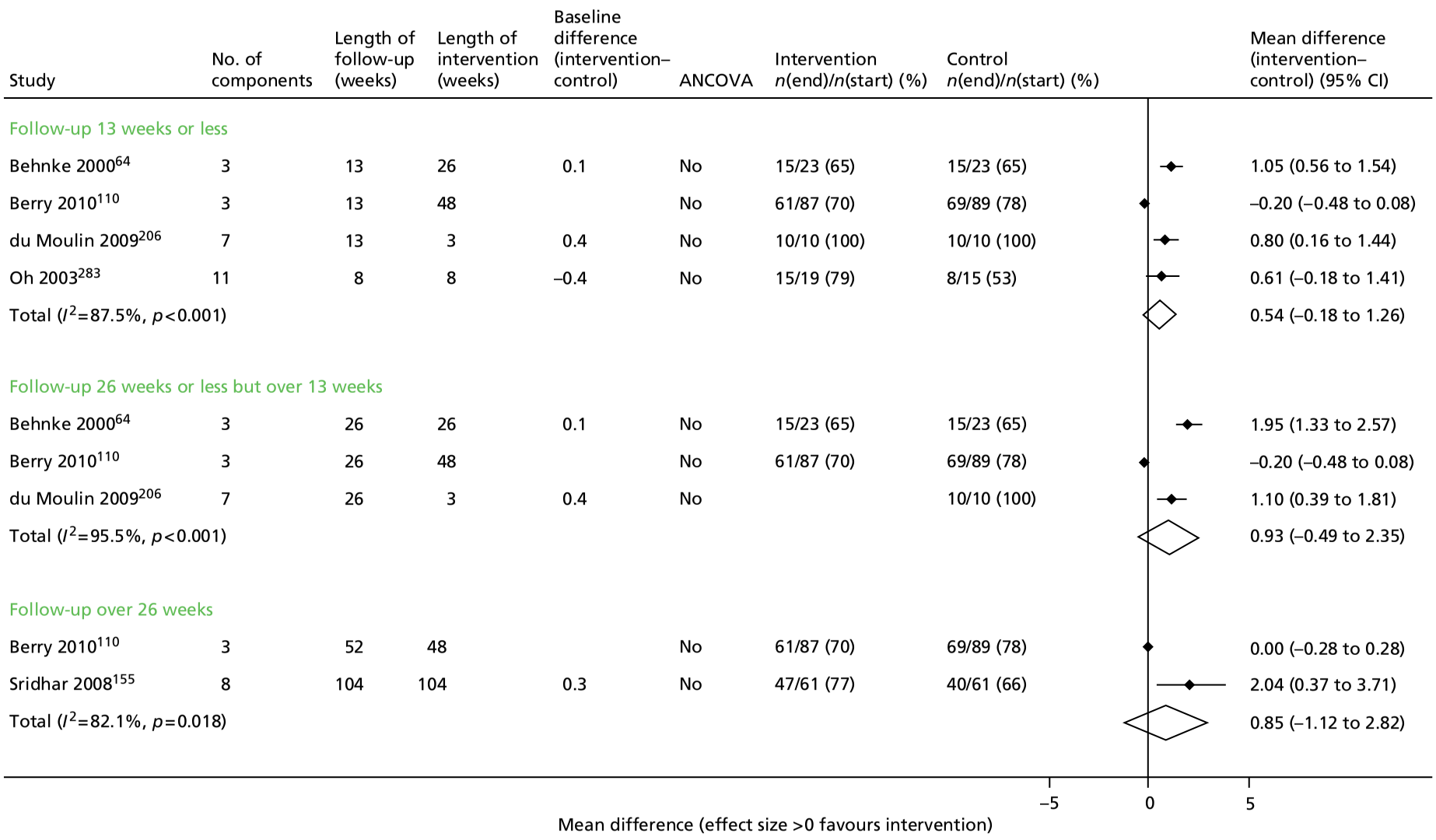


FIGURE 40 Health-related quality-of-life (CRQ) outcomes for enhanced care (±SM package) vs. UC/SM package.

On average, enhanced care had a similar risk of hospital admission at 3 and 6 months (*Figure 41* and *Table 54*), but a lower risk at 1 year or longer (HR 0.78, 95% CI 0.62 to 0.99). However, there was moderate heterogeneity at 1 year and the prediction interval showed that the intervention would frequently not be effective in lowering hospital admissions. Seven studies did not provide data that could be included in the meta-analyses,[69,74,136,140,180,188,251] of which three also reported a statistically significant reduction in hospital admissions at 1-year follow-up.[140,180,251]

Only three trials[155,188,206] were included in the meta-analyses for exacerbations with no evidence of any effect of enhanced care on risk of exacerbation (*Figure 42*). Four other trials[120,140,180,251] reported exacerbation rates at last follow-up, one[140] of which reported a statistically significant reduction.

Summary: enhanced care interventions

Positive effect on HRQoL, particularly at medium-/longer-term follow-up. There may be a reduction in hospital admissions with longer-term follow-up, but there is considerable heterogeneity. There is insufficient evidence to establish the effect on exacerbations.

The contribution of exercise to multicomponent self-management packages

The following analyses explore the contribution of exercise and its mode of delivery as a contributor to the heterogeneity. Multicomponent interventions:

- with a supervised exercise element compared with UC
- a structured, unsupervised exercise element compared with UC
- exercise counselling only compared with UC
- without an exercise element compared with UC.

Multicomponent interventions with a supervised exercise element compared with usual care

Trials were included in this category if the exercise component of a larger package of care was directly supervised. The majority were group, centre-based interventions (generally referred to as PR).

Health-related quality of life

Of the 47 trials that reported HRQoL, 26 trials (27 interventions) reported disease-specific HRQoL using the total SGRQ or CRQ (see *Appendices 13* and *27*). Findings are similar to those for multicomponent interventions overall, with the largest estimate of the average effect in SGRQ at up to 3 months' follow-up (7.75, 95% CI 3.49 to 12.01) points. There was no difference in average effect between the intervention and UC arms in SGRQ at follow-up of > 6 months. Heterogeneity was very high for most outcomes and follow-up times and loss to follow-up variable. Small but significant improvements in the CRQ were seen at 3 and 6 months' follow-up favouring the SM group. Details are given in *Figures 43* and *44* and *Table 55*.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Koff 2009[120]	6	13	13	No	20	1	20	3	0.32 (0.03 to 3.03)
Hermiz 2002[67]	8	13	4	No	67	16	80	14	1.42 (0.69 to 2.91)
Kwok 2004[70]	8	4	26	No	70	33	79	29	1.39 (0.85 to 2.30)
Hernandez 2003[68]	10	8	8	No	121	23	101	26	0.71 (0.40 to 1.24)
Total (I^2=38.3%, p=0.182)									1.05 (0.67 to 1.66)
Follow-up 26 weeks or less but over 13 weeks									
Kwok 2004[70]	8	26	26	No	70	53	79	49	1.46 (0.99 to 2.16)
Aimonino Ricauda 2008[75]	9	26	2	No	52	17	52	34	0.37 (0.21 to 0.67)
Total (I^2=93.2%, p<0.001)									0.75 (0.20 to 2.86)
Follow-up over 26 weeks									
Behnke 2000[64a]	3	78	78	No	14	3	12	9	0.17 (0.05 to 0.64)
Cockcroft 1987[142]	3			No	42	25	33	17	1.25 (0.67 to 2.31)
Littlejohns 1991[146]	5	52	52	No	68	12	65	14	0.80 (0.37 to 1.73)
Bucknall 2012[63]	6	52	52	Yes	232	88	232	92	0.94 (0.70 to 1.27)
Rea 2004[230]	7	52	52	No	83	29	52	26	0.62 (0.37 to 1.05)
Smith 1999[168]	7	52	52	No	48	34	48	28	1.56 (0.79 to 3.09)
Sridhar 2008[155]	8	104	104	No	55	29	49	24	1.11 (0.65 to 1.91)
Rice 2010[140]	9	52	52	Yes	372		371		0.72 (0.55 to 0.95)
Casas 2006[71]	10	52		Yes	65	29	90	60	0.55 (0.35 to 0.87)
Bourbeau 2003[192]	12	52	8	No	96	31	95	48	0.55 (0.35 to 0.87)
Total (I^2=55.1%, p=0.018)									0.78 (0.62 to 0.99)

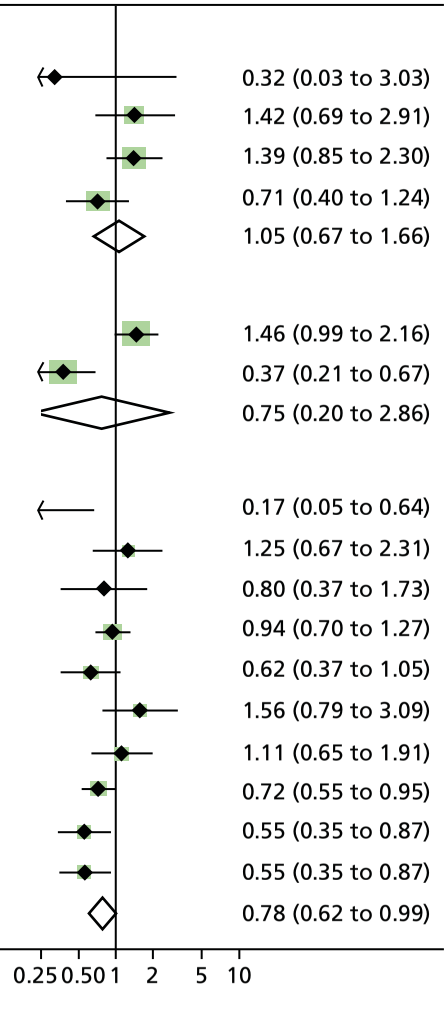


FIGURE 41 Admissions outcomes for enhanced care (± SM package) vs. UC/SM package. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

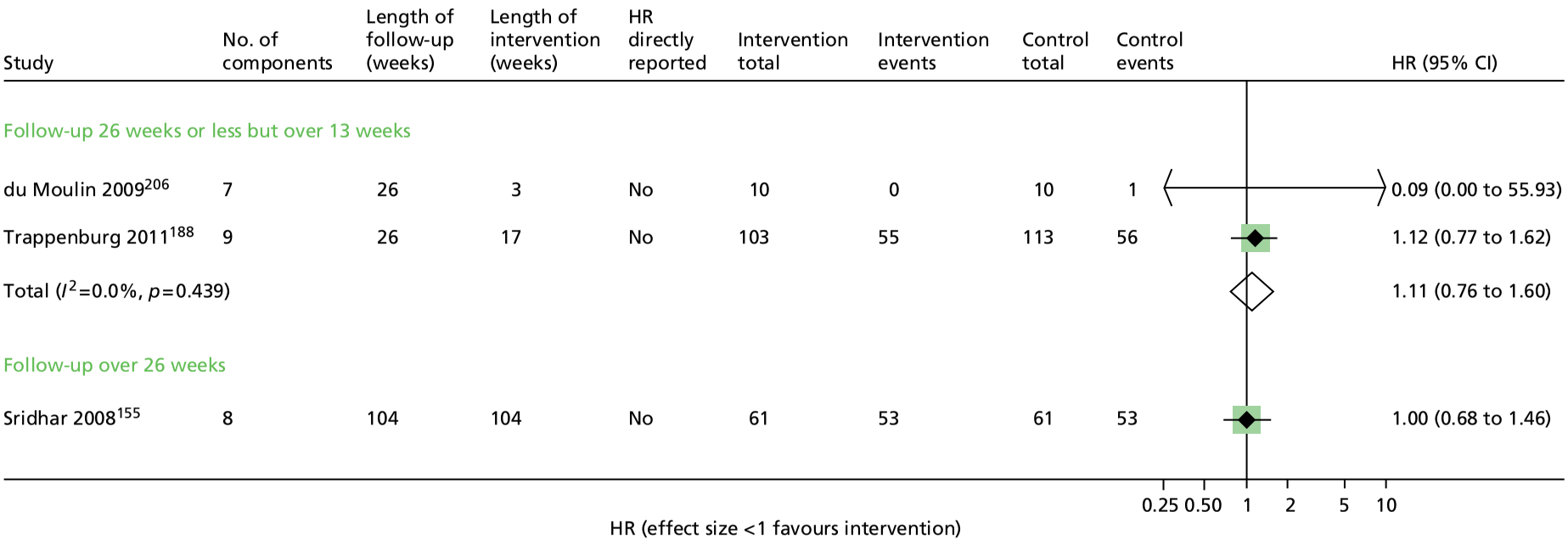


FIGURE 42 Exacerbation outcomes for enhanced care (±SM package) vs. UC/SM package.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Chan 2010[212] B	3	13	13	–2.4	No	69/69 (100)	67/67 (100)	3.00 (–2.20 to 8.20)
Brooks 2002[193]	5	13	52	0.5	No	36/37 (97)	48/48 (100)	–2.90 (–6.00 to 0.20)
Lord 2010[147]	5	7	6	5.8	No	15/20 (75)	13/16 (81)	0.70 (–5.47 to 6.87)
Ringbaek 2000[226]	5	8	8	5.5	No	17/24 (71)	21/21 (100)	–0.10 (–10.00 to 9.80)
Ko 2011[213]	6	13	8	3.9	No	30/30 (100)	30/30 (100)	6.76 (–2.68 to 16.20)
Man 2004[148]	6	13	8	–4.2	No	18/21 (86)	16/21 (76)	12.70 (4.65 to 20.75)
Petersen 2008[225]	6	7	7	–10.0	No	9/9 (100)	10/10 (100)	15.00 (1.14 to 28.86)
Elci 2008[236]	7	13	13		No	39/39 (100)	39/39 (100)	19.59 (13.03 to 26.15)
Finnerty 2001[143]	7	13	6	0.6	No	32/50 (64)	23/50 (46)	10.40 (3.55 to 17.25)
Kayahan 2006[238]	7	9	8	–5.6	No	26/26 (100)	19/19 (100)	18.71 (8.96 to 28.46)
Boxall 2005[160]	8	12	12	–4.5	No	23/30 (77)	23/30 (77)	8.90 (1.63 to 16.17)
Karapolat 2007[237]	8	12	8	–5.6	No	26/27 (96)	19/22 (86)	10.90 (0.87 to 20.93)
Theander 2009[220]	8	12	12	8.0	No	12/15 (80)	14/15 (93)	5.00 (–3.84 to 13.84)
Bestall 2003[141]	11	8	8	–2.0	No	29/29 (100)	27/27 (100)	6.00 (–1.38 to 13.38)
Total (I^2=80.1%, p<0.001)								7.75 (3.49 to 12.01)
Follow-up 26 weeks or less but over 13 weeks								
Barakat 2008[249]	3	14	14	1.1	No	35/40 (88)	36/40 (90)	9.70 (8.46 to 10.94)
Hoogendoorn 2009[182a]	4	17	104	1.0	Yes	87/102 (85)	88/97 (91)	4.10 (1.31 to 6.89)
Brooks 2002[193]	5	26	52	0.5	No	31/37 (84)	45/48 (94)	3.30 (–0.04 to 6.64)
Ko 2011[213]	6	26	8	3.9	No	30/30 (100)	30/30 (100)	9.14 (–0.74 to 19.02)
Finnerty 2001[143]	7	26	6	0.6	No	24/50 (48)	25/50 (50)	8.10 (1.35 to 14.85)
Bestall 2003[141]	11	26	8	–2.0	No	28/29 (97)	24/27 (89)	7.00 (–2.10 to 16.10)
Total (I^2=77.6%, p<0.001)								6.57 (3.24 to 9.90)
Follow-up over 26 weeks								
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)
Ko 2011[213]	6	52	8	3.9	No	30/30 (100)	30/30 (100)	1.81 (–9.42 to 13.04)
Engstrom 1999[219]	7	52	52	3.3	No	26/26 (100)	24/24 (100)	–3.10 (–12.39 to 6.19)
Bestall 2003[141]	11	52	8	–2.0	No	26/29 (90)	21/27 (78)	4.00 (–5.05 to 13.05)
Total (I^2=0.0%, p=0.751)								1.13 (–2.81 to 5.08)

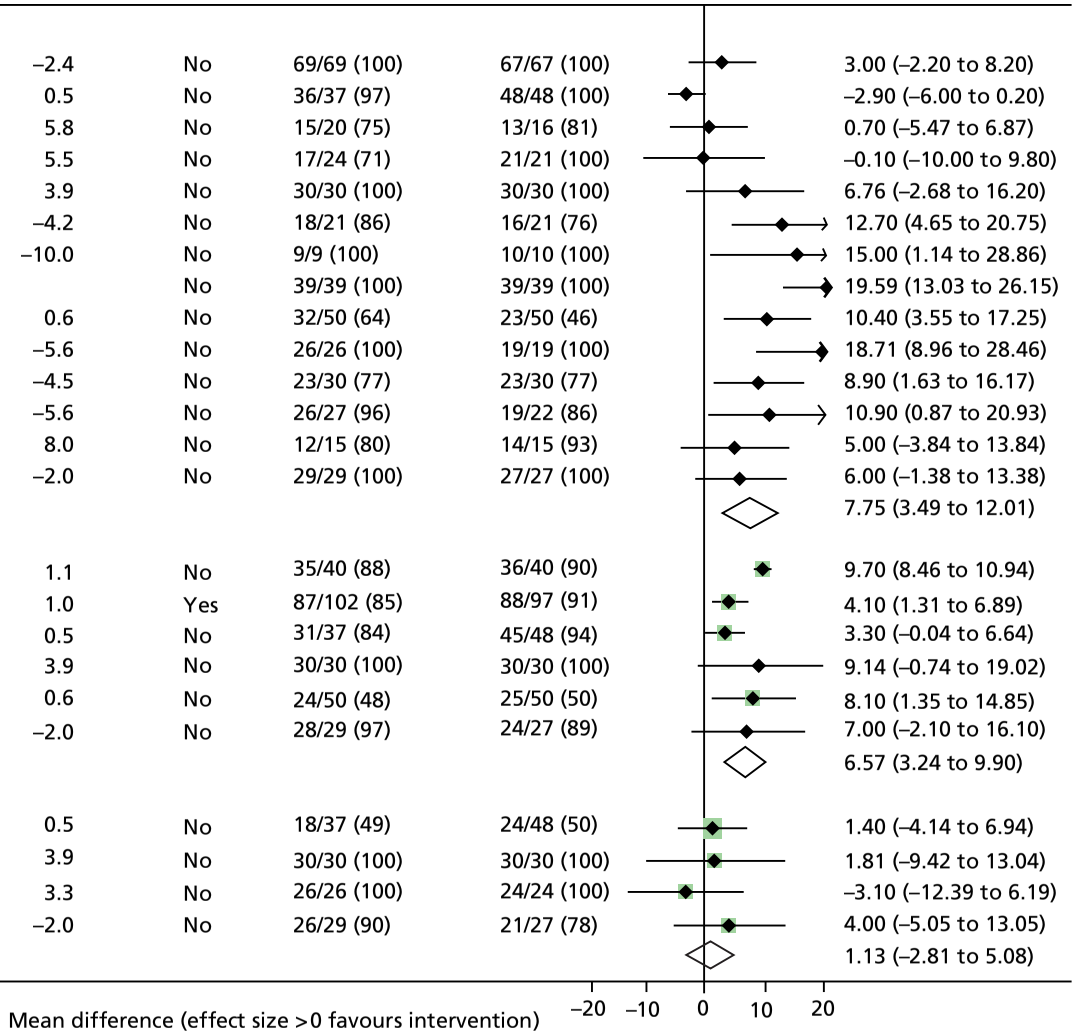


FIGURE 43 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM interventions including supervised exercise vs. UC/control. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. Chan 2010[212] B = exercise vs. control.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Behnke 2000[64]	3	13	26	0.1	No	15/23 (65)	15/23 (65)	1.05 (0.56 to 1.54)
Berry 2010[110]	3	13	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Xu 2010[204] A	3	13	52	–0.1	No	20/20 (100)	20/20 (100)	1.17 (0.13 to 2.21)
Janaudis-Ferreira 2011[197]	4	6	6	–0.4	No	13/17 (76)	18/19 (95)	0.10 (–0.36 to 0.56)
du Moulin 2009[206]	7	13	3	0.4	No	10/10 (100)	10/10 (100)	0.80 (0.16 to 1.44)
Bendstrup 1997[222]	9	12	12	0.2	No	16/22 (73)	16/20 (80)	0.40 (–0.11 to 0.91)
Bestall 2003[141]	11	8	8	–0.3	No	29/29 (100)	27/27 (100)	0.20 (–0.28 to 0.68)
Total (I^2=77.8%, p<0.001)								0.43 (0.03 to 0.83)
Follow-up 26 weeks or less but over 13 weeks								
Behnke 2000[64]	3	26	26	0.1	No	15/23 (65)	15/23 (65)	1.95 (1.33 to 2.57)
Berry 2010[110]	3	26	48		No	61/87 (70)	69/89 (78)	–0.20 (–0.48 to 0.08)
Xu 2010[204]A	3	26	52	–0.1	No	20/20 (100)	20/20 (100)	2.48 (1.42 to 3.54)
du Moulin 2009[206]	7	26	3	0.4	No	10/10 (100)	10/10 (100)	1.10 (0.39 to 1.81)
Bendstrup 1997[222]	9	24	12	0.2	No	16/22 (73)	16/20 (80)	0.85 (0.19 to 1.50)
Bestall 2003[141]	11	26	8	–0.3	No	28/29 (97)	24/27 (89)	0.30 (–0.29 to 0.89)
Total (I^2=92.0%, p<0.001)								1.02 (0.19 to 1.86)
Follow-up over 26 weeks								
Berry 2010[110]	3	52	48		No	61/87 (70)	69/89 (78)	0.00 (–0.28 to 0.28)
Xu 2010[204] A	3	52	52	–0.1	No	20/20 (100)	20/20 (100)	3.73 (2.76 to 4.70)
Bestall 2003[141]	11	52	8	–0.3	No	26/29 (90)	21/27 (78)	0.10 (–0.50 to 0.70)
Total (I^2=96.2%, p<0.001)								1.21 (–0.47 to 2.88)

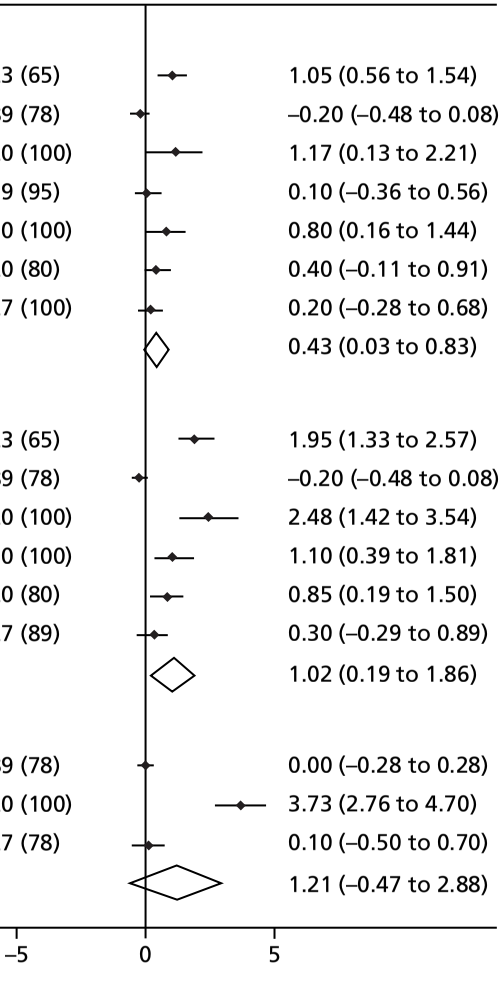


FIGURE 44 Health-related quality-of-life (CRQ) outcomes for multicomponent SM interventions including supervised exercise vs. UC/control. Xu 2010[204] A = rehabilitation (traditional and modern) + qigong + breathing training + limb training vs. UC.

TABLE 55 Outcomes for multicomponent interventions with supervised exercise

Outcome	Time frame	No. of studies (comparisons)	Summary MD (95% CI)	I^2 (%)	95% prediction interval
SGRQ	≤ 3 months	14	7.75 (3.49 to 12.01)	80.1	–8.25 to 23.75
	> 3 to ≤ 6 months	6	6.57 (3.24 to 9.90)	77.6	–3.66 to 16.79
	> 6 months	4	1.13 (–2.81 to 5.08)	0	–
CRQ	≤ 3 months	7	0.43 (0.03 to 0.83)	77.8	–0.86 to 1.72
	> 3 to ≤ 6 months	6	1.02 (0.19 to 1.86)	92.0	–1.95 to 3.99
	> 6 months	3	1.21 (–0.47 to 2.88)	95.2	–
			Summary HR (95% CI)		
Admissions	≤ 3 months	4	0.78 (0.54 to 1.14)	0.0	–
	> 3 to ≤ 6 months	1	0.55 (0.25 to 1.18)	n/a	–
	> 6 months	2	0.47 (0.08 to 2.60)	83.8	–
Exacerbations	> 3 to ≤ 6 months	2	0.99 (0.56 to 1.75)	0	–
	> 6 months	2	1.09 (0.77 to 1.53)	37.5	–

n/a, not applicable.

Hospital admissions

We were able to combine the reports of hospital admission rates in six trials.[65,148,160,192,212,213,227] Although the trend was for the average effect on admission rates to be lower in the intervention arms, this was not a significant effect at any of the follow-up time points (*Figure 45*). Four other trials[172,182,212,213] reported hospital admissions at last follow-up; only one reported a statistically significant reduction in hospital admissions.[172]

Exacerbations

Three trials[182,206,213] reported exacerbation rates in such a way that a HR could be computed; heterogeneity was low or moderate but no evidence of effect was observed (*Figure 46* and *Table 55*). Two additional trials[172,212] reported exacerbations at last study follow-up, with Güell *et al.*[172] reporting a statistically significant reduction in favour of the intervention group.

Multicomponent interventions with a structured, unsupervised exercise element compared with usual care

Trials were included in this category if they provided detail about a structured home exercise programme including duration and proposed frequency of exercise within a larger package of care. These were home-based interventions.

Of the eight trials[186,251,255,262,264,270,283,284] that reported HRQoL, five used the total SGRQ[186,251,255,262,270] and one the CRQ.[283] On average, the multicomponent SM package with structured unsupervised exercise had a larger improvement in SGRQ at 3–6 months' follow-up than UC [3.59 points (95% CI 1.28 to 5.91 points; $I^2 = 0\%$)]. However, by 1-year follow-up there was no evidence of effect: SGRQ 0.80 points (95% CI –1.03 to 2.63 points; prediction interval –2.39 to 3.99). Only one trial[283] reported the CRQ at 8 weeks' follow-up (0.61, 95% CI –0.18 to 1.41 points) (*Figures 47* and *48*, and *Table 56*).

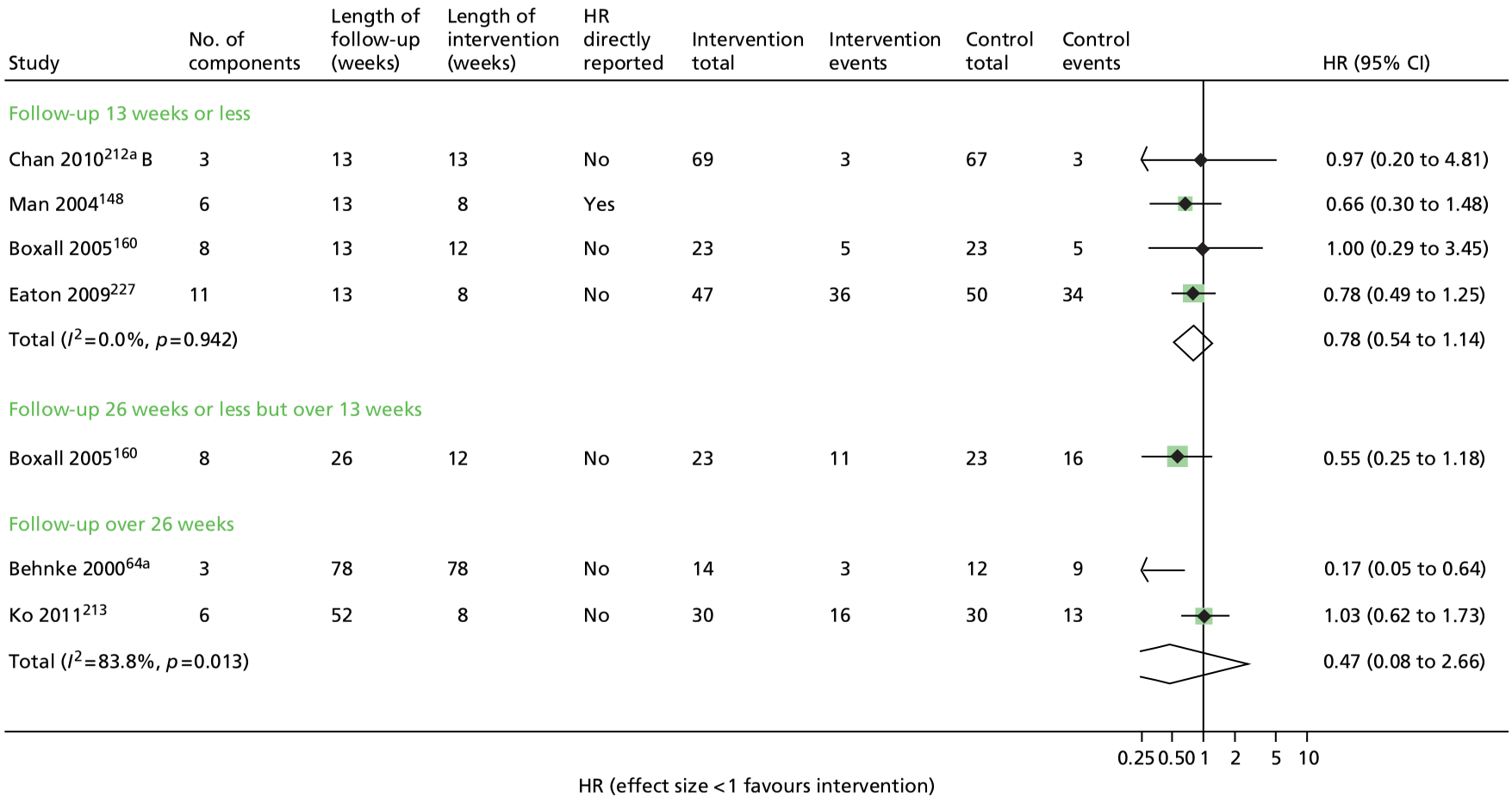


FIGURE 45 Admissions outcomes for multicomponent SM interventions including supervised exercise vs. UC/control. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*. Chan 2010[212] B = exercise vs. control.

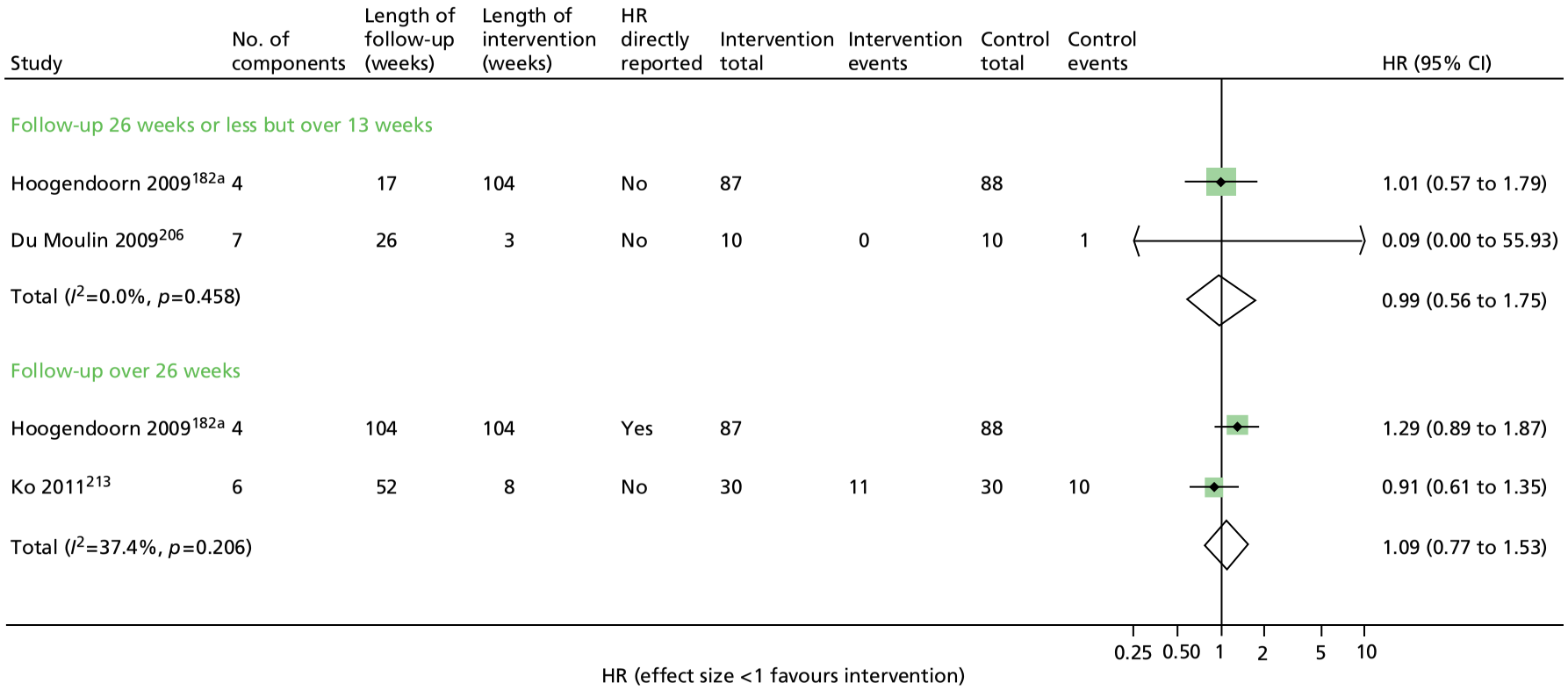


FIGURE 46 Exacerbation outcomes for multicomponent SM interventions including supervised exercise vs. UC/control. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 26 weeks or less but over 13 weeks								
Wakabayashi 2011[262]	8	26	26	–4.2	No	50/52 (96)	48/50 (96)	4.80 (–2.67 to 12.27)
Khdour 2009[251]	10	26	1	–0.6	No	71/86 (83)	72/87 (83)	5.20 (–0.30 to 10.70)
Monninkhof 2003[186]	10	26	52	–0.9	No	124/127 (98)	117/121 (97)	1.30 (–3.00 to 5.60)
Bourbeau 2003[192]	12	17	8	–1.6	No	88/96 (92)	84/95 (88)	4.20 (0.70 to 7.70)
Total (I^2=0.0%, p=0.651)								3.59 (1.28 to 5.91)
Follow-up over 26 weeks								
Wakabayashi 2011[262]	8	52	26	–4.2	No	42/52 (81)	43/50 (86)	5.00 (–3.28 to 13.28)
Gallefoss 1999[255]	10	52			No	26/31 (84)	27/31 (87)	3.10 (–6.93 to 13.13)
Khdour 2009[251]	10	52	1	–0.6	No	71/86 (83)	72/87 (83)	3.80 (–1.95 to 9.55)
Monninkhof 2003[186]	10	52	52	–0.9	No	122/127 (96)	113/121 (93)	–0.60 (–2.85 to 1.65)
Bourbeau 2003[192]	12	52	8	–1.6	No	81/96 (84)	76/95 (80)	2.00 (–1.85 to 5.85)
Total (I^2=2.3%, p=0.394)								0.80 (–1.03 to 2.63)

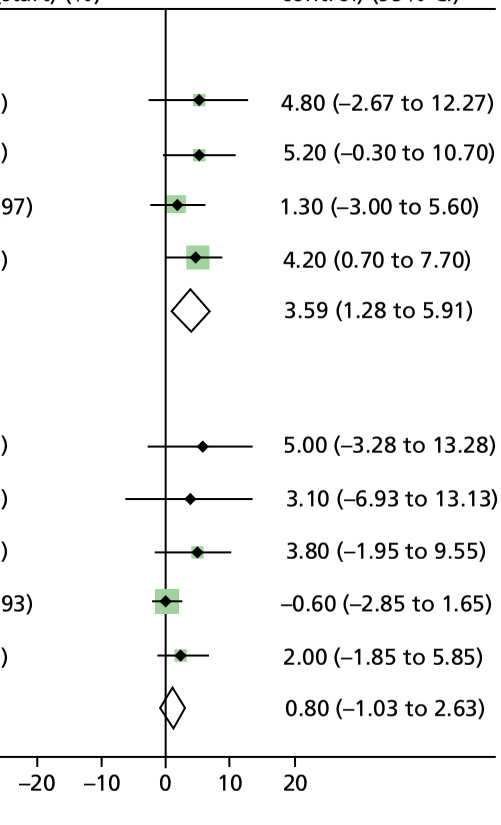


FIGURE 47 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM interventions with structured, unsupervised exercise vs. UC/control.

FIGURE 48 Health-related quality-of-life (CRQ) outcomes for multicomponent SM interventions with structured, unsupervised exercise vs. UC/control.

TABLE 56 Outcomes for multicomponent interventions with structured, unsupervised exercise

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	> 3 to ≤ 6 months	4	3.59 (1.28 to 5.91)	0.0
	> 6 months	5	0.80 (–1.03 to 2.63)	2.3
CRQ	≤ 3 months	1	0.61 (–0.18 to 1.41)	n/a
			Summary HR (95% CI)	
Admissions	> 6 months	1	0.55 (0.35 to 0.87)	n/a
Exacerbations	≤ 3 months	1	3.01 (0.31 to 28.96)	n/a

n/a, not applicable.

Of the four trials[182,255,262,270] that reported hospital admissions at last follow-up, two[182,270] reported a statistically significant reduction in the intervention group. A HR could be calculated for only one trial,[270] which reported a significant reduction in hospital admissions (HR 0.55, 95% CI 0.35 to 0.87) (*Figure 49*).[270] Moore *et al.*,[284] who had only 27 participants (and wide CIs), reported exacerbations (HR 3.01, 95% CI 0.31 to 28.96) (see *Figure 50*). An additional two trials[192,251] reported no significant difference in exacerbations at last follow-up point.

Multicomponent interventions with exercise counselling only compared with usual care

Seven trials[67,72,73,140,170,180,266] reported disease-specific HRQoL using total SGRQ or CRQ following multicomponent interventions that included advice about increasing exercise. There were no significant effects on the SGRQ in the combined analyses at any of the three follow-up points and heterogeneity was high (*Figure 51* and *Table 57*). Two trials[72,180] had large differences in the SGRQ score at baseline that were not accounted for, and three trials[72,73,140] had low or imbalanced follow-up rates.

Eight trials reported hospital admissions,[67,70,71,73,75,140,168,266] of which one[168] was not included in the meta-analyses. There were no significant effects on admissions at any of the three follow-up points, and heterogeneity was high at the 6- and 12-month follow-up points. Details are given in *Figure 52* and *Table 57*.

Only Dheda *et al.*[73] reported exacerbation rates at 6 months' follow-up in a form enabling a HR to be calculated, with no difference between study arms (*Figure 53*). Three other trials[140,180,266] reported exacerbations at 6 months[265] or a year,[140,180] with Rice *et al.*[140] reporting a significant reduction in exacerbations at 1 year.

Multicomponent interventions without an exercise element compared with usual care

We included five trials[63,112,120,185,256] of multicomponent interventions that did not include exercise or even advice about exercise as a component in the meta-analyses.

Although the estimates of average effects of QoL (SGRQ) at all three follow-up points were in the direction favouring the intervention, none was statistically significant and heterogeneity was high (*Figure 54* and *Table 58*).

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up over 26 weeks									
Bourbeau 2003[192]	12	52	8	No	96	31	95	48	0.55 (0.35 to 0.87)

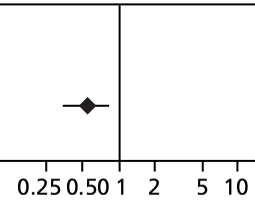


FIGURE 49 Admissions outcomes for multicomponent SM interventions with structured, unsupervised exercise vs. UC/control.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Moore 2009[284]	8	6	6	No	14	3	13	1	3.01 (0.31 to 28.96)

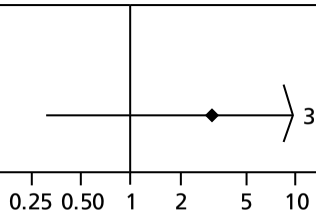


FIGURE 50 Exacerbation outcomes for multicomponent SM interventions with structured, unsupervised exercise vs. UC/control.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Hermiz 2002[67]	8	13	4	3.0	No	67/84 (80)	80/93 (86)	1.32 (–2.97 to 5.61)
Follow-up 26 weeks or less but over weeks								
Jarab 2012[266]	5	26	1	0.4	No	63/66 (95)	64/67 (96)	0.80 (–3.84 to 5.44)
Dheda 2004[73]	6	26	26		No	10/15 (67)	15/18 (83)	15.00 (2.45 to 27.55)
Wood-Baker 2006[170]	12	26	1	–0.8	No	61/67 (91)	62/72 (86)	–2.30 (–6.19 to 1.59)
Total (I^2=71.2%, p=0.031)								1.87 (–4.43 to 8.18)
Follow-up over 26 weeks								
Soler 2006[180]	7	52	52	–10.6	No	13/13 (100)	13/13 (100)	14.60 (3.90 to 25.30)
Rice 2010[140]	9	52	52		No	223/372 (60)	204/371 (55)	5.10 (2.55 to 7.65)
Casas 2006[71a]	10	52		–9.3	No	21/44 (48)	41/69 (59)	2.39 (–5.78 to 10.56)
Wood-Baker 2006[170]	12	52	1	–0.8	No	54/67 (81)	58/72 (81)	–1.70 (–5.83 to 2.43)
Total (I^2=74.6%, p=0.008)								3.88 (–1.39 to 9.14)

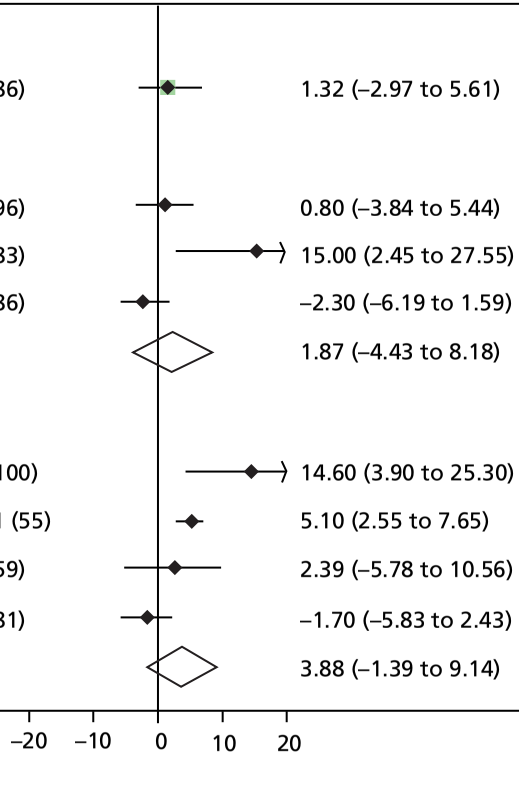


FIGURE 51 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM interventions with exercise counselling only vs. UC/control. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

TABLE 57 Outcomes for multicomponent interventions with exercise counselling only compared with UC

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	1	1.32 (–2.97 to 5.61)	n/a
	> 3 to ≤ 6 months	3	1.87 (–4.43 to 8.18)	71.2
	> 6 months	4	3.88 (–1.39 to 9.14)	74.6
			Summary HR (95% CI)	
Admissions	≤ 3 months	2	1.40 (0.93 to 2.11)	0
	> 3 to ≤ 6 months	3	0.52 (0.13 to 2.09)	81.0
	> 6 months	3	0.79 (0.50 to 1.26)	67.9
Exacerbations	> 3 to ≤ 6 months	1	1.0 (0.17 to 5.98)	n/a

n/a, not applicable.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Hermiz 2002[67]	8	13	4	No	67	16	80	14	1.42 (0.69 to 2.91)
Kwok 2004[70]	8	4	26	No	70	33	79	29	1.39 (0.85 to 2.30)
Total (I^2=0.0%, p=0.969)									1.40 (0.93 to 2.11)
Follow-up 26 weeks or less but over 13 weeks									
Jarab 2012[266]	5	26	1	No	66	3	67	11	0.26 (0.07 to 0.93)
Dheda 2004[73]	6	26	26	No	10	2	15	9	0.24 (0.05 to 1.15)
Kwok 2004[70]	8	26	26	No	70	53	79	49	1.46 (0.99 to 2.16)
Total (I^2=81.0%, p=0.005)									0.52 (0.13 to 2.09)
Follow-up over 26 weeks									
Smith 1999[168]	7	52	52	No	48	34	48	28	1.56 (0.79 to 3.09)
Rice 2010[140]	9	52	52	Yes	372		371		0.72 (0.55 to 0.95)
Casas 2006[71]	10	52		Yes	65	29	90	60	0.55 (0.35 to 0.87)
Total (I^2=67.9%, p=0.044)									0.79 (0.50 to 1.26)

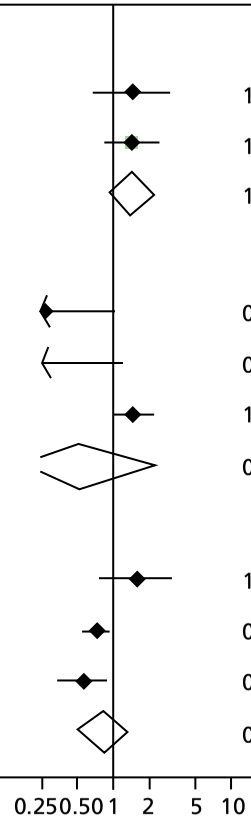


FIGURE 52 Admission outcomes for multicomponent SM interventions with exercise counselling only vs. UC/control.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 26 weeks or less but over 13 weeks									
Dheda 2004[73]	6	26	26	No	10	2	15	3	1.00 (0.17 to 5.98)

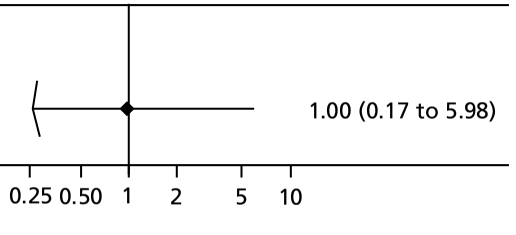


FIGURE 53 Exacerbation outcomes for multicomponent SM interventions with exercise counselling only vs. UC/control.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Hynninen 2010[256]	3	9	7	–4.4	No	25/25 (100)	26/26 (100)	0.30 (–0.25 to 0.85)
Lamers 2010[185]	4	13	13	–1.9	No	38/96 (40)	44/91 (48)	6.97 (2.14 to 11.80)
Koff 2009[120]	6	13	13	3.2	No	19/20 (95)	19/20 (95)	9.70 (0.43 to 18.97)
Total (I^2=82.0%, p=0.004)								4.65 (–1.45 to 10.74)
Follow-up 26 weeks or less but over 13 weeks								
Coultas 2005[112] A	5	26	26	–0.9	No	51/72 (71)	26/37 (70)[a]	2.60 (–5.85 to 11.05)
Coultas 2005[112] B	5	26	26	3.4	No	49/72 (68)	26/37 (70)[a]	2.90 (–5.58 to 11.38)
Total (I^2=0.0%, p=0.961)								2.75 (–3.24 to 8.74)
Follow-up over 26 weeks								
Hynninen 2010[256]	3	35	7	–4.4	No	25/25 (100)	26/26 (100)	0.40 (–0.15 to 0.95)
Lamers 2010[185]	4	39	13	–1.9	No	42/96 (44)	42/91 (46)	7.94 (2.62 to 13.26)
Bucknall 2012[63]	6	52	52	0.8	Yes	69/232 (30)	53/232 (23)	4.52 (–0.03 to 9.07)
Total (I^2=81.1%, p=0.005)								3.73 (–0.99 to 8.44)

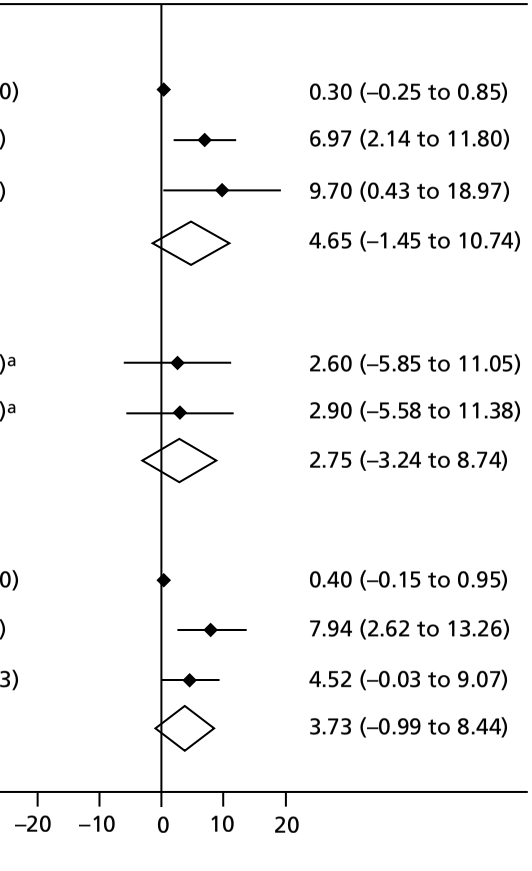


FIGURE 54 Health-related quality-of-life (SGRQ) outcomes for multicomponent SM interventions without an exercise element vs. UC/control. a, Indicates that the control group that has been halved in size (split between two comparisons). Coultas 2005[112] A = nurse-assisted collaborative management vs. UC; Coultas 2005[112] B = nurse-assisted medical management vs. UC.

TABLE 58 Health-related quality of life and admission outcomes for multicomponent interventions without exercise advice or support

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	3	4.65 (–1.45 to 10.74)	82.0
	> 3 to ≤ 6 months	2	2.75 (–3.24 to 8.74)	0
	> 6 months	3	3.73 (–0.99 to 8.44)	81.1
			Summary HR (95% CI)	
Admissions	≤ 3 months	1	0.32 (0.03 to 3.03)	n/a
	> 6 months	2	0.99 (0.76 to 1.30)	0

n/a, not applicable.

Results were combined for two trials that reported hospital admission rates at 3–6 months.[63,142] Neither reported a statistically significant reduction in admissions (*Figure 55*). Three other trials[112,136,142] that reported hospital admissions at last follow-up did not find any significant difference between study groups. Koff *et al.*[120] reported no significant difference in exacerbations at 3 months' follow-up.

Summary: role of exercise in multicomponent interventions

- Multicomponent interventions with supervised exercise compared with UC have a positive effect on HRQoL and positive trend for hospital admissions but not reaching statistical significance.
- For multicomponent interventions with structured, unsupervised exercise there is evidence of effectiveness on HRQoL in the medium term, but insufficient evidence for hospital admissions and exacerbations.
- For interventions with advice to increase exercise in an unstructured manner there were few trials, but no evidence of overall effect on HRQoL, hospital admissions or exacerbations.
- There were limited numbers of studies of multicomponent interventions without any exercise counselling. There is some evidence that they may lead to short-term improvements in HRQoL, but there was inconclusive evidence for hospital admissions.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Koff 2009[120]	6	13	13	No	20	1	20	3	0.32 (0.03 to 3.03)
Follow-up over 26 weeks									
Cockcroft 1987[142]	3			No	42	25	33	17	1.25 (0.67 to 2.31)
Bucknall 2012[63]	6	52	52	Yes	232	88	232	92	0.94 (0.70 to 1.27)
Total (I^2=0.0%, p=0.422)									0.99 (0.76 to 1.30)

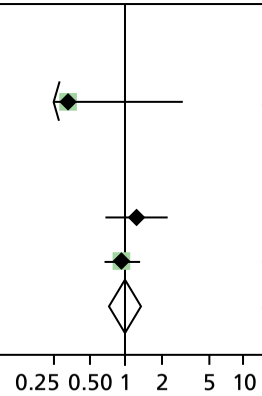


FIGURE 55 Admissions outcomes for multicomponent SM interventions without an exercise element vs. UC/control.

Self-management interventions including an exercise component consisting of aerobic and strength training

Given the possible influence of exercise, we further explored the effect of different types of exercise interventions by first examining the effects of interventions that include both aerobic and strength training.

The summary meta-analysis result indicates that, on average, the combined aerobic/strength exercise arm has a SGRQ score of 7.80 points higher than the UC arm (95% CI 2.82 to 12.79 points). However, this is the average of the distribution of intervention effects and this distribution was wide as a result of high heterogeneity ($I^2 = 81.5\%$). The prediction interval, in which 95% of the distribution of the effects occur, is –10.60 to 26.21, which is mainly in favour of the intervention, but also indicates that the intervention is not always effective. At the mid follow-up point of 3–6 months, the estimate of the average effect was 3.76 points on the SGRQ (95% CI 2.13 to 5.39 points; $I^2 = 0\%$) favouring the intervention group. However, at > 6 months there was no evidence of effect (*Figure 56* and *Table 59*). The CRQ results favoured the intervention group up to 6 months' follow-up (*Figure 57*).

We identified six trials[148,154,160,213,227,270] reporting hospital admissions but at no follow-up time point was the average effect significantly in favour of the intervention arm (*Figure 58* and *Table 59*).

Similarly, the average effects of the four trials reporting exacerbations,[154,182,213,284] showed no evidence of effect of aerobic and strength training (*Figure 59*).

Summary: strength and aerobic exercise interventions

Favourable effect on HRQoL and hospital admissions (although not statistically significant). No evidence of effect on exacerbations.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start)(%)	Control *n*(end)/*n*(start)(%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Paz-Diaz 2007[269]	2	9	8	3.0	No	10/10 (100)	14/14 (100)	13.00 (1.79 to 24.21)
Seymour 2010[154]	3	13	8	6.7	Yes	23/30 (77)	26/30 (87)	8.20 (1.30 to 15.10)
de Blok 2006[181]	3	9	9	8.3	No	8/10 (80)	8/11 (73)	–11.60 (–29.69 to 6.49)
Brooks 2002[193]	5	13	52	0.5	No	36/37 (97)	48/48 (100)	–2.90 (–6.00 to 0.20)
Ringbaek 2000[226]	5	8	8	5.5	No	17/24 (71)	21/21 (100)	–0.10 (–10.00 to 9.80)
Ko 2011[213]	6	13	8	3.9	No	30/30 (100)	30/30 (100)	6.76 (–2.68 to 16.20)
Man 2004[148]	6	13	8	–4.2	No	18/21 (86)	16/21 (76)	12.70 (4.65 to 20.75)
Elci 2008[236]	7	13	13		No	39/39 (100)	39/39 (100)	19.59 (13.03 to 26.15)
Kayahan 2006[238]	7	9	8	–5.6	No	26/26 (100)	19/19 (100)	18.71 (8.96 to 28.46)
Boxall 2005[160]	8	12	12	–4.5	No	23/30 (77)	23/30 (77)	8.90 (1.63 to 16.17)
Karapolat 2007[237]	8	12	8	–5.6	No	26/27 (96)	19/22 (86)	10.90 (0.87 to 20.93)
Theander 2009[220]	8	12	12	8.0	No	12/15 (80)	14/15 (93)	5.00 (–3.84 to 13.84)
Bestall 2003[141]	11	8	8	–2.0	No	29/29 (100)	27/27 (100)	6.00 (–1.38 to 13.38)
Total (I^2=81.5%, p<0.001)								7.80 (2.82 to 12.79)
Follow-up 26 weeks or less but over 13 weeks								
Hoogendoorn 2009[182a]	4	17	104	1.0	Yes	87/102 (85)	88/97 (91)	4.10 (1.31 to 6.89)
Brooks 2002[193]	5	26	52	0.5	No	31/37 (84)	45/48 (94)	3.30 (–0.04 to 6.64)
Ko 2011[213]	6	26	8	3.9	No	30/30 (100)	30/30 (100)	9.14 (–0.74 to 19.02)
Monninkhof 2003[186]	10	26	52	–0.9	No	124/127 (98)	117/121 (97)	1.30 (–3.00 to 5.60)
Bestall 2003[141]	11	26	8	–2.0	No	28/29 (97)	24/27 (89)	7.00 (–2.10 to 16.10)
Bourbeau 2003[192]	12	17	8	–1.6	No	88/96 (92)	84/95 (88)	4.20 (0.70 to 7.70)
Total (I^2=0.00%, p=0.688)								3.76 (2.13 to 5.39)
Follow-up over 28 weeks								
Brooks 2002[193]	5	52	52	0.5	No	18/37 (49)	24/48 (50)	1.40 (–4.14 to 6.94)
Ko 2011[213]	6	52	8	3.9	No	30/30 (100)	30/30 (100)	1.81 (–9.42 to 13.04)
Engstrom 1999[219]	7	52	52	3.3	No	26/26 (100)	24/24 (100)	–3.10 (–12.39 to 6.19)
Monninkhof 2003[186]	10	52	52	–0.9	No	122/127 (96)	113/121 (93)	–0.60 (–2.85 to 1.65)
Bestall 2003[141]	11	52	8	–2.0	No	26/29 (90)	21/27 (78)	4.00 (–5.05 to 13.05)
Bourbeau 2003[192]	12	52	8	–1.6	No	81/96 (84)	76/95 (80)	2.00 (–1.85 to 5.85)
Total (I^2=0.0%, p=0.740)								0.27 (–1.47 to 2.01)

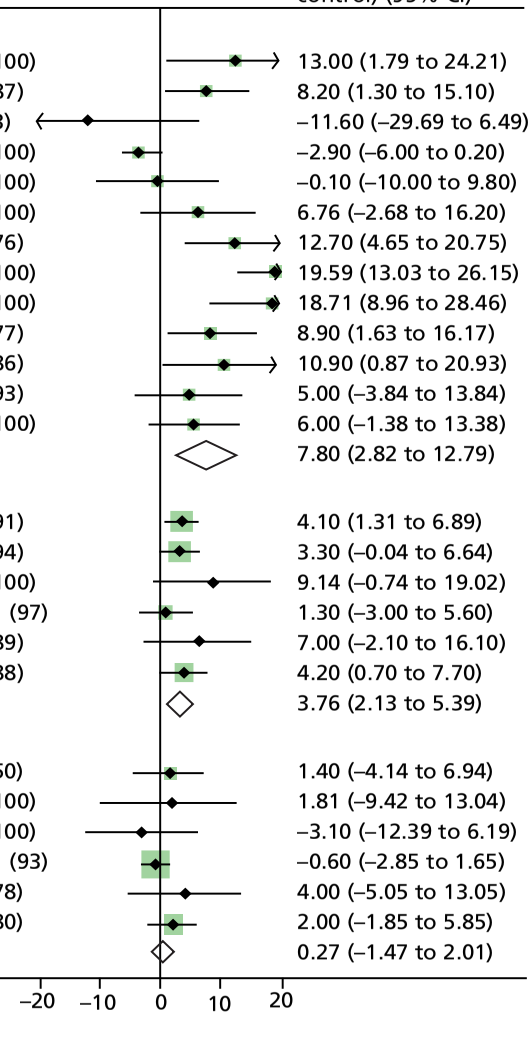


FIGURE 56 Health-related quality-of-life (SGRQ) outcomes for combined strength and aerobic exercise interventions with SM components vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

TABLE 59 Outcomes for combined strength and aerobic exercise interventions compared with UC

Outcome	Time frame	No. of studies (comparisons)	Summary MD (95% CI)	I^2 (%)	95% prediction interval
SGRQ	≤ 3 months	13	7.80 (2.82 to 12.79)	81.5	–10.60 to 26.21
	> 3 to ≤ 6 months	6	3.76 (2.13 to 5.39)	0.0	1.45 to 6.07
	> 6 months	6	0.27 (–1.47 to 2.01)	0.0	–2.20 to 2.74
CRQ	≤ 3 months	4	0.27 (0.00 to 0.53)	0	–
	> 3 to ≤ 6 months	2	0.55 (0.02 to 1.09)	32.1	–
	> 6 months	1	0.10 (–0.50 to 0.70)	70.1	–
			Summary HR (95% CI)		
Admissions	≤ 3 months	4	0.67 (0.42 to 1.09)	23.1	–
	> 3 to ≤ 6 months	1	0.55 (0.25 to 1.18)	n/a	–
	> 6 months	2	0.75 (0.41 to 1.37)	68.2	–
Exacerbations	≤ 3 months	2	0.80 (0.11 to 5.83)	65.4	–
	> 3 to ≤ 6 months	1	1.01 (0.57 to 1.79)	n/a	–
	> 6 months	2	1.09 (0.77 to 1.53)	37.4	–

n/a, not applicable.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Janaudis-Ferreira 2011[197]	4	6	6	–0.4	No	13/17 (76)	18/19 (95)	0.10 (–0.36 to 0.56)
Bendstrup 1997[222]	9	12	12	0.2	No	16/22 (73)	16/20 (80)	0.40 (–0.11 to 0.91)
Bestall 2003[141]	11	8	8	–0.3	No	29/29 (100)	27/27 (100)	0.20 (–0.28 to 0.68)
Oh 2003[283]	11	8	8	–0.4	No	15/19 (79)	8/15 (53)	0.61 (–0.18 to 1.41)
Total (I^2=0.0%, p=0.665)								0.27 (0.00 to 0.53)
Folllow-up 26 weeks or less but over 13 weeks								
Bendstrup 1997[222]	9	24	12	0.2	No	16/22 (73)	16/20 (80)	0.85 (0.19 to 1.50)
Bestall 2003[141]	11	26	8	–0.3	No	28/29 (97)	24/27 (89)	0.30 (–0.29 to 0.89)
Total (I^2=32.1%, p=0.225)								0.55 (0.02 to 1.09)
Follow-up over 26 weeks								
Bestall 2003[141]	11	52	8	–0.3	No	26/29 (90)	21/27 (78)	0.10 (–0.50 to 0.70)

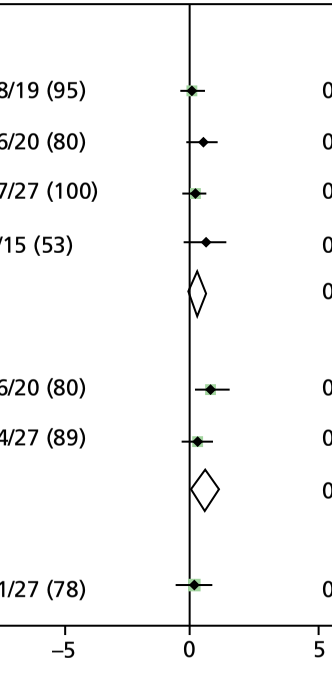


FIGURE 57 Health-related quality-of-life (CRQ) outcomes for combined strength and aerobic exercise interventions with SM components vs. UC.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Seymour 2010[154]	3	13	8	No	30	2	30	10	0.17 (0.04 to 0.78)
Man 2004[148]	6	13	8	Yes					0.66 (0.30 to 1.48)
Boxall 2005[160]	8	13	12	No	23	5	23	5	1.00 (0.29 to 3.45)
Eaton 2009[227]	11	13	8	No	47	36	50	34	0.78 (0.49 to 1.25)
Total (I^2=23.1/%, p=0.273)									0.67 (0.42 to 1.09)
Follow-up 26 weeks or less but over 13 weeks									
Boxall 2005[160]	8	26	12	No	23	11	23	16	0.55 (0.25 to 1.18)
Follow-up over 26 weeks									
Ko 2011[213]	6	52	8	No	30	16	30	13	1.03 (0.62 to 1.73)
Bourbeau 2003[192]	12	52	8	No	96	31	95	48	0.55 (0.35 to 0.87)
Total (I^2=68.2%, p=0.076)									0.75 (0.41 to 1.37)

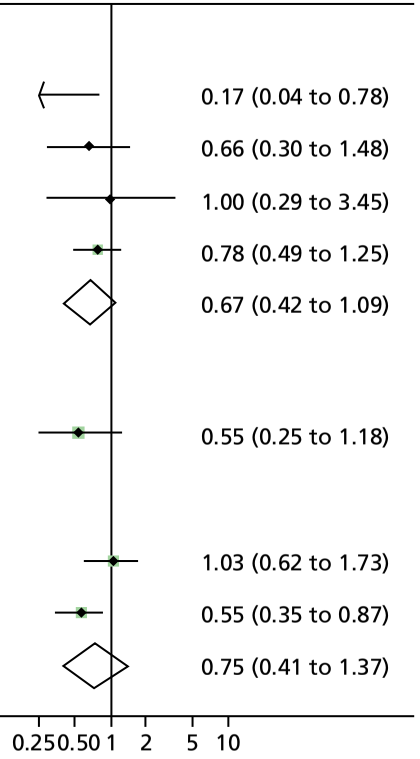


FIGURE 58 Admission outcomes for combined strength and aerobic exercise interventions with SM components vs. UC.

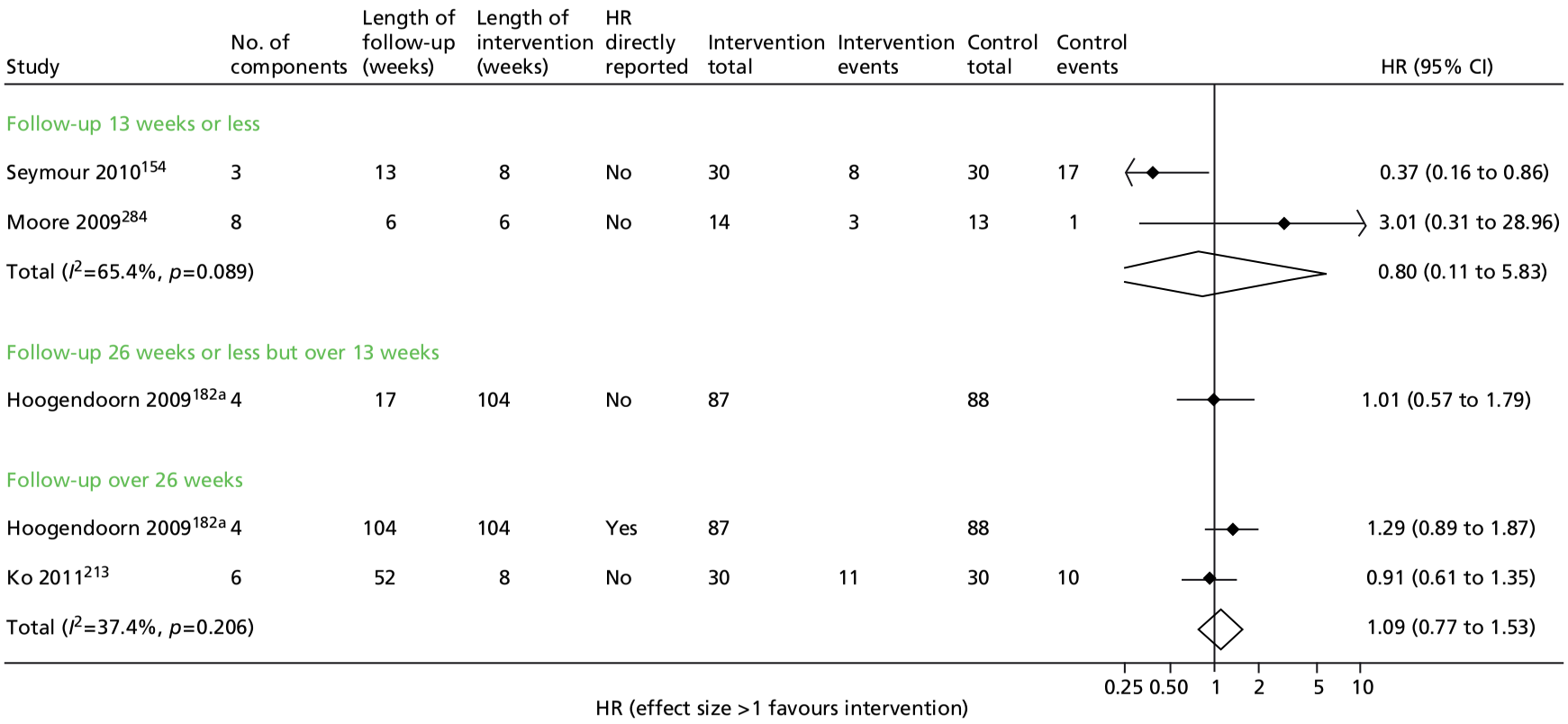


FIGURE 59 Exacerbation outcomes for combined strength and aerobic exercise interventions with SM components vs. UC. a, Indicates that several papers are represented by this lead publication. Details are given in *Appendix 22*.

Strength and aerobic exercise training compared with aerobic training only

To investigate the effect of strength training, we evaluated the effects of studies reporting the addition of strength training over aerobic training. Two trials reported this comparison at 3 months' follow-up.[233,246] On average combined training has a SGRQ 4.23 points (95% CI –8.75 to 17.22 points) higher than aerobic training alone, but this effect is not statistically significant (*Figure 60*).

Summary: strength training

Limited evidence from only two trials;[233,246] no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Dourado 2009[233] B	1	12	12	–5.0	No	11/14 (79)	13/19 (68)	6.00 (–7.65 to 19.65)
Vonbank 2012[246] B	1	12	12	12.8	No	12/12 (100)	12/12 (100)	–12.50 (–54.52 to 29.52)
Total (I^2=0.0%, p=0.412)								4.23 (–8.75 to 17.22)

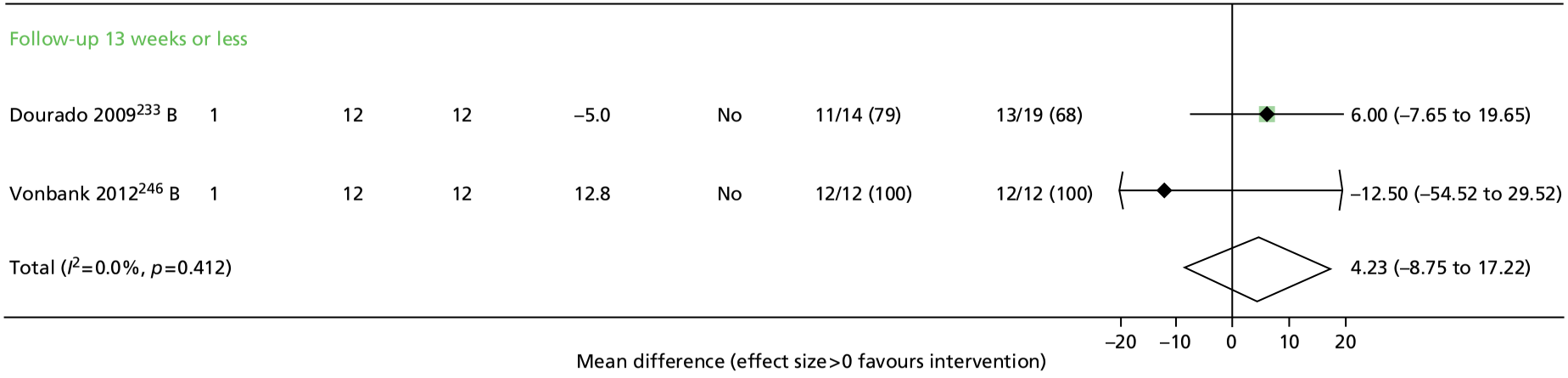


FIGURE 60 Health-related quality-of-life (SGRQ) outcomes for strength and aerobic exercise training interventions vs. aerobic exercise only. Dourado 2009[233] B = strength training and low-intensity general training vs. low-intensity general training; Vonbank 2012[246] B = strength and endurance training vs. endurance training.

Endurance training compared with strength/resistance training

To explore which of the strength or endurance training was more effective we examined trials directly comparing both. Four trials reported HRQoL for this comparison (*Figures 61* and *62*).[216,233,246,247] At none of the follow-up points was there any evidence of a significant difference in average effect (*Table 60*). Only one trial reported hospital admission rates, which showed no evidence of effect (HR 0.68, 95% CI 0.22 to 2.13) (*Figure 63*).[247]

Summary: endurance training compared with strength/resistance training

Limited evidence; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Dourado 2009[233] C	1	12	12	2.0	No	13/19 (68)	11/15 (73)	–4.00 (–19.00 to 11.00)
Vonbank 2012[246] C	1	12	12	–14.4	No	12/12 (100)	12/12 (100)	11.00 (–27.58 to 49.58)
Arnardottir 2006[216]	2	8	8	–1.4	No	20/31 (65)	22/32 (69)	1.00 (–7.78 to 9.78)
Total (I^2=0.0%, p=0.728)								0.14 (–7.30 to 7.58)
Follow-up 26 weeks or less but over 13 weeks								
Arnardottir 2006[216]	2	26	8	–1.4	No	17/31 (55)	18/32 (56)	0.90 (–11.65 to 13.45)
Follow-up over 26 weeks								
Arnardottir 2006[216]	2	52	8	–1.4	No	17/31 (55)	15/32 (47)	1.30 (–7.02 to 9.62)

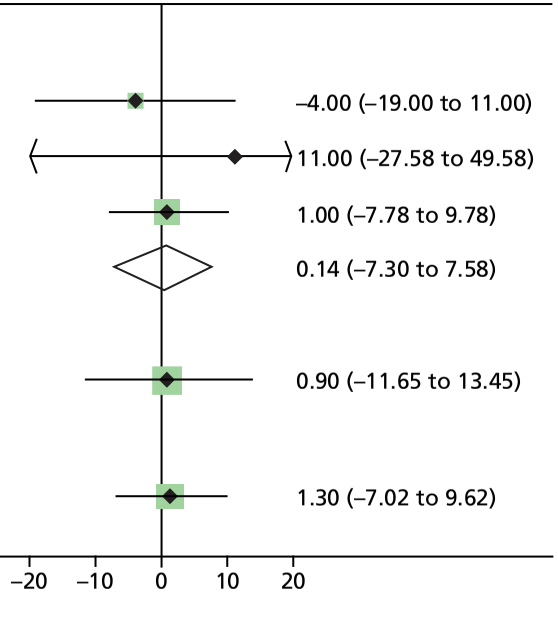


FIGURE 61 Health-related quality-of-life (SGRQ) outcomes for endurance training vs. strength/resistance exercise training. Dourado 2009[233] C = low-intensity general training vs. strength training; Vonbank 2012[246] C = endurance training vs. strength training.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Spruit 2002[247]	1	12	12	0.2	No	16/24 (67)	14/24 (58)	0.00 (–0.90 to 0.90)

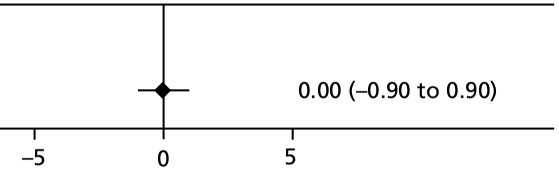


FIGURE 62 Health-related quality-of-life (CRQ) outcomes for endurance training vs. strength/resistance exercise training.

TABLE 60 Health-related quality of life and admissions outcomes for endurance training compared with strength/resistance training

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	3	0.14 (–7.30 to 7.58)	0
	> 3 to ≤ 6 months	1	0.90 (–11.65 to 13.45)	n/a
	> 6 months	1	1.30 (–7.02 to 9.62)	n/a
CRQ	≤ 3 months	1	0.0 (–0.90 to 0.90)	n/a
			Summary HR (95% CI)	
Admissions	≤ 3 months	1	0.68 (0.22 to 2.13)	n/a

n/a, not applicable.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 13 weeks or less									
Spruit 2002[247]	1	12	12	No	24	5	24	7	0.68 (0.22 to 2.13)

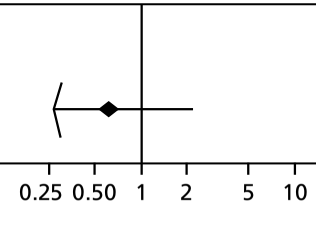


FIGURE 63 Admission outcomes for endurance training vs. strength/resistance exercise training.

Upper and lower limb training compared with lower limb training only

This analysis aimed to explore the addition of upper limb training, which trains accessory respiratory muscles. Only one trial[263] of 48 participants reported the CRQ immediately post intervention at 8 weeks with no evidence of effect (–0.21, 95% CI –0.85 to 0.42) (*Figure 64*).

Summary: upper limb training

Limited evidence from one trial[263] only; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Sívori 1998[263]	1	8	8	–0.6	No	14/14 (100)	14/14 (100)	–0.21 (–0.85 to 0.42)

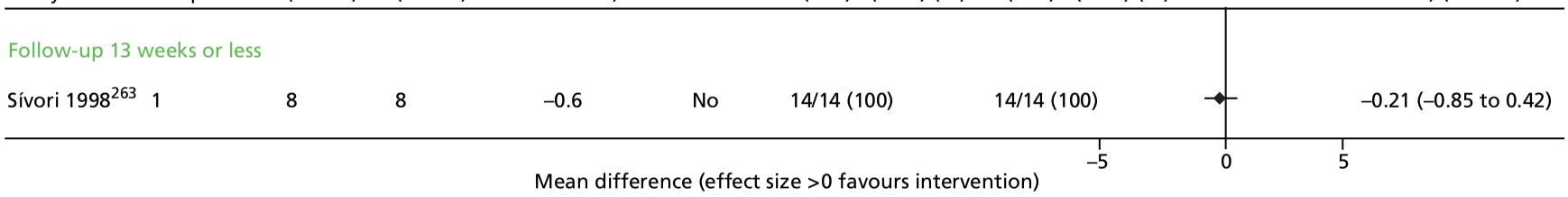


FIGURE 64 Health-related quality-of-life (CRQ) outcomes of upper and lower limb training vs. lower limb training only.

Interval compared with continuous exercise

We explored whether interval or continuous exercise training was more effective. In a direct comparison, three trials reported the CRQ at ≤ 3 months (*Figure 65*).[124,257,265] There was no evidence of a difference in average effect of interval exercise compared with continuous exercise interventions (CRQ –0.14, 95% CI –0.32 to 0.04; $I^2 = 0\%$) (see *Figure 65*).

Summary: interval training compared with continuous training

Limited evidence; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Mador 2009[124]	3	8	8	0.1	No	21/25 (84)	20/23 (87)	0.21 (–0.39 to 0.81)
Puhan 2006[257]	4	5	5	–0.2	No	44/49 (90)	46/51 (90)	–0.08 (–0.42 to 0.26)
Vogiatzis 2002[265]	7	13	12		No	18/22 (82)	18/23 (78)	–0.21 (–0.43 to 0.01)
Total (I^2=0.0%, p=0.404)								–0.14 (–0.32 to 0.04)

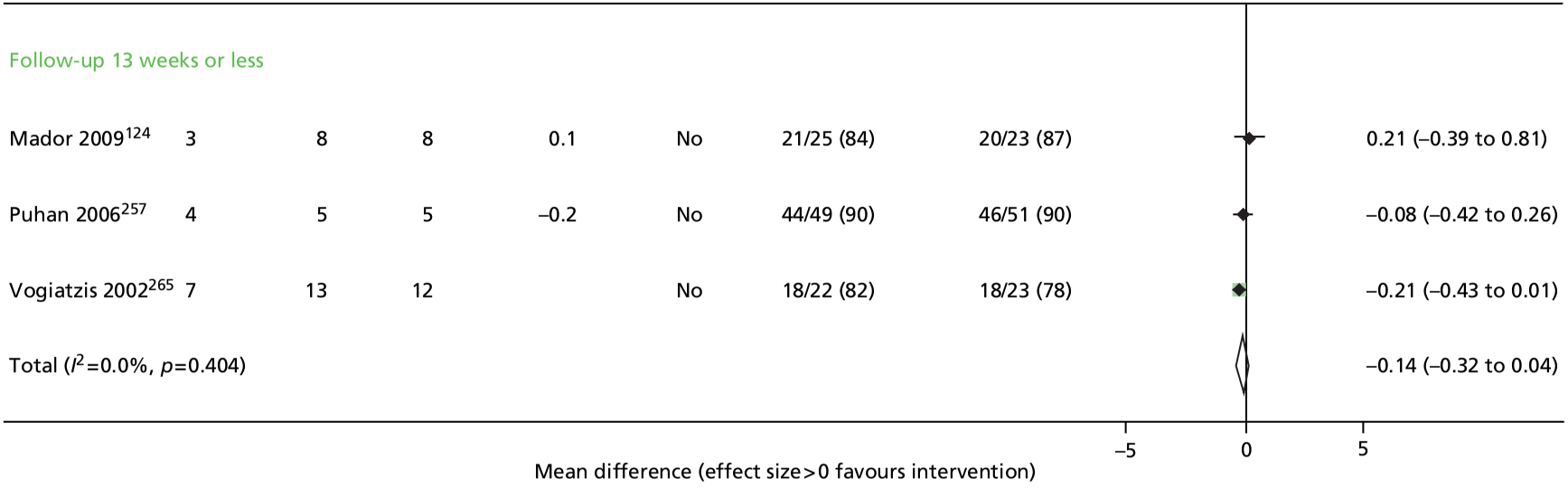


FIGURE 65 Health-related quality-of-life (CRQ) outcomes of interval vs. continuous training.

Inspiratory or expiratory muscle training compared with usual care or a sham intervention

Four trials[163,184,253,254] reported RMT compared with a UC or sham intervention. Two small trials[253,254] reported the SGRQ at three follow-up points but with wide CIs around a non-significant effect. Two small trials[163,184] reported the CRQ immediately post intervention at 5 and 8 weeks, with an average CRQ score of 0.44 points (95% CI –0.27 to 1.15) higher than UC, indicating a non-statistically significant improvement in HRQoL. Only one trial[253] reported hospital admissions, with a non-significantly lower HR in the RMT arm (HR 0.77, 95% CI 0.34 to 1.72) (*Figures 66–68* and *Table 61*).

Summary: inspiratory/expiratory muscle training

Limited evidence. Some evidence of potential effect on HRQoL in mid to longer term.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Beckerman 2005[253]	1	13	52	–2.1	No	17/21 (81)	14/21 (67)	6.40 (–11.62 to 24.42)
Magadle 2007[254]	3	13	26	1.8	No	16/16 (100)	15/15 (100)	–1.80 (–18.32 to 14.72)
Total (I^2=0.0%, p=0.511)								1.95 (–10.23 to 14.12)
Follow-up 26 weeks or less but over 13 weeks								
Beckerman 2005[253]	1	26	52	–2.1	No	17/21 (81)	14/21 (67)	9.70 (–6.86 to 26.26)
Magadle 2007[254]	3	26	26	1.8	No	16/16 (100)	15/15 (100)	6.20 (–10.32 to 22.72)
Total (I^2=0.0%, p=0.769)								7.95 (–3.75 to 19.64)
Follow-up over 26 weeks								
Beckerman 2005[253]	1	52	52	–2.1	No	17/21 (81)	14/21 (67)	13.00 (–2.25 to 28.25)
Magadle 2007[254]	3	39	26	1.8	No	16/16 (100)	15/15 (100)	6.30 (–11.16 to 23.76)
Total (I^2=0.0%, p=0.571)								10.10 (–1.38 to 21.59)

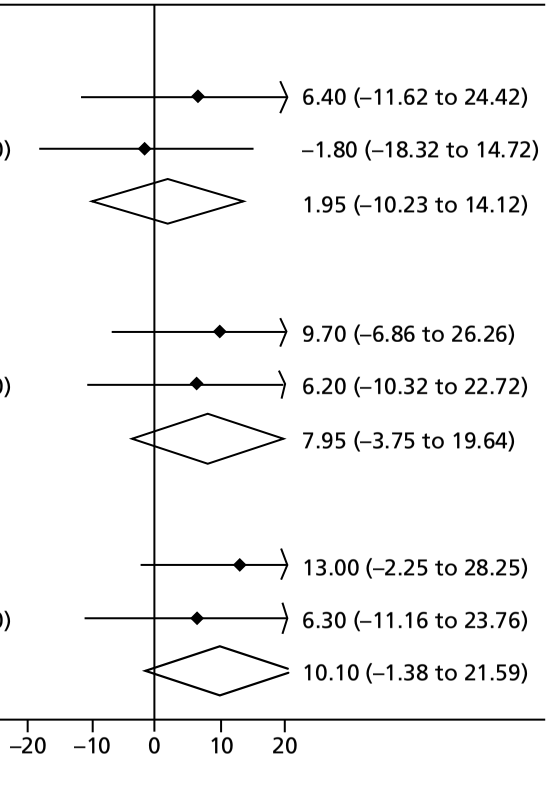


FIGURE 66 Health-related quality-of-life (SGRQ) outcomes for inspiratory and expiratory muscle training interventions vs. UC/control/sham training.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks of less								
Hill 2006[163]	1	8	8	0.4	No	16/18 (89)	17/17 (100)	0.80 (0.25 to 1.35)
Koppers 2006[184]	1	5	5	–0.2	No	18/18 (100)	18/18 (100)	0.08 (–0.47 to 0.63)
Total (I^2=69.8%, p=0.069)								0.44 (–0.27 to 1.15)

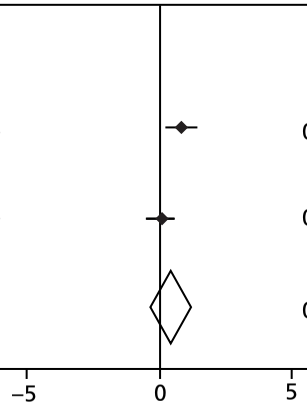


FIGURE 67 Health-related quality-of-life (CRQ) outcomes for inspiratory and expiratory muscle training interventions vs. UC/control/sham training.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up over 26 weeks									
Beckerman 2005[253]	1	52	52	No	21	11	21	13	0.77 (0.34 to 1.72)

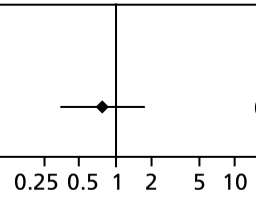


FIGURE 68 Admission outcomes for inspiratory muscle training and expiratory muscle training interventions vs. UC/control/sham training.

TABLE 61 Health-related quality of life and admissions outcomes for inspiratory and expiratory muscle training compared with UC/sham

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	2	1.95 (–10.23 to 14.12)	0
	> 3 to ≤ 6 months	2	7.95 (–3.75 to 19.64)	0
	> 6 months	2	10.10 (–1.38 to 21.59)	0
CRQ	≤ 3 months	2	0.80 (–0.27 to 1.15)	69.8
			Summary HR (95% CI)	
Admissions	≤ 3 months	1	0.77 (0.34 to 1.72)	n/a

n/a, not applicable.

Direct comparison of more sessions/longer duration with shorter programmes

This analysis investigated the effect of longer programmes: 7 weeks' duration compared with 4 weeks' duration,[144] additional exercise sessions following a course of PR[224] or two compared with one repeat PR sessions.[244] It did not investigate the intensity of exercise undertaken within a session. There is no evidence that longer programmes or more sessions lead to improved SGRQ scores or reduced exacerbations (*Figures 69–71* and *Table 62*).

Summary: more sessions/longer-duration interventions

Limited evidence; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intevention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Romagnoli 2006[244]	5	4	52	1.0	No	17/17 (100)	18/18 (100)	1.00 (–8.15 to 10.15)
Linneberg 2012[224]	6	13	45	4.8	No	53/59 (90)	58/59 (98)	–0.10 (–4.10 to 3.90)
Total (I^2=0.0%, p=0.829)								0.08 (–3.59 to 3.74)
Follow-up 26 weeks or less but over 13 weeks								
Romagnoli 2006[244]	5	26	52	1.0	No	16/17 (94)	16/18 (89)	2.00 (–6.83 to 10.83)
Linneberg 2012[224]	6	26	45	4.3	No	51/59 (86)	56/59 (95)	–2.90 (–7.05 to 1.25)
Total (I^2=0.0%, p=0.325)								–2.01 (–5.77 to 1.74)
Follow-up over 26 weeks								
Romagnoli 2006[244]	5	56	52	1.0	No	14/17 (82)	15/18 (83)	–1.00 (–5.74 to 3.74)
Linneberg 2012[224]	6	52	45	3.4	No	49/59 (83)	50/59 (85)	–3.40 (–7.20 to 0.40)
Total (I^2=0.0%, p=0.439)								–2.46 (–5.42 to 0.50)

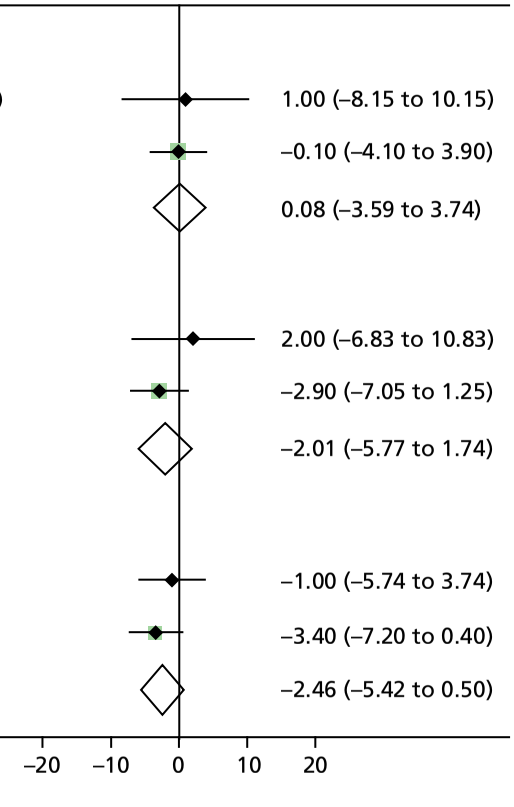


FIGURE 69 Health-related quality-of-life (SGRQ) outcomes for SM interventions of a longer duration vs. SM interventions of a shorter duration.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Green 2001[144]	2	7	7	0.5	No	21/21 (100)	23/23 (100)	0.61 (0.15 to 1.07)
du Moulin 2009[206]	7	13	3	0.4	No	10/10 (100)	10/10 (100)	0.80 (0.16 to 1.44)
Total (I^2=0.0%, p=0.637)								0.68 (0.30 to 1.05)
Follow-up 26 weeks or less but over 13 weeks								
du Moulin 2009[206]	7	26	3	0.4	No	10/10 (100)	10/10 (100)	1.10 (0.39 to 1.81)

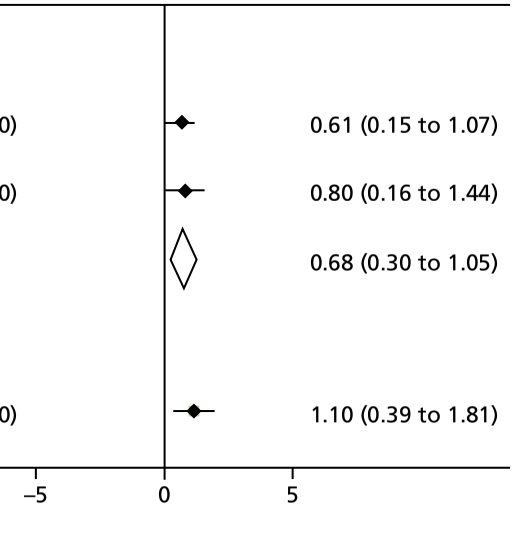


FIGURE 70 Health-related quality-of-life (CRQ) outcomes for SM interventions of a longer duration vs. SM interventions of a shorter duration.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 26 weeks or less but over 13 weeks									
du Moulin 2009[206]	7	26	3	No	10	0	10	1	0.09 (0.00 to 55.93)

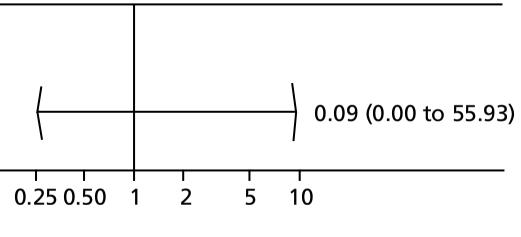


FIGURE 71 Exacerbation outcomes for SM interventions of a longer duration vs. SM interventions of a shorter duration.

TABLE 62 Health-related quality of life and exacerbations for longer/more sessions compared with shorter/fewer sessions programmes

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	2	0.08 (–3.59 to 3.74)	0.0
	> 3 to ≤ 6 months	2	–2.01 (–5.77 to 1.74)	0.0
	> 6 months	2	–2.46 (–5.42 to 0.50)	0.0
			Summary HR (95% CI)	
Exacerbations	> 3 to ≤ 6 months	1	0.09 (0.00 to 55.93)	n/a

n/a, not applicable.

Hospital compared with home location

Four trials reported disease-specific HRQoL outcomes in hospital with or without home locations compared with a home-based programme (*Table 63*).[64,169,177,198] There was no evidence of an average effect that differed between the comparison groups in HRQoL at any of the follow-up points except for one small trial at 6 months' follow-up[64] (*Figures 72* and *73*). In Maltais *et al.*[198] both groups received a 4-week outpatient supervised educational package, while the exercise component was either hospital- or home-based.

Summary: hospital-based compared with home-based interventions

Limited evidence; no evidence of effect.

TABLE 63 Health-related quality of life and admissions outcomes for hospital compared with home SM interventions

Outcome	Time frame	No. of studies	Summary MD (95% CI)	I^2 (%)
SGRQ	≤ 3 months	2	–0.25 (–4.58 to 4.09)	28.2
	> 3 to ≤ 6 months	1	3.00 (–4.94 to 10.94)	n/a
	> 6 months	2	–1.94 (–5.26 to 1.38)	15.6
CRQ	≤ 3 months	2	0.33 (–1.09 to 1.75)	93.7
	> 3 to ≤ 6 months	1	1.95 (1.33 to 2.57)	n/a

n/a, not applicable.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Spencer 2010[169]	2	13	52	–5.0	No	24/31 (77)	24/28 (86)	4.00 (–4.51 to 12.51)
Maltais 2008[198]	4	13	12		No	95/126 (75)	89/126 (71)	–1.40 (–4.25 to 1.45)
Total (I^2=28.2%, p=0.238)								–0.25 (–4.58 to 4.09)
Follow-up 26 weeks or less but over 13 weeks								
Spencer 2010[169]	2	26	52	–5.0	No	24/31 (77)	24/28 (86)	3.00 (–4.94 to 10.94)
Follow-up over 26 weeks								
Spencer 2010[169]	2	52	52	–5.0	No	24/31 (77)	24/28 (86)	–5.00 (–11.50 to 1.50)
Maltais 2008[198]	4	52	12		No	95/126 (75)	89/126 (71)	–1.00 (–4.10 to 2.10)
Total (I^2=15.6, p=0.276)								–1.94 (–5.26 to 1.38)

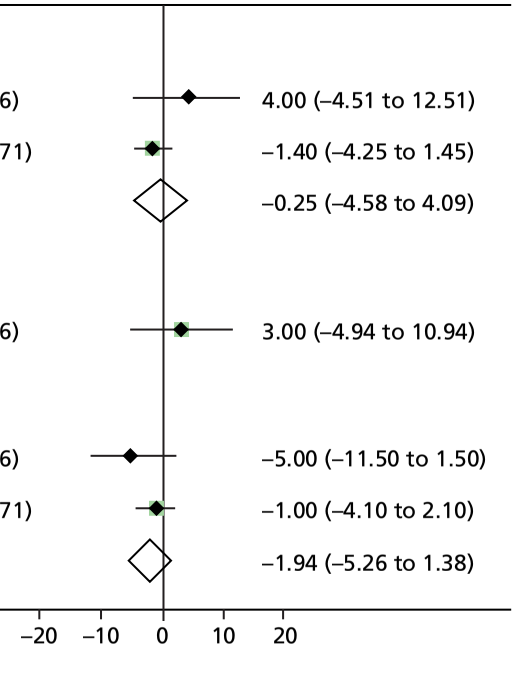


FIGURE 72 Health-related quality-of-life (SGRQ) outcomes for SM interventions delivered in hospital vs. delivered at home.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intevention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 13 weeks or less								
Behnke 2000[64]	3	13	26	0.1	No	15/23 (65)	15/23 (65)	1.05 (0.56 to 1.54)
Puente-Maestu 2000[177]	3	8	8	–0.2	No	21/25 (84)	20/24 (83)	–0.40 (–0.91 to 0.12)
Total (I^2=93.7%, p<0.001)								0.33 (–1.09 to 1.75)
Follow-up 26 weeks or less but over 13 weeks								
Behnke 2000[64]	3	26	26	0.1	No	15/23 (65)	15/23 (65)	1.95 (1.33 to 2.57)

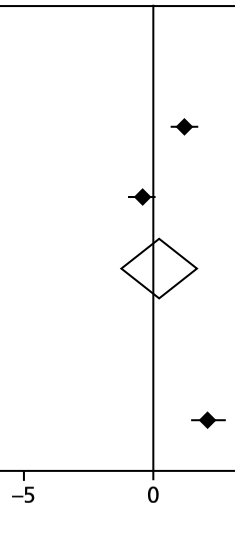


FIGURE 73 Health-related quality-of-life (CRQ) outcomes for SM interventions delivered in hospital vs. delivered at home.

Delivery by pharmacists

We aimed to explore any effects by professional delivering care. The majority of interventions were delivered by nurses or physiotherapists. Three trials[136,251,266,285] had a SM intervention delivered by a pharmacist with a UC comparator. Of these, two trials[251,266] reported the SGRQ, with a higher average effect in favour of the pharmacist-led intervention at 6 months (2.74, 95% CI –1.54 to 7.03; $I^2 = 30.3\%$), but this was not statistically significant (*Figure 74*). At 1-year follow-up, Khdour *et al.*[251] reported a non-significant difference of 3.80 SGRQ points in favour of the pharmacist-led intervention (95% CI –1.95 to 9.55 points). Jarab *et al.*[266] reported a significant reduction in hospital admissions at 6 months (HR 0.26, 95% CI 0.07 to 0.93) (*Figure 75*).

Summary: delivery by pharmacists

Insufficient evidence; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up 26 weeks of less but over 13 weeks								
Jarab 2012[266]	5	26	1	0.4	No	63/66 (95)	64/67 (96)	0.80 (–3.84 to 5.44)
Khdour 2009[251]	10	26	1	–0.6	No	71/86 (83)	72/87 (83)	5.20 (–0.30 to 10.70)
Total (I^2=30.3%, p=0.231)								2.74 (–1.54 to 7.03)
Follow-up over 26 weeks								
Khdour 2009[251]	10	52	1	–0.6	No	71/86 (83)	72/87 (83)	3.80 (–1.95 to 9.55)

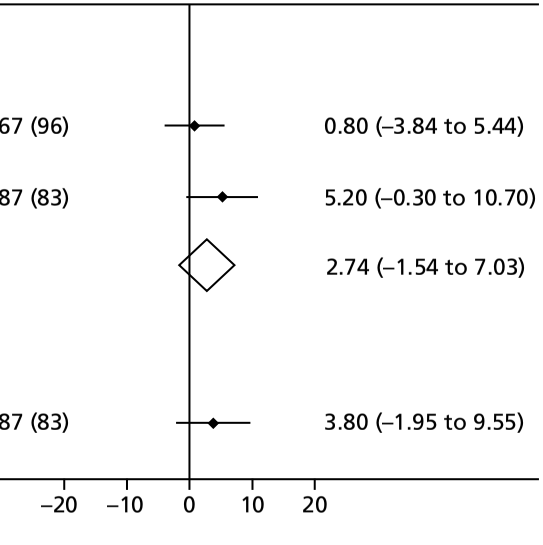


FIGURE 74 Health-related quality-of-life (SGRQ) outcomes for pharmacist-led interventions.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up 26 weeks or less but over 13 weeks									
Jarab 2012[266]	5	26	1	No	66	3	67	11	0.26 (0.07 to 0.93)

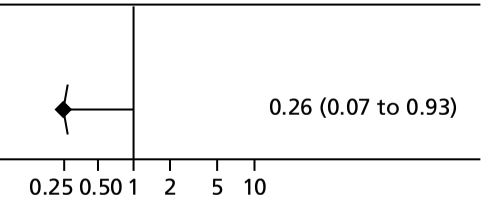


FIGURE 75 Admission outcomes for pharmacist-led interventions.

Maintenance programme post pulmonary rehabilitation compared with no maintenance programme

No combined analyses were possible for this analysis. Romagnoli *et al.*[244] found no evidence of effect on HRQoL from a maintenance programme following PR at 4, 26 or 52 weeks (*Figure 76*). At 2 years' follow-up, Sridhar *et al.*[155] reported a significantly greater CRQ score (2.04, 95% CI 0.37 to 3.71) but no effect on hospital admissions (HR 1.11, 95% CI 0.65 to 1.91) or exacerbations (HR 1.00, 95% CI 0.68 to 1.46) (*Figures 77–79*).

Summary: maintenance programme post rehabilitation

Limited evidence; no evidence of effect.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95%CI)
Follow-up 13 weeks or less								
Romagnoli 2006[244]	5	4	52	1.0	No	17/17 (100)	18/18 (100)	1.00 (–8.15 to 10.15)
Follow-up 26 weeks or less but over 13 weeks								
Romagnoli 2006[244]	5	26	52	1.0	No	16/17 (94)	16/18 (89)	2.00 (–6.83 to 10.83)
Follow-up over 26 weeks								
Romagnoli 2006[244]	5	56	52	1.0	No	14/17 (82)	15/18 (83)	–1.00 (–5.74 to 3.74)

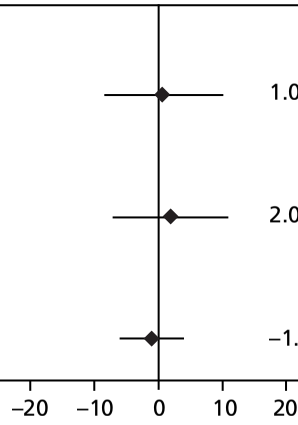


FIGURE 76 Health-related quality-of-life (SGRQ) outcomes for maintenance PR vs. PR with no maintenance period.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	Baseline difference (intervention–control)	ANCOVA	Intervention *n*(end)/*n*(start) (%)	Control *n*(end)/*n*(start) (%)	Mean difference (intervention–control) (95% CI)
Follow-up over 26 weeks								
Sridhar 2008[155]	8	104	104	0.3	No	47/61 (77)	40/61 (66)	2.04 (0.37 to 3.71)

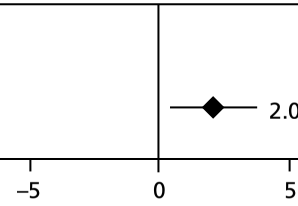


FIGURE 77 Health-related quality-of-life (CRQ) outcomes for maintenance PR vs. PR with no maintenance period.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up over 26 weeks									
Sridhar 2008[155]	8	104	104	No	55	29	49	24	1.11 (0.65 to 1.91)

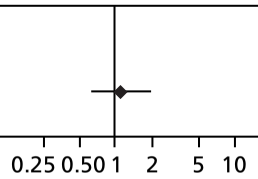


FIGURE 78 Admission outcomes for maintenance PR vs. PR with no maintenance period.

Study	No. of components	Length of follow-up (weeks)	Length of intervention (weeks)	HR directly reported	Intervention total	Intervention events	Control total	Control events	HR (95% CI)
Follow-up over 26 weeks									
Sridhar 2008[155]	8	104	104	No	61	53	61	53	1.00 (0.68 to 1.46)

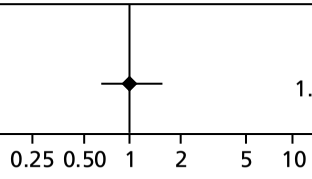


FIGURE 79 Exacerbation outcomes for maintenance PR vs. PR with no maintenance period.

Exploring heterogeneity using meta-regression

Meta-regression was used to explore the effects of risk of bias within studies, the average severity of COPD in the participants, the number of intervention components and the duration of the intervention. The last analysis is also clearly related to the follow-up time point. No clear pattern emerged. Although at up to 3 months' follow-up the trials of all multicomponent interventions with generally low risk of bias have a significantly higher SGRQ score than trials at higher risk of bias, this effect was not seen at any other time point or for subgroups of interventions. Similarly, increasing numbers of components were associated with significant improvements of SGRQ in analyses of all multicomponent interventions, but a small but opposite effect was seen for the effect of enhanced SM on hospital admissions. For multicomponent interventions, the population with severe COPD had a reduced improvement in SGRQ compared with those with moderate or less severe COPD. Inconsistent results were observed for length of follow-up (*Tables 64* and *65*).

Publication bias

We present funnel plots of the analyses, which included at least 10 studies (see *Appendices 28–33*). The asymmetric distribution apparent in several of the plots is suggestive of publication bias, with an Egger's test for asymmetry showing $p < 0.1$ in five of the six analyses with ≥ 10 trials. These patterns are consistent with an absence of smaller studies with negative outcomes. This would be consistent with biases observed in other literatures, particularly in the context of a comprehensive search of the literature such as the one carried out here. Although the publication bias is thus a genuine concern, the asymmetry may also be due to systematic associations between sample size and other heterogeneous characteristics that impact on outcome.

TABLE 64 Meta-regression of a range of SM interventions on the SGRQ

Category	Follow-up	Coefficient	95% CI	*p*-value
All multicomponent interventions				
Low risk of bias[a]	≤ 3 months	9.86	6.91 to 12.80	< 0.001
Severe population[b]		–3.84	–5.85 to –1.83	< 0.001
No. of components		1.36	0.89 to 1.84	< 0.001
Length of intervention (weeks):[c]				
14–26		–	–	–
27+		–10.16	–20.74 to 0.41	0.060
Low risk of bias[a]	> 3 to ≤ 6 months	–0.95	–5.52 to 3.62	0.684
Severe population[b]		–1.97	–7.00 to 3.06	0.443
No. of components		–0.51	–1.07 to 0.05	0.074
Length of intervention (weeks):[c]				
14–26		4.40	0.24 to 8.55	0.038
27+		–0.21	–4.27 to 3.85	0.918
Low risk of bias[a]	> 6 months	–0.10	–3.81 to 3.60	0.957
Severe population[b]		–2.90	–4.69 to –1.10	0.002
No. of components		–0.26	–0.81 to 0.29	0.358
Length of intervention (weeks):[c]				
14–26		4.48	–3.81 to 12.78	0.289
27+		1.76	0.22 to 3.30	0.025
Multicomponent interventions with supervised exercise				
Low risk of bias[a]	≤ 3 months	6.27	–1.37 to 13.91	0.108
Severe population[b]		1.70	–10.21 to 13.62	0.779
Number of components		1.19	–0.70 to 3.08	0.218
Length of intervention (weeks):[c]				
14–26		–	–	–
27+		–11.60	–22.11 to –1.09	0.031
Interventions including an exercise component consisting of aerobic and strength training				
Low risk of bias[a]	≤ 3 months	6.21	–2.19 to 14.62	0.148
Severe population[b]		2.08	–8.09 to 12.24	0.689
Number of components		0.60	–1.15 to 2.36	0.501
Length of intervention (weeks):[c]				
14–26		–	–	–
27+		–12.31	–21.94 to –2.68	0.012

a Reference is higher risk of bias.
b Reference is less severe population.
c Reference is intervention length of ≤ 13 weeks.

TABLE 65 Meta-regressions of enhanced care interventions on hospital admissions

Category	Follow-up	Coefficient	95% CI	*p*-value
Enhanced care				
Low risk of bias[a]	> 6 months	0.17	–0.34 to 0.68	0.513
Severe population[b]		–0.27	–1.02 to 0.49	0.492
No. of components		–0.08	–0.14 to –0.01	0.020
Length of intervention (weeks):[c]				
14–26		–	–	–
27+		0.39	–0.27 to 1.04	0.244

a Reference is higher risk of bias.
b Reference is less severe population.
c Reference is intervention length of ≤ 13 weeks.

Discussion

We report the findings of a large systematic review that has explored the components and delivery of SM interventions in order to try to identify the optimal mode of delivery and make-up of such interventions.

Key results

Overall we found that:

- There were a large number of relevant trials with our primary outcomes of interest but the majority were small, short term (≤ 3 months) and poorly reported.
- Almost half of the trials suffered from incomplete outcome reporting, which was likely to be an important source of bias for the HRQoL results in particular.
- Interventions were very heterogeneous and usually multicomponent.
- Exercise was the most common component, but other common components were breathing management techniques and general education about COPD and its management.
- Overall, the nature and results of the studies were so heterogeneous it was not appropriate to combine them all together.
- Studies assessing the effect of individual components were few but, from the evidence available, only exercise significantly improved patient outcomes, but this was restricted to HRQoL in the short term.
- Multicomponent interventions (with three or more components) produced combined effects which suggested that HRQoL was improved compared with UC. However, there was much statistical heterogeneity that could not be explained by length of follow-up. The results were also consistent with a potential reduction in admissions but, again, data were heterogeneous and the CIs crossing the line of no effect. Further exploration using meta-regression techniques indicated that the results could have been affected by the likely bias introduced in the study, the disease severity of the populations and the number of components in the interventions, although across time points, these findings were not stable.
- Subgroups of the multicomponent studies revealed that interventions with more enhanced care and support were effective in improving HRQoL and reducing admission rates among the studies of ≥ 6 months' duration.
- Furthermore, multicomponent interventions that included supervised exercise, or an unsupervised but structured exercise element, resulted in significant and clinically important improvements in HRQoL up to 6 months, although data were sometimes heterogeneous. There was insufficient evidence to comment on other outcomes.
- Further exploration of exercise did not reveal which type of exercise was more effective or whether duration/intensity was important.
- Insufficient evidence was available to assess the effect of delivery of SM type of health professional.

Comparison of findings with other reviews

Contents of self-management interventions

Through mapping the SM interventions and their individual components we are able to show the huge range of interventions, with differing components, delivered either as brief information/education or in a more supported manner. Exercise was the most frequent component and the most common component of single/two-component interventions. A recent systematic review by Stoilkova *et al.*[286] has mapped educational programmes in COPD management only, including studies published in the English language. This reported that over half of educational interventions had ≥ 10 topics incorporated within a programme. We took a much broader approach to defining SM, searching for studies that might include any of the relevant aspects of SM. Although we also found that a high proportion of trials evaluated multicomponent interventions, about one-fifth were single component, usually exercise only.

Role of behaviour change strategies

From the descriptions of interventions it was frequently not clear to what extent techniques for behaviour change were used in the SM education and support. Most intervention descriptions had no description of underlying behavioural change theory or the individual behaviour change strategies used. Some papers described using self-regulation theory, or Bandura's Social Learning Theory;[31] others described strategies such as self-monitoring, goal-setting, action planning and the use of biofeedback. The use of Abraham and Michie's[287] taxonomy of behaviour change to underpin the descriptions of the SM interventions would enable their relative contributions to be ascertained. Education is an important element of COPD SM interventions, with almost half of the studies in this review including this component. However, education as directly imparted provision of information is generally not effective by itself.[288] Information is effective when accompanied by active, behavioural strategies, and it is not clear to what extent these have been included within the interventions included in this review. Dishman *et al.*[289] identified that knowledge alone did not predict behaviour change, but that self-efficacy is an important cognitive determinant of change, showing that people have at least acquired the confidence and belief that they can self-manage their COPD. Trials that used action planning for an exacerbation generally failed to measure self-efficacy to determine whether they increased self-efficacy for identification of an exacerbation and confidence with commencing treatment. Given that action planning has not been found to be effective,[50] it is vital to explore the mechanisms by which it is proposed to work, to establish whether any lack of effect is due to a failure to commence treatment as a result of lack of confidence.

Behavioural change techniques that have been shown to be most effective in the promotion of physical activity and healthy eating in the general population may also be beneficial to encourage physical activity and exercise in people with COPD.[290] The technique associated with most effects was being prompted to self-monitor behaviour. Other techniques that appeared to be effective when combined with self-monitoring were prompting intention formation, goal-setting and providing feedback on performance. These would all be achievable as part of a SM intervention for people with COPD.

Results of effectiveness of self-management interventions

Overall the effect on HRQoL of multicomponent SM interventions was positive, with an average effect size of greater than four points on the SGRQ, which is considered to be the minimal clinically important difference. The effect of SM on admissions and exacerbations was less clear, possibly as a result of fewer trials in the analyses. Our plan was to explore the expected high levels of heterogeneity to try to identify formats of SM for COPD that looked particularly promising in terms of HRQoL and health service utilisation outcomes. These analyses were developed by the wider project steering group and aimed to have a clinical coherence. We decided not to repeat analyses that were the subject of recent Cochrane systematic reviews.

We have no evidence from our analyses that SM interventions with more components are better than those with fewer. The results from the meta-regression provided inconsistent results in relation to the risk of bias of the study, severity of the population's COPD and number of components.

Role of specific components of self-management

There were few studies that evaluated either single components of SM compared with UC, or the addition of an individual component to a wider package of care. The exploration of single component interventions is important, as it may be the case that it is easier for participants to focus on a single component better than a multicomponent intervention.

Action plans

A Cochrane systematic review investigated the effect of action plans with a brief educational component compared with UC.[50] There was no effect on HRQoL, emergency room visits, general practitioner consultations or hospital admissions, but participants in the action plan group had more treatments for exacerbations. Our review did not identify any additional studies addressing this SM strategy alone. Action planning was a component in over half of the multicomponent interventions.

Smoking cessation interventions

Smoking cessation was a surprisingly low proportion of the SM components (in $< 20\%$ of interventions); however, this may be a result of people with COPD being referred out to a separate smoking cessation service, rather than including it as part of a SM programme. It is possible that the inclusion of smoking cessation within SM programmes may be a source of heterogeneity, which we have not explored. In a systematic review of smoking cessation interventions for COPD five studies were included.[291] There were no comparisons of psychological interventions compared with no interventions. Direct comparisons of two active psychosocial interventions showed no significant difference, but a combination of a psychosocial and pharmacological intervention compared with no treatment showed sustained cessation.

Exercise-only interventions

We have reported the effects of exercise-only/exercise with dyspnoea management interventions compared with UC. At follow-up of ≤ 3 months the average effect of exercise only was –4.87 (95% CI –5.79 to –3.96) SGRQ points in favour of the intervention but, because of small numbers of trials reporting HRQoL with a longer follow-up or admissions or exacerbations, we do not have evidence of an effect after this short period. All but one of these trials included supervised exercise, so we were unable to explore the role of direct supervision compared with unsupervised home-based exercise in the absence of other SM components.

Effect of multicomponent interventions

In the wide range of multicomponent SM interventions and settings evaluated, our meta-analysis indicates that overall (on average) multicomponent SM interventions have a positive effect on HRQoL. Our summary estimates were larger than the minimal clinically important difference for SGRQ at follow-up to 6 months for the multicomponent interventions and at all follow-up points for the CRQ.[292] However, we did find considerable heterogeneity, making it hard to establish which particular interventions and which particular settings work best. Our findings are similar to those of a systematic review by Effing *et al.*,[48] who evaluated the effectiveness of SM education compared with UC. Effing *et al.*[48] included 14 trials, with considerable overlap with our analysis but they excluded trials of PR. Effing *et al.*[48] reported a smaller improvement on the SGRQ (2.6, 95% CI 0.02 to 5.0) than we found, but did report a significant reduction in respiratory admissions, which did not agree with our findings.

Integrated disease management

Several systematic reviews have addressed the effectiveness of disease management.[47,49] This has been defined by Schrijvers[293] as 'Disease management consists of a group of coherent interventions designed to prevent or manage one or more chronic conditions using a systematic, multidisciplinary approach and potentially employing multiple treatment modalities. The goal of chronic disease management is to identify persons at risk for one or more chronic conditions, to promote SM by patients and to address the illness or conditions with maximum clinical outcome, effectiveness and efficiency regardless of treatment setting(s) or typical reimbursement patterns'. The most recent review is a Cochrane review by Kruis *et al.*[47] The Cochrane review[47] included 26 trials and reported a difference of 3.71 points on the SGRQ (95% CI 1.6 to

5.8 points) in favour of the intervention group, a reduction in respiratory admissions (OR 0.68, 95% CI 0.47 to 0.99) and a reduction in all-cause admissions up to 12 months (OR 0.62, 95% CI 0.36 to 1.07). There was no effect on exacerbations. Given this recent review, we have not repeated this analysis in this report.

Enhanced care

Our definition of enhanced care included proactive telephone calls from a respiratory health-care professional and helplines available to patients or visits from health-care professionals, all as a means to reinforce information/techniques/strategies and encourage behaviour change. The interventions were generally delivered by a respiratory nurse or physiotherapist/physiologist. This has not been addressed in other systematic reviews. We have identified improvements in HRQoL and reduced hospital admissions after 6 months of follow-up, suggesting that these enhancements should be considered further. The analyses had high levels of heterogeneity, so further exploration of the individual components would be useful.

Role of exercise alone or within larger self-management packages

Group-based self-management with supervised exercise as part of a multicomponent self-management intervention

Our analysis of SM interventions with supervised exercise is similar to that of Lacasse *et al.*'s[46] Cochrane review of PR programmes. Although the Lacasse *et al.* review[46] included six trials in their analysis of total SGRQ, we included 18, and found a similar effect size at our follow-up points up to 6 months, but an attenuated effect after one year follow-up. We had higher heterogeneity than that reported by Lacasse *et al.*,[46] which may reflect our wider inclusion criteria. We have been able to extend the Lacasse review by reporting hospital admissions and exacerbations; however, the number of trials in these analyses was low (five and three, respectively) and no significant effects were seen.

Multicomponent self-management without supervised exercise

We undertook subgroup analyses to explore the effect of the level of supervision and amount of exercise advice and support in multicomponent SM interventions. The unsupervised exercise was structured in terms of frequency, duration and intensity, but did not take place in a centre or group setting. Although we identified an average effect on the SGRQ at 3 months that was significant, evidence of effect in the longer term was absent. Interventions that included exercise advice only or no exercise at all (as part of a multicomponent intervention) had no evidence of effectiveness.

To further explore the role of exercise we investigated the effect of strength and aerobic exercise training compared with UC. These interventions all included at least one other SM component with the exercise. This showed significantly higher HRQoL scores, but no effect on hospital admissions and exacerbations.

In a systematic review, Zainuldin *et al.*[294] explored intensity of leg training and type of training (interval compared with continuous). Three trials compared higher-intensity training with lower-intensity training but the pooled effect showed no significant difference between the groups on 6-Minute Walk Distance. HRQoL and hospital admissions/exacerbations were not reported. There was no significant difference between the interval and continuous training groups in the eight included studies, for any of the outcomes, including HRQoL.[294] In our study we also found no difference between interval and continuous training.

Role of aerobic and resistance exercise

To unpick the relative contributions of resistance (strength) and aerobic exercise on HRQoL, hospital admissions and exacerbations, we undertook direct comparisons. Only two trials[233,246] directly compared resistance and aerobic exercise with aerobic exercise only, with no difference in average HRQoL between the exercise arms. No trials reported hospital admissions.

Four trials compared endurance with resistance exercise showing no effect of HRQoL or hospital admissions.[216,233,246,247]

Respiratory muscle training

Two main groups of interventions came under this category. Sívori *et al.*[263] compared upper limb exercises to UC, with no significant effect on HRQoL. Our findings are similar to those of Costi *et al.*,[295] who reported the HRQoL outcomes individually for three trials, all of which found no significant difference.

We identified a large number of trials that evaluated inspiratory muscle training (IMT) and expiratory muscle training (EMT) using threshold devices (20 trials: see *Appendix 27*). These either had UC or sham devices (set at the lowest setting for resistance) as the comparison group. Only four trials[163,184,253,254] reported disease-specific HRQoL using the SGRQ or CRQ and one trial[253] reported hospital admissions. We did not identify any evidence of effectiveness of RMT on these outcomes.

Our findings can be compared with those of systematic reviews of IMT compared with UC,[296] and IMT or IMT plus PR compared with other rehabilitation interventions.[297] Geddes *et al.*[296] had only two trials that compared IMT to sham treatment and reported the total CRQ (weighted MD 0.33, 95% CI 0.19 to 1.47). The review by O'Brien *et al.*[297] reported only the individual subscales for the CRQ, but found a significantly greater improvement in the dyspnoea subscale for the exercise-only interventions than the interventions that included IMT (CRQ dyspnoea 1.94, 95% CI 1.01 to 2.88).

Interventions delivered by particular professional groups

Three trials[136,251,266,285] reported SM interventions by pharmacists. We hypothesised that the multicomponent interventions that they delivered would have a particular focus on medication management, which was a component of all three trials. The combined effects on HRQoL were not significant, but Jarab *et al.*[266] reported a significant reduction in hospital admissions at 6 months' follow-up.

Other systematic reviews have reported the effects of interventions delivered by physiotherapists[298] and of outreach nursing.[52] The review of outreach nursing[52] has considerable overlap with the concept of integrated disease management. Wong *et al.*[52] reported a significant improvement in HRQoL, but no effect on mortality or hospital admissions.

How the evidence fits with other long-term conditions

All our included trials took a patient-based approach in which the SM was delivered to patients in the form of group-based or individual education and other support. A large UK-based cluster randomised trial (WISE: Whole System informing self-management engagement),[34] published after our search was completed, sought to support primary care practitioners to embed SM support into their everyday practice. The trial recruited 1634 patients with COPD in primary care but did not find statistically significant improvements in self-efficacy, generic HRQoL or shared decision-making. The authors cited difficulties with implementation in a 'real' primary care setting with an unselected group of patients.

Recent studies of note since our searches were undertaken

A recent trial[34] was halted prematurely after interim analysis identified a higher mortality rate in the group that received the SM intervention. The intervention failed to increase knowledge or use of antibiotics as part of action planning, but the findings are otherwise unexplained. An analysis of mortality rates across all of the included studies in our review might help identify whether this was an outlying result.

Strengths and limitations

Strengths

This is the largest systematic review of SM for COPD, with 174 trials reporting our three outcomes in 229 comparisons. We had no exclusions by language or publication date and included 12 trials that were reported in a language other than English. The review was undertaken with two people independently selecting titles, abstracts and full papers for inclusion/exclusion, with a third person reviewing and deciding on papers where there was a disagreement, and group discussion about papers and interventions that were difficult to categorise. We used an extensive data extraction form to extract directly and – when not reported – indirectly calculate statistical results for the intervention effects of interest. This allowed us to incorporate a larger number of studies in the meta-analysis than previous reviews, especially with regard to HRs.

Many of our subgroup analyses cover topics of published systematic reviews and we were able to extend the included papers in a number of these. We have also explored additional groups of interventions, for example in relation to the level of supervision and specification of the exercise component. Although we would have liked to undertake indirect comparisons to explore individual or groups of components further, this was not possible due to the heterogeneity of populations, interventions and comparators.

Heterogeneity was apparent in most meta-analyses but the causes of heterogeneity were difficult to identify due to the small number of studies in most meta-analyses and the potential for trial-level confounding when exploring heterogeneity. Therefore, to help summarise the heterogeneity more clearly, when five or more studies were included in the meta-analysis we reported 95% prediction intervals. These revealed the range of possible intervention effects caused by unexplained heterogeneity. However, this interval may also reflect heterogeneity caused by small-study effects and low-quality primary studies rather than just clinical causes of heterogeneity.

Limitations of studies within the review

The main limitations of our review result from the heterogeneity of both the interventions and the comparison groups, and the general poor standard of reporting and conduct in many of the identified trials. The included trials were often small, with 46% having < 50 participants; few included a power calculation; and the reporting of method of randomisation, allocation concealment and blinding of outcome assessment was often absent or poorly described. When undertaking risk of bias assessment we did not use explicit cut-offs for a certain attrition or imbalance between study groups because so many studies had small sample sizes and these thresholds were easily crossed by one or two more participants lost to follow-up in one study arm compared with the other.

As many of the trials used a ‘UC’ comparator, it was not possible to blind participants to their allocation. This is likely to lead to an attention effect, when the participants in the active intervention arm have a more positive experience and often more social support through group-based activities. As most of the trials reported HRQoL which often includes a mental or social component and follow-up was frequently only undertaken at the end of the intervention period, attention bias is likely.

Limitations of our review methods

In defining SM interventions we took a very broad perspective but tried to exclude those interventions when the intervention was largely provided by a professional. Thus hospital-at-home interventions were included only if they expressly described a SM or educational component. Disease management programmes were excluded if they were telemonitoring without an educational or SM element. Some exercise programmes that were delivered by physiotherapists were short term and appeared to describe something ‘done to’ the patient rather than teaching them to self-manage; these were excluded. Owing to the large number of papers identified and a number of people reviewing abstracts and papers for eligibility, there will inevitably be some inconsistencies in relation to inclusion/exclusion. We tried to minimise this through regular team discussions about papers that we were unsure of including.

We planned to undertake full independent double data extraction on all papers but, owing to the large number of eligible papers, only one person extracted the characteristics and outcomes, with a 20% check of the outcome data and a 100% check for key characteristics such as number of participants, duration of intervention and duration of follow-up. To ensure consistency the same person categorised the components in all trials.

In extracting HRQoL outcome data we focused on the disease-specific measures (SGRQ and CRQ) and have not reported the generic HRQoL outcomes, as a wide variety of these were reported in a small number of trials. We decided not to combine the findings of the SGRQ and CRQ in meta-analysis, as they report different domains. In addition, the reporting of the actual point differences in meta-analysis on the original scales, rather than a standardised MD, makes interpretation easier.

The admission results were reported in several different ways, for example first admission, mean admissions, etc. Although ideally we would like to be able to capture all of this information, especially because some patients may have multiple admissions, current methodologies are inadequate to do so. We chose rate of first admission because there were more data available; however, it is not clear how the effect of the interventions would vary if all admissions could be considered.

The trials reported a large number of outcomes, and trials that met our inclusion criteria in relation to population and intervention – but did not report one of our three primary outcomes (HRQoL, hospital admissions and exacerbations) – are listed but not described. Although we acknowledge the importance of other outcomes, such as exercise capacity, the focus of this review was health service utilisation and patient QoL. Mortality was rarely reported as an outcome but can be obtained from the reasons for loss to follow-up. Papers often did not report the cause of death (respiratory or other cause) and we cannot be sure about completeness, given that few trials specified mortality as an outcome measure. Therefore, we did not include mortality in our analyses.

We have undertaken a large number of comparisons, with the associated risk of identifying significant effects due to chance. However, this review was planned to be exploratory in nature and we are cautious in the interpretation of our findings.

We had planned to undertake indirect comparisons of clusters of intervention components but did not do this owing to considerable heterogeneity of the UC arms and difficulties in identifying potential comparison groups. The heterogeneity and low-quality studies led us to conclude that the consistency assumption (which is required to undertake a mixed-treatment comparison) was unlikely to be plausible, and thus indirect comparisons were not considered.[107]

Generalisability

Our trials were set in 21 different countries, suggesting that our findings can be generalised across a range of different health-care settings. We did not explore the effect of location, and thus the standard level of COPD care as a potential cause of heterogeneity but it may be an important factor. In particular, we did not focus on studies undertaken only in the UK. Most of the trial participants were recruited from secondary care settings – usually hospital outpatients – and $< 6\%$ were from primary care. In addition, the participants generally had moderate or severe COPD, as defined by GOLD criteria. Thus our findings may not be generalised well to populations with milder COPD managed in primary care. In addition, trials may recruit participants who are more affluent or have a higher educational level than the general population. Given the fundamental role of self-efficacy in many SM interventions, the representativeness of the participants is key. Comparisons of the characteristics of recruited participants and people who decline to take part in a trial are rarely reported, so we are unable to comment on the generalisability of the trial participants in these aspects.

Chapter 8 Overall discussion

Introduction

This report had two aims: to evaluate the effectiveness and cost-effectiveness of SM commencing within 6 weeks of hospital discharge for an exacerbation of COPD, and to explore which components or mechanisms of delivery appear most promising in terms of the effectiveness of SM interventions for COPD in general.

Main findings

The review of SM post discharge identified no evidence of benefit of early SM support on admissions, mortality and most other health outcomes, although a modest, but possibly biased, improvement in HRQoL. However, the direction of the effect for many of the outcomes (including admissions) favoured the SM intervention. A speculative economic model was developed to explore the cost-effectiveness of such an intervention – if it were truly effective at reducing hospital admissions. The main drivers of the model were the effect on hospital readmission, the duration of the effect and the cost of a SM programme. To be cost-effective, a SM programme post admission for an acute exacerbation would need to cost no more than £2200 if there was an 18% reduction in readmissions. The sensitivity analysis suggested that SM had a probability of 68% of being cost-effective at a threshold incremental cost-effectiveness ratio of £20,000 per quality-adjusted life-year, demonstrating the uncertainty around the impact of SM on readmissions.

The second study was an exploratory review of the broad SM and PR literature to try to determine the components and mechanisms of delivery that are associated with better outcomes. Multicomponent (at least three individual components) SM interventions are likely to be effective, but the degree of heterogeneity suggests that there are important features of these interventions that need to be established; those with supervised exercise (as in a PR programme) or structured, unsupervised exercise (as in a home rehabilitation programme) appear effective. SM programmes that provide an enhanced level of care and support may reduce hospital admissions in the medium term (6 months).

Except for exercise-only interventions, there were surprisingly few trials of individual SM components, and few for which the difference between study groups was only one component. Notably, there was no evidence that action plans were effective by themselves.

Overall conclusion

It is difficult to recommend any type of SM support to be provided immediately after discharge with the evidence available, as there is no clear evidence of effect across most of the outcomes. Notwithstanding, the point estimate is consistent with ≈20% reduction in admissions, which has been observed in other systematic reviews of COPD SM interventions.

Although some components of SM interventions are associated with positive effects of HRQoL, such as structured exercise (either within a supervised group or home based), enhanced care and multicomponent interventions, it was not possible to establish the relative roles of the individual components in reducing hospital admissions and improving HRQoL.

Recommendations for future research

1. Current interventions to support patient SM that is delivered post discharge cannot currently be recommended because interventions are heterogeneous and methodology is problematic, and, despite there being potential benefit in terms of HRQoL, there is not enough good evidence to be sure that clinical outcomes could be improved. Therefore:

    i. High-quality studies should be undertaken among patients with COPD disease post discharge.
    ii. This should include qualitative work to explore barriers and facilitators to SM when patients have recently had an exacerbation, exploration of novel approaches to affect behaviour change, and exploration of approaches tailored to the individual and their circumstances.
    iii. New approaches should be evaluated by properly designed and conducted trials, with special attention to reducing loss to follow-up.

2. Owing to the heterogeneity and complexity of interventions, it was not possible to unpick the most important components of SM interventions in general or to confirm whether they improve clinical outcomes. It is clear that action plans alone do not seem to work in their present form, but that structured exercise and more heavily supported interventions (which may not usually be defined as SM) might work better. Therefore:

    i. Further in-depth work using individual patient data (e.g. an Individual Patient Data meta-analysis) should be carried out to try to identify which are the most effective components of interventions and identify patient-specific factors that may modify this. This work is ongoing by other researchers.
    ii. Future studies might try to identify the characteristics of patients who are more likely to be able to self-manage, and consider a more targeted approach.
    iii. Further qualitative work is needed to explore patients' barriers and facilitators to SM interventions.
    iv. Novel approaches to influence behaviour change and to help patients manage or prevent exacerbations should be explored, first using qualitative studies and then properly designed and conducted randomised controlled trials (RCTs). Most trials include a mixture of components; more trials teasing out the individual elements, either as lone interventions, or with the addition of one component, would be useful.

3. Recommendations for the design and conduct of future RCTs of interventions to support patient SM:

    i. In general, new trials should adhere to modern standards of design, conduct and reporting in order to reduce risks of bias, for example blinding of outcome assessment, attempts to maximise follow-up or methods to impute this, and reporting of the characteristics of all randomised patients.
    ii. The behaviour change theories and strategies that underpin COPD SM interventions need to be better characterised and described.
    iii. A clear framework for describing and classifying SM interventions and their comparators is required.
    iv. Trials need to be adequately powered to detect a clinically relevant difference and long enough to assess changing effects over time. There should be clear reporting of outcomes to include self-efficacy, behaviour change and clinical outcomes such as hospital admissions and exacerbations.
    v. Given the wide range of HRQoL outcomes available, it would be useful to standardise their use within COPD research and ensure that they are reported accurately within publications.

Statistical analysis methods should be improved: in particular (1) analysis of HRQoL outcomes should routinely adjust for baseline values to overcome baseline imbalance, account for correlation between final score and baseline score, and increase statistical power; and (2) time-to-event outcomes (such as admissions, mortality, etc.) should be analysed using suitable analyses that allow for differential patient follow-up, and summarised using HRs (rather than odds ratios).

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Contributions of authors

Rachel E Jordan (Senior Lecturer, Public Health/Epidemiology) (co-principal investigator) wrote the protocol, co-directed and developed the review, chaired the team and investigator meetings, liaised with the Public and Patient Participation group, contributed to study selection, undertook and oversaw data extraction and risk of bias assessment for reviews 1 and 2, wrote the background, oversaw and wrote the results for reviews 1 and 2, and commented on and edited all other aspects of the report.

Saimma Majothi (Research Fellow, Systematic Reviews), lead reviewer, led and coordinated the systematic review, led study selection, led the development of risk of bias and data extraction tools, undertook classification of studies, extracted results of studies for reviews 1–4, undertook risk of bias assessment for reviews 1–4, coordinated data analysis, wrote the methods sections, wrote sections for the qualitative review (review 2), wrote the cost-effectiveness review (review 3), drafted interim reports and commented on the final report.

Nicola R Heneghan (Lecturer, Physiotherapy), second reviewer, contributed to review development, study selection, data extraction and risk of bias assessment, and commented on the final report.

Deirdre B Blissett (Research Fellow, Health Economics) led and wrote the section on the economic model, undertook risk of bias for review 3 and commented on the final report.

Richard D Riley (Professor, Biostatistics) advised on methodology of the protocol, advised on statistical and reviewing methods, developed data extraction form for statistical results, undertook initial statistical analyses, supervised statistical analyses, contributed to writing the statistical methods and commented on the final report.

Alice J Sitch (Research Fellow, Biostatistics) undertook analyses for review 4, contributed to methods of analyses and commented on the final report.

Malcolm J Price (Research Fellow, Biostatistics) extracted samples of results, advised and undertook statistical analyses for review 1, wrote analysis methods for review 1, and commented on the final report.

Elizabeth J Bates (Academic Clinical Lecturer, Primary Care) contributed to risk of bias assessment, contributed to data extraction, provided clinical input, advised on costs and commented on the final report.

Alice M Turner (Clinician Scientist and Honorary Consultant Physician) contributed to study selection, provided data and advice on components of cost for the economic modelling, provided clinical input to protocol and review, and commented on the final report.

Susan Bayliss (Information Specialist) advised on, and performed, search strategies.

David Moore (Senior Lecturer, Systematic Reviews) advised on methodology of protocol, provided ongoing advice on conduct of review and methodology, contributed to study selection and risk of bias, provided technical support and commented on the final report.

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Publications

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Appendix 1 Search strategies for clinical effectiveness evidence: reviews 1, 2 and 4

MEDLINE (via Ovid)

URL: https://ovid.sp.com

Date range searched: 1946 to April Week 4 2012.

Date of search: 2 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp Pulmonary Disease, Chronic Obstructive/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. Pulmonary Emphysema/
8. exp Bronchitis/
9. emphysema.ti,ab.
10. or/1-9
11. exp Self Care/
12. self care.ti,ab.
13. self manage$.ti,ab.
14. self caring.ti,ab.
15. (self adj2 (support$ or care or caring or manage$)).ti,ab.
16. post discharge.ti,ab.
17. early discharge.ti,ab.
18. home care.ti,ab.
19. home care services/ or home nursing/
20. patient centred care.ti,ab.
21. patient education/ or patient education.ti,ab.
22. patient participation.ti,ab.
23. post hospital care.ti,ab.
24. action planning.ti,ab.
25. discharge planning.ti,ab.
26. continuity of patient care/
27. (support$ adj2 discharge).ti,ab.
28. (support$ adj2 manag$).ti,ab.
29. patient focus$.ti,ab.
30. management plan$.ti,ab.
31. management program$.ti,ab.
32. rehabilitation.mp. or exp Rehabilitation/
33. or/11-32
34. 10 and 33

MEDLINE In-Process & Other Non-Indexed Citations (via Ovid)

URL: https://ovidsp.ovid.com

Date range searched: inception to 2 May 2012.

Date of search: 2 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.ti,ab.
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. emphysema.ti,ab.
8. bronchitis.ti,ab.
9. or/1-8
10. (self adj2 (support$ or care or caring or manage$)).ti,ab.
11. post discharge.ti,ab.
12. early discharge.ti,ab.
13. home care.ti,ab.
14. home nursing.ti,ab.
15. patient centred care.ti,ab.
16. patient centered care.ti,ab.
17. patient education.mp.
18. patient participation.ti,ab.
19. post hospital care.ti,ab.
20. action planning.ti,ab.
21. discharge planning.ti,ab.
22. (continuity adj2 care).ti,ab.
23. (support$ adj2 (discharge or manage$)).ti,ab.
24. patient focus$.ti,ab.
25. management plan$.ti,ab.
26. management program$.ti,ab.
27. rehabilitation.ti,ab.
28. or/10-27
29. 9 and 28

EMBASE (via Ovid)

URL: https://ovidsp.ovid.com

Date range searched: 1980 to 2012 Week 17.

Date of search: 2 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp chronic obstructive lung disease/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. pulmonary emphysema.mp. or exp lung emphysema/
8. emphysema.ti,ab.
9. bronchitis.mp. or exp bronchitis/
10. or/1-9
11. self care.mp. or exp self care/
12. (self adj2 (support$ or care or caring or manage$)).ti,ab.
13. post discharge.ti,ab.
14. early discharge.ti,ab.
15. exp home care/
16. home nursing.ti,ab.
17. patient centred care.ti,ab.
18. patient centered care.ti,ab.
19. patient education/
20. patient education.ti,ab.
21. patient participation.ti,ab.
22. post hospital care.ti,ab.
23. action planning.ti,ab.
24. discharge planning.ti,ab.
25. continuity of patient care.ti,ab.
26. (support$ adj2 discharge).ti,ab.
27. (support$ adj2 manage$).ti,ab.
28. patient focus$.ti,ab.
29. management plan$.ti,ab.
30. management program$.ti,ab.
31. rehabilitation.mp. or exp rehabilitation/
32. or/11-31
33. 10 and 32

PsycINFO (via Ovid)

URL: https://ovidsp.ovid.com

Date ranged searched: 1806 to May week 1 2012.

Date of search: 2 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp Chronic Obstructive Pulmonary Disease/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. exp Pulmonary Emphysema/ or emphysema.ti,ab.
8. bronchitis.ti,ab.
9. or/1-8
10. (self adj2 (support$ or care or caring or manage$)).ti,ab.
11. post discharge.ti,b.
12. early discharge.ti,ab.
13. home care.mp. or exp Home Care/
14. patient centred care.ti,ab.
15. patient centered care.ti,ab.
16. client education/
17. patient education.ti,ab.
18. patient participation.ti,ab.
19. post hospital care.ti,ab.
20. action planning.ti,ab.
21. discharge planning.ti,ab.
22. 'continuum of care'/
23. continuity of patient care.ti,ab.
24. (support$ adj2 discharge).ti,ab.
25. (support$ adj manage$).ti,ab.
26. patient focus$.ti,ab.
27. management plan$.ti,ab.
28. management program$.ti,ab.
29. exp Rehabilitation/ or rehabilitation.mp.
30. or/10-29
31. 9 and 30

The Cochrane Library (Wiley) 2012; Cochrane Central Register of Controlled Trials (CENTRAL); Cochrane Database of Systematic Reviews (CDSR) Issue 4 of 12; Database of Abstracts of Reviews of Effects (DARE); NHS EED issue 4 of 12

URL: www.cochranelibrary.com

Date range searched: inception to 8 May 2012.

Date of search: 8 May 2012.

Search strategy

#1 copd

#2 chronic next obstructive next pulmonary disease

#3 MeSH descriptor Pulmonary Disease, Chronic Obstructive explode all trees

#4 chronic next obstructive next airway next disease

#5 chronic next respiratory next disorder*

#6 smoking next related next lung next disease*

#7 emphysema

#8 MeSH descriptor Pulmonary Emphysema explode all trees

#9 MeSH descriptor Bronchitis explode all trees

#10 bronchitis

#11 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10)

#12 self next care

#13 MeSH descriptor Self Care explode all trees

#14 self near/2 (support* or care or caring or manage*)

#15 post next discharge

#16 early next discharge

#17 MeSH descriptor Home Care Services explode all trees

#18 home next nursing

#19 patient next centred next care

#20 patient next centered next care

#21 MeSH descriptor Patient Education as Topic explode all trees

#22 patient next education

#23 patient next participation

#24 post next hospital next care

#25 action next planning

#26 discharge next planning

#27 continuity near/1 patient

#28 support* near/2 discharge

#29 support* near/2 manage*

#30 patient next focus*

#31 management next plan*

#32 management next program*

#33 rehabilitation

#34 MeSH descriptor Rehabilitation explode all trees

#35 (#12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34)

#36 (#11 AND #35)

Physiotherapy Evidence Database (PEDro)

URL: www.pedro.org.au

Date range searched: 1929 to 8 May 2012.

Date of search: 8 May 2012.

Search strategy

Terms used: self-management and copd or chronic obstructive pulmonary disease.

Science Citation Index (SCI) (Web of Science)

URL: http://thompsonreuters.com/en/products-services/scholarly-scientific-research/scholarly-search-and-discovery/web-of-science.html

Date range searched: 1964 to 8 May 2012.

Date of search: 8 May 2012.

Search strategy

Topic = (copd or (chronic obstructive pulmonary disease) or bronchitis or emphysema or (smoking related lung disease) or (chronic obstructive lung disease) or (chronic obstructive airway disease)) AND Topic = ((self management) or (self support*) or (self care) or (home care) or (home nursing) or (patient cent*) or (patient education) or (patient participation) or (post hospital) or (action planning) or (discharge planning) or continuity or (support* discharge) or (support* manage*) or (patient focus*) or (management plan*) or (management program*) or (rehabilitation))

Refined by: Web of Science Categories = (RESPIRATORY SYSTEM)

Timespan = All Years. Databases = SCI-EXPANDED.

Zetoc (Mimas)

URL: http://zetoc.mimas.ac.uk

Date range searched: 1993 to 8 May 2012.

Date of search: 8 May 2012.

Search strategy

Terms used: COPD and rehabilitation; Patient education; COPD and self-management; Pulmonary and self-management.

Conference Proceedings Citation Index (CPCI) (Web of Science)

URL: http://thompsonreuters.com/en/products-services/scholarly-scientific-research/scholarly-search-and-discovery/conference-proceedings-citation-index.html

Date range searched: 1990 to 8 May 2012.

Date of search: 8 May 2012.

Search strategy

Topic = (copd or (chronic obstructive pulmonary disease) or bronchitis or emphysema or (smoking related lung disease) or (chronic obstructive lung disease) or (chronic obstructive airway disease)) AND Topic = ((self management) or (self support*) or (self care) or (home care) or (home nursing) or (patient cent*) or (patient education) or (patient participation) or (post hospital) or (action planning) or (discharge planning) or continuity or (support* discharge) or (support* manage*) or (patient focus*) or (management plan*) or (management program*) or (rehabilitation))

Timespan = All Years. Databases = CPCI-S.

Appendix 2 List of excluded papers, with reasons for exclusion: reviews 1 and 4

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Abad-Corp, Carrillo-Alcaraz A, Royo-Morales T, Perez-Garcia MC, Rodriguez-Mondejar JJ, Saez-Soto A, *et al.* Effectiveness of planning hospital discharge and follow-up in primary care for patients with chronic obstructive pulmonary disease: research protocol. *J Adv Nurs* 2010;**66**:1365–70	Intervention	Intervention
Adams SG, Melo J, Luther M, Anzueto A. Antibiotics are associated with lower relapse rates in outpatients with acute exacerbations of COPD. *Chest* 2000;**117**:1345–52	Intervention	Intervention
Ahmed S, Bourbeau J, Maltais F, Mansour A. The Oort structural equation modeling approach detected a response shift after a COPD self-management program not detected by the Schmitt technique. *J Clin Epidemiol* 2009;**62**:1165–72	Time point	Study design
Aiken LS, Butner J, Lockhart CA, Volk-Craft BE, Hamilton G, Williams FG. Outcome evaluation of a randomized trial of the PhoenixCare intervention: program of case management and coordinated care for the seriously chronically ill. *J Palliat Med* 2006;**9**:111–26	Population	Population
Aimonino RN, Tibaldi V, Leff B, Scarafiotti C, Marinello R, Zanocchi M, *et al.* Substitutive 'hospital at home' versus inpatient care for elderly patients with exacerbations of chronic obstructive pulmonary disease: a prospective randomized, controlled trial. *J Am Geriatr Soc* 2008;**56**:493–500	Time point	–
Akinci AC, Olgun N. The effectiveness of nurse-led, home-based pulmonary rehabilitation in patients with COPD in Turkey. *Rehabil Nurs J* 2011;**36**:159–65	Time point	Study design
Al-Showair RA, Tarsin WY, Assi KH, Pearson SB, Chrystyn H. Can all patients with COPD use the correct inhalation flow with all inhalers and does training help? *Respir Med* 2007;**101**:2395–401	Time point	Outcome
Alexander JL, Phillips WT, Wagner CL. The effect of strength training on functional fitness in older patients with chronic lung disease enrolled in pulmonary rehabilitation. *Rehabil Nurs J* 2008;**33**:91–7	Time point	–
Ambrosino N, Paggiaro PL, Macchi M, Filieri M, Toma G, Lombardi FA, *et al.* A study of short-term effect of rehabilitative therapy in chronic obstructive pulmonary disease. *Respiration* 1981;**41**:40–4	Time point	–
Antonana J, Sobradillo V, De MD, Chic S, Galdiz J, Iriberri M. [Early discharge and home health care program for patients with exacerbated COPD and asthma.] *Arch Bronconeumol* 2001;**37**:489–94	Population	Population
Antoniu SA. Self-management programs in chronic obstructive pulmonary disease: are they worthy? *Exp Rev Pharmacoecon Outcome Res* 2003;**3**:681–3	Publication type	Publication type
Antoniu SA. Self-management programs in chronic obstructive pulmonary disease: do they have a sustained effect on health resource utilization? *Exp Rev Pharmacoecon Outcome Res* 2006;**6**:155–7	Publication type	Publication type
Arbane G, Douiri A, Enright L, Haggis L, Poulter T, Garrod R. Effects of physical activity top up 'pat on the back' programme on exercise capacity and healthcare utilisation for people with chronic obstructive pulmonary disease (COPD). British Thoracic Society Winter Meeting, 1–3 December 2010, London. *Thorax* 2010; conference publication:A96	Time point	Publication type
Armour C, Bosnic-Anticevich S, Brillant M, Burton D, Emmerton L, Krass I, *et al.* Pharmacy Asthma Care Program (PACP) improves outcomes for patients in the community. *Thorax* 2007;**62**:496–502	Population	Population

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Arnardottir RH, Sorensen S, Ringqvist I, Larsson K. Two different training programmes for patients with COPD: a randomised study with 1-year follow-up. *Respir Med* 2006;**100**:130–9	Time point	–
Arnardottir RH, Boman G, Larsson K, Hedenstrom H, Emtner M. Interval training compared with continuous training in patients with COPD. *Respir Med* 2007;**101**:1196–204	Time point	–
Ashida C, Fukata Y, Shiota M, Hayashi Y, Yoshida Y. [Acute exacerbation of chronic obstructive lung diseases and self management: observation of the early symptoms and their management.] *Kango Gijutsu* 1988;**34**:1777–81	Study design	Study design
Ashikaga T, Vacek PM, Lewis SO. Evaluation of a community-based education program for individuals with chronic obstructive pulmonary disease. *J Rehabil* 1980;**46**:23–7	Population	Population
Ashikaga T, Vacek PM, Lewis SO, Seckerwalker R. Impact of a COPD patient self-management program. *Am Rev Respir Dis* 1983;**127**:152	Time point	Study design
Atkins CJ, Kaplan RM, Timms RM, Reinsch S, Lofback K. Behavioral exercise programs in the management of chronic obstructive pulmonary disease. *J Consult Clin Psychol* 1984;**52**:591–603	Population	Population
Baarends EM, Schols AM, Slebos DJ, Mostert R, Janssen PP, Wouters EF. Metabolic and ventilatory response pattern to arm elevation in patients with COPD and healthy age-matched subjects. *Eur Respir J* 1995;**8**:1345–51	Population	Population
Bagnall P, Heslop A. Chronic respiratory disease: educating patients at home. *Prof Nurse* 1987;**2**:293–6	Outcome	Outcome
Baker S, Davenport P, Sapienza C. Examination of strength training and detraining effects in expiratory muscles. *J Speech Lang Hear Res* 2005;**48**:1325–3	Population	Population
Baltzan MA, Kamel H, Alter A, Rotaple M, Wolkove N. Pulmonary rehabilitation improves functional capacity in patients 80 years of age or older. *Can Respir J* 2004;**11**:407–13	Intervention	Study design
Barakat S, Michele G, George P, Nicole V, Guy A. Outpatient pulmonary rehabilitation in patients with chronic obstructive pulmonary disease. *Int J Chron Obstruct Pulmon Dis* 2008;**3**:155–62	Time point	–
Barbanel D, Eldridge S, Griffiths C. Can a self-management programme delivered by a community pharmacist improve asthma control? A randomised trial. *Thorax* 2003;**58**:851–4	Population	Population
Barber CM, Bradshaw LM, Buttery P, Fishwick D, Whyte MK, Higenbottam TW. Assisted discharge for patients with exacerbations of COPD. *Thorax* 2001;**56**:417–18	Publication type	Publication type
Barnestein-Fonseca P, Leiva-Fernandez J, Vidal-Espana F, Garcia-Ruiz A, Prados-Torres D, Leiva-Fernandez F. Efficacy and safety of a multifactor intervention to improve therapeutic adherence in patients with chronic obstructive pulmonary disease (COPD): protocol for the ICEPOC study. *Trials* 2011;**12**:40	Publication type	Publication type
Baron K. COPD intervention investigation: Comparing the effect of an outpatient counseling session after discharge to an educational counseling session on admission day 2 on hospitalization rates in patients with COPD. 50th Annual Assembly of the New York State Council of Health-System Pharmacists, NYSCHP 2011 Verona, NY, USA, 29 April to 1 May 2011. *J Pharm Pract* 2011:354	Publication type	Publication type
Bass H, Whitcomb JF, Forman R. Exercise training: therapy for patients with chronic obstructive pulmonary disease. *Chest* 1970;**57**:116–21	Time point	Study design
Battaglia E, Fulgenzi A, Ferrero ME. Rationale of the combined use of inspiratory and expiratory devices in improving maximal inspiratory pressure and maximal expiratory pressure of patients with chronic obstructive pulmonary disease. *Arch Phys Med Rehabil* 2009;**90**:913–18	Time point	Outcome

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Battersby MW, Harris M, Reed RL, Harvey PW, Woodman RJ, Frith P. A randomised trial of the Flinders Program to improve patient self-management competencies in a range of chronic conditions: study rationale and protocol. *Australasian Med J* 2010;**1**:198–204	Publication type	Publication type
Bauldoff GS, Hoffman LA, Sciurba F, Zullo TG. Home-based, upper-arm exercise training for patients with chronic obstructive pulmonary disease. *Heart Lung* 1996;**25**:288–94	Time point	–
Bauldoff GS, Hoffman LA, Zullo TG, Sciurba FC. Exercise maintenance following pulmonary rehabilitation: effect of distractive stimuli. *Chest* 2002;**122**:948–54	Time point	–
Bauldoff GS, Rittinger M, Nelson T, Doehrel J, Diaz PT. Feasibility of distractive auditory stimuli on upper extremity training in persons with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 2005;**25**:50–5	Time point	–
Bausewein C, Booth S, Gysels M, Kuhnbach R, Higginson IJ. Effectiveness of a hand-held fan for breathlessness: a randomised phase II trial. *BMC Palliat Care* 2010;**9**:22	Population	Population
Beaulieu-Genest L, Chretien D, Maltais F, Pelletier K, Parent JG, Lacasse Y. Self-administered prescriptions of oral steroids and antibiotics in chronic obstructive pulmonary disease: are we doing more harm than good? *Chron Respir Dis* 2007;**4**:143–7	Time point	Study design
Beckerman M, Magadle R, Weiner M, Weiner P. The effects of 1 year of specific inspiratory muscle training in patients with COPD. *Chest* 2005;**128**:3177–82	Time point	–
Bellone A, Lascioli R, Raschi S, Guzzi L, Adone R. Chest physical therapy in patients with acute exacerbation of chronic bronchitis: Effectiveness of three methods. *Arch Phys Med Rehabil* 2000;**81**:558–60	Intervention	Intervention
Bellone A, Spagnolatti L, Massobrio M, Bellei E, Vinciguerra R, Barbieri A, *et al.* Short-term effects of expiration under positive pressure in patients with acute exacerbation of chronic obstructive pulmonary disease and mild acidosis requiring non-invasive positive pressure ventilation. *Intensive Care Med* 2002;**28**:581–85	Intervention	Intervention
Belman MJ, Kendregan BA. Physical training fails to improve ventilatory muscle endurance in patients with chronic obstructive pulmonary disease. *Chest* 1982;**81**:440–3	Time point	Study design
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Berry MJ, Rejeski WJ, Miller ME, Adair NE, Lang W, Foy CG, *et al.* A lifestyle activity intervention in patients with chronic obstructive pulmonary disease. *Respir Med* 2010;**104**:829–39	Time point	–
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Excluded article	Reasons for exclusion	
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[Better quality of life by early diagnosis and patient education in COPD.] *MMW Fortschr Med* 2003;**145**:4–8	Publication type	Publication type
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Bird S, Noronha M, Sinnott H. An integrated care facilitation model improves quality of life and reduces use of hospital resources by patients with chronic obstructive pulmonary disease and chronic heart failure. *Aust J Prim Health* 2010;**16**:326–33	Population	Population
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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	Time point	–
Bourbeau J. Disease management for COPD: avoiding hospitalizations and controlling cost? *COPD* 2011;**8**:143–4	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Breslin EH. Breathing retraining in chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 1995;**15**:25–33	Publication type	Publication type
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Brundage DJ, Swearengen P, Woody JW. Self-care instruction for patients with COPD. *Rehabil Nurs J* 1993;**18**:321–5	Outcome	Study design
Busch AJ, McClements JD. Effects of a supervised home exercise program on patients with severe chronic obstructive pulmonary disease. *Phys Ther* 1988;**68**:469–74	Time point	–
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Callaghan S. ACTRITE: Acute Chest Triage Rapid Intervention Team. *Accid Emerg Nurs* 1999;**7**:42–6	Study design	Study design
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Excluded article	Reasons for exclusion	
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Cambach W. [Rehabilitation of patients with asthma and mild to moderate chronic obstructive lung disease.] *Geneesk Sport* 1999;**32**:27–30	Population	Population
Cao Z, Ong KC, Eng P, Tan WC, Ng TP. Frequent hospital readmissions for acute exacerbation of COPD and their associated factors. *Respirology* 2006;**11**:188–95	Study design	Study design
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Cardozo L, Steinberg J. Telemedicine for recently discharged older patients. *Telemed J E Health* 2010;**16**:49–55	Population	Population
Caress A, Staples V, Towey M, Woodcock A, Niven R, Frank T, *et al.* Participation in treatment decisions in patients with COPD and recurrent bronchitis: a qualitative study. *Thorax* 2004;**59**:100	Time point	Study design
Carone M, Bertolotti G, Cerveri I, De BF, Fogliani V, Nardini S, *et al.* EDU-CARE, a randomised, multicentre, parallel group study on education and quality of life in COPD. *Monaldi Arch Chest Dis* 2002;**57**:25–9	Publication type	Publication type
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Carrieri-Kohlman G. *Internet-based and established dyspnea self-management programs in chronic obstructive pulmonary (COPD) patients*; 2005. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Publication type	Publication type
Carrieri-Kohlman V, Gormley JM, Douglas MK, Paul SM, Stulbarg MS. Exercise training decreases dyspnea and the distress and anxiety associated with it. Monitoring alone may be as effective as coaching. *Chest* 1996;**110**:1526–35	Time point	–
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Carrieri-Kohlman V, Nguyen HQ, Donesky-Cuenco D, mir-Deviren S, Neuhaus J, Stulbarg MS. Impact of brief or extended exercise training on the benefit of a dyspnea self-management program in COPD. *J Cardiopulm Rehabil* 2005;**25**:275–84	Time point	–
Casaburi R, Bhasin S, Cosentino L, Porszasz J, Somfay A, Lewis MI, *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	Time point	–
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Casey D, Murphy K, Cooney A, Mee L. Developing a structured education programme for clients with COPD. *Br J Community Nurs* 2011;**16**:231–7	Publication type	Publication type
Chan AW, Lee A, Suen LK, Tam WW. Effectiveness of a Tai chi Qigong program in promoting health-related quality of life and perceived social support in chronic obstructive pulmonary disease clients. *Qual Life Res* 2010;**19**:653–64	Time point	–

Excluded article	Reasons for exclusion	
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Chang AT, Haines T, Jackson C, Yang I, Nitz J, Low CN, *et al.* Rationale and design of the PRSM study: pulmonary rehabilitation or self management for chronic obstructive pulmonary disease (COPD), what is the best approach? *Contemp Clin Trials* 2008;**29**:796–800	Publication type	Publication type
Chang CL, Sullivan GD, Karalus NC, Hancox RJ, McLachlan JD, Mills GD. Audit of acute admissions of chronic obstructive pulmonary disease: inpatient management and outcome. *Intern Med J* 2007;**37**:236–41	Study design	Study design
Chen H, Dukes R, Martin BJ. Inspiratory muscle training in patients with chronic obstructive pulmonary disease. *Am Rev Respir Dis* 1985;**131**:251–5	Time point	–
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Christensen EF, Nedergaard T, Dahl R. Long-term treatment of chronic bronchitis with positive expiratory pressure mask and *chest* physiotherapy. *Chest* 1990;**97**:645–50	Intervention	Intervention
Chuang C, Levine SH, Rich J. Enhancing cost-effective care with a patient-centric coronary obstructive pulmonary disease program. *Popul Health Manag* 2011;**14**:133–6	Time point	Study design
Clark CJ, Cochrane L, Mackay E. Low intensity peripheral muscle conditioning improves exercise tolerance and breathlessness in COPD. *Eur Respir J* 1996;**9**:2590–6	Time point	–
Clark CJ, Cochrane LM, Mackay E, Paton B. Skeletal muscle strength and endurance in patients with mild COPD and the effects of weight training. *Eur Respir J* 2000;**15**:92–7	Time point	–
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Connolly MJ, Lowe D, Anstey K, Hosker HS, Pearson MG, Roberts CM, *et al.* Admissions to hospital with exacerbations of chronic obstructive pulmonary disease: Effect of age related factors and service organisation. *Thorax* 2006;**61**:843–8	Study design	Study design
Cooper CB. Desensitization to dyspnea in COPD with specificity for exercise training mode. *Int J Chron Obstruct Pulmon Dis* 2009;**4**:33–43	Time point	–
Coppoolse R, Schols AMWJ, Baarends EM, Mostert R, Akkermans MA, Janssen PP, *et al.* Interval versus continuous training in patients with severe COPD: a randomized clinical trial. *Eur Respir J* 1999;**14**:258–63	Time point	–

Excluded article	Reasons for exclusion	
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Cortopassi F, Castro AA, Porto EF, Colucci M, Fonseca G, Torre-Bouscoulet L, *et al.* Comprehensive exercise training improves ventilatory muscle function and reduces dyspnea perception in patients with COPD. *Monaldi Archr Chest Dis* 2009;**71**:106–12	Time point	Study design
Costes F, Roche F, Pichot V, Vergnon JM, Garet M, Barthelemy JC. Influence of exercise training on cardiac baroreflex sensitivity in patients with COPD. *Eur Respir J* 2004;**23**:396–401	Time point	Study design
Costi S, Brooks D, Goldstein RS. Perspectives that influence action plans for chronic obstructive pulmonary disease. *Can Respir J* 2006;**13**:362–8	Time point	Study design
Costi S, Crisafulli E, Antoni FD, Beneventi C, Fabbri LM, Clini EM. Effects of unsupported upper extremity exercise training in patients with COPD: a randomized clinical trial. *Chest* 2009;**136**:387–95	Time point	–
Costi S, Di BM, Pillastrini P, D'Amico R, Crisafulli E, Arletti C, *et al.* Short-term efficacy of upper-extremity exercise training in patients with chronic airway obstruction: a systematic review. *Phys Ther* 2009;**89**:443–55	Publication type	Publication type
Cotton MM, Bucknall CE, Dagg KD, Johnson MK, MacGregor G, Stewart C, *et al.* Early discharge for patients with exacerbations of chronic obstructive pulmonary disease: a randomized controlled trial. *Thorax* 2000;**55**:902–6	Intervention	Intervention
Coultas D, Frederick J, Barnett B, Singh G, Wludyka P. A randomized trial of two types of nurse-assisted home care for patients with COPD. *Chest* 2005;**128**:2017–24	Time point	–
Couser J, Martinez FJ, Celli BR. Pulmonary rehabilitation that includes arm exercise reduces metabolic and ventilatory requirements for simple arm elevation. *Chest* 1993;**103**:37–41	Time point	Study design
Coventry PA, Hind D. Comprehensive pulmonary rehabilitation for anxiety and depression in adults with chronic obstructive pulmonary disease: systematic review and meta-analysis. *J Psychosom Res* 2007;**63**:551–65	Publication type	Publication type
Covey MK, Larson JL. Exercise and COPD. *Am J Nurs* 2004;**104**:40–3	Study design	Study design
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Cox NJ, Hendricks JC, Binkhorst RA, van Herwaarden CL. A pulmonary rehabilitation program for patients with asthma and mild chronic obstructive pulmonary diseases (COPD). *Lung* 1993;**171**:235–44	Population	Population
Creutzberg EC, Wouters EF, Mostert R, Weling-Scheepers CA, Schols AM. Efficacy of nutritional supplementation therapy in depleted patients with chronic obstructive pulmonary disease. *Nutrition* 2003;**19**:120–7	Time point	Study design
Crisafulli E, Costi S, de BF, Biscione G, Americi F, Penza S, *et al.* Effects of a walking aid in COPD patients receiving oxygen therapy. *Chest* 2007;**131**:1068–74	Intervention	Intervention
Cummings E, Turner P. Patient self-management and chronic illness: evaluating outcomes and impacts of information technology. *Stud Health Technol Inform* 2009;**143**:229–34	Study design	Study design
Cummings JE, Hughes SL, Weaver FM, Manheim LM, Conrad KJ, Nash K, *et al.* Cost-effectiveness of Veterans Administration hospital-based home care. A randomized clinical trial. *Arch Intern Med* 1990;**150**:1274–80	Population	Population
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Currie GP, Miller D. Action plans for patients with chronic obstructive pulmonary disease. *BMJ* 2012;**344**:e1164	Publication type	Publication type

Excluded article	Reasons for exclusion	
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Cuvelier A. [Education for the early recognition of exacerbations at home. Importance of a personalized action plan.] *Rev Mal Respir* 2006;**23**:15S39–15S43	Publication type	Publication type
Cydulka RK, Rowe BH, Clark S, Emerman CL, Camargo CA Jr. Emergency department management of acute exacerbations of chronic obstructive pulmonary disease in the elderly: the Multicenter Airway Research Collaboration. *J Am Geriatr Soc* 2003;**51**:908–16	Study design	Study design
Datta D, Zuwallack R. High versus low intensity exercise training in pulmonary rehabilitation: is more better? *Chron Respir Dis* 2004;**1**:143–9	Publication type	Publication type
Davies L, Angus RM, Calverley PM. Oral corticosteroids in patients admitted to hospital with exacerbations of chronic obstructive pulmonary disease: a prospective randomised controlled trial. *Lancet* 1999;**354**:456–60	Intervention	Intervention
Davies L, Wilkinson M, Bonner S, Calverley PM, Angus RM. 'Hospital at home' versus hospital care in patients with exacerbations of chronic obstructive pulmonary disease: prospective randomised controlled trial. *BMJ* 2000;**321**:1265–8	Intervention	Intervention
Davis AH. Exercise adherence in patients with chronic obstructive pulmonary disease: an exploration of motivation and goals. *Rehabil Nurs J* 2007;**32**:104–10	Time point	Study design
Davis AH, Carrieri-Kohlman V, Janson SL, Gold WM, Stulbarg MS. Effects of treatment on two types of self-efficacy in people with chronic obstructive pulmonary disease. *J Pain Symptom Manage* 2006;**32**:60–70	Time point	–
De Blaquiere P, Christensen DB, Carter WB, Martin TR. Use and misuse of metered-dose inhalers by patients with chronic lung disease: a controlled, randomized trial of two instruction methods. *Am Rev Respir Dis* 1989;**140**:910–16	Population	Population
de Blasio F. A Doubting Thomas dealing with pulmonary rehabilitation. *Chest* 2000;**117**:929–31	Publication type	Publication type
De Blok BM, de Greef MH, Ten Hacken NH, Sprenger SR, Postema K, Wempe JB. The effects of a lifestyle physical activity counseling program with feedback of a pedometer during pulmonary rehabilitation in patients with COPD: a pilot study. *Patient Educ Couns* 2006;**61**:48–55	Time point	–
De Godoy DV, de Godoy RF. A randomized controlled trial of the effect of psychotherapy on anxiety and depression in chronic obstructive pulmonary disease. *Arch Phys Med Rehabil* 2003;**84**:1154–7	Time point	–
De Lucas RP, Rodríguez González-Moro JM, de García PJ, Santacruz SA, Tatay ME, Cubillo Marcos JM. [Training of inspiratory muscles in chronic obstructive lung disease. Its impact on functional changes and exercise tolerance.] *Arch Bronconeumol* 1998;**34**:64–70	Time point	Study design
De Toledo P, Jimenez S, del PF, Roca J, Alonso A, Hernandez C. Telemedicine experience for chronic care in COPD. *IEEE Trans Inf Technol Biomed* 2006;**10**:567–73	Study design	Study design
De Tullio PL, Corson ME. Effect of pharmacist counseling on ambulatory patients' use of aerosolized bronchodilators. *Am J Hosp Pharm* 1987;**44**:1802–6	Time point	Study design
DeBisschop M, Robitaille B. Can a patient information sheet reduce antibiotic use in adult outpatients with acute bronchitis? *J Fam Pract* 2002;**51**:381	Population	Population
Dechman G, Wilson CR. Evidence underlying breathing retraining in people with stable chronic obstructive pulmonary disease. *Phys Ther* 2004;**84**:1189–97	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Derom E, Marchand E, Troosters T. [Rehabilitation of patients with chronic obstructive lung disease.] *Ann Readapt Med Phys* 2007;**50**:602–14	Study design	Study design
Devine EC, Pearcy J. Meta-analysis of the effects of psychoeducational care in adults with chronic obstructive pulmonary disease. *Patient Educ Couns* 1996;**29**:167–78	Publication type	Publication type
Dewan NA, Rafique S, Kanwar B, Satpathy H, Ryschon K, Tillotson GS, *et al.* Acute exacerbation of COPD: factors associated with poor treatment outcome. *Chest* 2000;**117**:662–71	Time point	Study design
Dewan NA, Rice KL, Caldwell M, Hilleman DE. Economic evaluation of a disease management program for chronic obstructive pulmonary disease. *COPD* 2011;**8**:153–9	Time point	Publication type
Dhein Y, Munks-Lederer C, Worth H. [Evaluation of a structured education programme for patients with COPD under outpatient conditions – a pilot study.] *Pneumologie* 2003;**57**:591–7	Time point	Study design
Dickenson J. An exploratory study of patient interventions and nutritional advice for patients with chronic obstructive pulmonary disease, living in the community. *Int J Disabil Hum Dev* 2009;**8**:43–9	Time point	Study design
Disler RT, Gallagher RD, Davidson PM. Factors influencing self-management in chronic obstructive pulmonary disease: an integrative review. *Int J Nurs Stud* 2012;**49**:230–42	Publication type	Publication type
Dolmage TE, Maestro L, Avendano MA, Goldstein RS. The ventilatory response to arm elevation of patients with chronic obstructive pulmonary disease. *Chest* 1993;**104**:1097–100	Time point	Study design
Donald KJ, McBurney H, Teichtahl H, Irving L. A pilot study of telephone based asthma management. *Aust Fam Physician* 2008;**37**:170–3	Population	Population
Donesky-Cuenco D, Janson S, Neuhaus J, Neilands TB, Carrieri-Kohlman V. Adherence to a home-walking prescription in patients with chronic obstructive pulmonary disease. *Heart Lung* 2007;**36**:348–63	Time point	Study design
Donesky-Cuenco D, Nguyen HQ, Paul S, Carrieri-Kohlman V. Yoga therapy decreases dyspnea-related distress and improves functional performance in people with chronic obstructive pulmonary disease: a pilot study. *J Altern Complement Med* 2009;**15**:225–34	Time point	–
Dourado VZ, Tanni SE, Antunes LC, Paiva SA, Campana AO, Renno AC, *et al.* Effect of three exercise programs on patients with chronic obstructive pulmonary disease. *Braz J Med Biol Res* 2009;**42**:263–71	Time point	–
Dowson CA, Kuijer RG, Town IG, Mulder RT. Impact of panic disorder upon self-management educational goals in chronic obstructive pulmonary disease? *Chron Respir Dis* 2010;**7**:83–90	Study design	Study design
Dugan D, Walker R, Monroe DA. The effects of a 9-week program of aerobic and upper body exercise on the maximal voluntary ventilation of chronic obstructive pulmonary disease patients. *J Cardiopulm Rehabil* 1995;**15**:130–3	Time point	Study design
du Moulin M, Taube K, Wegscheider K, Behnke M, van den Bussche H. Home-based exercise training as maintenance after outpatient pulmonary rehabilitation. *Respiration* 2009;**77**:139–45	Time point	–
Duschek S, Schandry R, Werner B. [Changes in quality of life in patients with chronic airway diseases participating in a pilot project on home-telecare.] *Pravention und Rehabilitation* 2006;**18**:57–67	Study design	Study design
Duwoos H, Naze D, Labbey JL, Deschamps D, Pingard R, Guyonnaud CD, *et al.* Evaluation of a method of pulmonary rehabilitation with physiotherapy and exercise training in patients with Chronic Obstructive Lung-Disease (Cold). *Clin Respir Physiol Bull* 1980;**16**:266–7	Time point	Study design

Excluded article	Reasons for exclusion	
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Excluded article	Reasons for exclusion	
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Excluded article	Reasons for exclusion	
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Excluded article	Reasons for exclusion	
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Groenewegen KH, Schols AM, Wouters EF. Mortality and mortality-related factors after hospitalization for acute exacerbation of COPD. *Chest* 2003;**124**:459–67	Study design	Study design
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Excluded article	Reasons for exclusion	
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Haave E. *Writing About Disease: Effect on Rehabilitation*; 2005. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Population	Population
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Haggerty MC, Stockdale-Woolley R, Nair S. Respi-Care. An innovative home care program for the patient with chronic obstructive pulmonary disease. *Chest* 1991;**100**:607–12	Intervention	Intervention
Han SJ. [The effects of a pulmonary rehabilitation program for chronic obstructive pulmonary disease patients.] *Daehan Ganho Haghoeji* 2003;**33**:1008–17	Time point	Study design
Harver A, Mahler DA, Daubenspeck JA. Targeted inspiratory muscle training improves respiratory muscle function and reduces dyspnea in patients with chronic obstructive pulmonary disease. *Ann Intern Med* 1989;**111**:117–24	Time point	–
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Health related quality of life changes in community based pulmonary rehabilitation for people with COPD. Data eighteen months post rehab. 07; Switzerland: Lausanne; 2007	Study design	Study design
Heijdra YF, Dekhuijzen PNR, van Herwaarden CLA, Folgering HT. Nocturnal saturation improves by target-flow inspiratory muscle training in patients with COPD. *Am J Respir Crit Care Med* 1996;**153**:260–5	Time point	–

Excluded article	Reasons for exclusion	
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Herala M, Stalenheim G, Boman G. Effects of positive expiratory pressure (PEP), continuous positive airway pressure (CPAP) and hyperventilation in COPD patients with chronic hypercapnea. *Ups J Med Sci* 1995;**100**:223–32	Intervention	Intervention
Herborg H, Soendergaard B, Froekjaer B, Fonnesbaek L, Jorgensen T, Hepler CD, *et al.* Improving drug therapy for patients with asthma. Part 1: Patient Outcomes. *J Am Pharm Assoc (Wash)* 2001;**41**:539–50	Population	Population
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Hesselink AE, Penninx BW, van der Windt DA, van Duin BJ, de Vries P, Twisk JW, *et al.* Effectiveness of an education programme by a general practice assistant for asthma and COPD patients: results from a randomised controlled trial. *Patient Educ Couns* 2004;**55**:121–8	Population	Population
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Hochstetter JK, Lewis J, Soares-Smith L. An investigation into the immediate impact of breathlessness management on the breathless patient: randomised controlled trial. *Physiotherapy* 2005;**91**:178–85	Population	Population
Hoff J, Tjonna AE, Steinshamn S, Hoydal M, Richardson RS, Helgerud J. Maximal strength training of the legs in COPD: a therapy for mechanical inefficiency. *Med Sci Sports Exerc* 2007;**39**:220–6	Time point	–
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Holden DA, Stelmach KD, Curtis PS, Beck GJ, Stoller JK. The impact of a rehabilitation program on functional status of patients with chronic lung disease. *Respir Care* 1990;**35**:332–41	Time point	Study design
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Holle RHO, Williams DV, Vandree JC, Starks GL, Schoene RB. Increased muscle efficiency and sustained benefits in an outpatient community hospital-based pulmonary rehabilitation program. *Chest* 1988;**94**:1161–8	Time point	Study design
Holm SM, Rodgers WM, Haennel RG, Bhutani M, MacDonald GF, Wong E. Physiological responses to treadmill and cycle ergometer exercise testing in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2011;**183**:A3965	Publication type	Publication type
Honeyman P, Barr P, Stubbing DG. Effect of a walking aid on disability, oxygenation, and breathlessness in patients with chronic airflow limitation. *J Cardiopulm Rehabil* 1996;**16**:63–7	Intervention	Intervention
Hoogendoorn M, van Wetering CR, Schols AM, Rutten-van Mölken MP. Self-report versus care provider registration of healthcare utilization: impact on cost and cost-utility. *Int J Technol Assess Health Care* 2009;**25**:588–95	Time point	–
Hoogendoorn M, van Wetering CR, Schols AM, Rutten-van Mölken MP. Is INTERdisciplinary COMmunity-based COPD management (INTERCOM) cost-effective? *Eur Respir J* 2010;**35**:79–87	Time point	–

Excluded article	Reasons for exclusion	
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Houchen L, Deacon S, Sandland C, Collier R, Steiner M, Morgan M, *et al.* Preservation of lower limb strength after a short course of pulmonary rehabilitation with no maintenance: a 6-month follow-up study. *Physiotherapy* 2011;**97**:264–6	Time point	Study design
Howard JE, Davies JL, Roghmann KJ. Respiratory teaching of patients: how effective is it? *J Adv Nurs* 1987;**12**:207–14	Time point	Study design
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Hsu HC. [Respiratory rehabilitation in patients with chronic obstructive pulmonary disease.] *Hu Li Tsa Chih* 1997;**44**:87–92	Publication type	Publication type
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Hui KP, Hewitt AB. A simple pulmonary rehabilitation program improves health outcomes and reduces hospital utilization in patients with COPD. *Chest* 2003;**124**:94–7	Time point	Study design
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Hunter J, Singh SJ, Morgan MDL. Objective monitoring of adherence with home exercise training during pulmonary rehabilitation for chronic obstructive pulmonary disease. *Physiotherapy* 2006;**92**:50–4	Time point	Study design
Hunter SM. Educating clients with COPD. *Home Healthc Nurse* 1987;**5**:41–3	Publication type	Publication type
Hunter SM, Hall SS. The effect of an educational support program on dyspnea and the emotional status of COPD clients. *Rehabil Nurs J* 1989;**14**:200–2	Time point	Study design
Hurst JR, Fitzgerald-Khan F, Quint JK, Goldring JJ, Mikelsons C, Dilworth JP, *et al.* Use and utility of a 24-hour Telephone Support Service for 'high risk' patients with COPD. *Prim Care Resp J* 2010;**19**:260–5	Time point	Study design
Hynninen MJ, Bjerke N, Pallesen S, Bakke PS, Nordhus IH. A randomized controlled trial of cognitive behavioral therapy for anxiety and depression in COPD. *Respir Med* 2010;**104**:986–94	Time point	–

Excluded article	Reasons for exclusion	
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Ige OM, Olarewaju RK, Lasebikan VO, Adeniyi YO. Outpatient pulmonary rehabilitation in severe chronic obstructive pulmonary disease. *Indian J Chest Dis Allied Sci* 2010;**52**:197–201	Time point	Study design
Ilayaraja A, Shawesh A. A comparative study on effectiveness of autogenic drainage (AD) versus postural drainage (PD) in improving pulmonary function (FEV_1, FVC) in chronic obstructive pulmonary disease (COPD). *Jamahiriya Med J* 2010;**10**:106–10	Unavailable	Unavailable
Incalzi RA, Corsonello A, Trojano L, Pedone C, Acanfora D, Spada A, *et al.* Cognitive training is ineffective in hypoxemic COPD: a six-month randomized controlled trial. *Rejuvenation Res* 2008;**11**:239–50	Time point	–
Incorvaia C, Riario-Sforza GG. Effect of patient education on adherence to drug treatment for chronic obstructive pulmonary disease. *Ann Thorac Med* 2011;**6**:242–3	Publication type	Publication type
Innocenti F, Fabbri A, Guerrini M, Fonseca D, Lippi P. Results of an outpatient pulmonary rehabilitation program in patients with COPD. *Eur Respir J* 2000;**16**(Suppl. 31):46	Unavailable	Unavailable
Inoue M, Ohtsu I, Tomioka S, Hagiya M, Sumi M, Aoki H, *et al.* [Effects of pulmonary rehabilitation on vital capacity in patients with chronic pulmonary emphysema.] *Nihon Kyobu Shikkan Gakkai Zasshi* 1996;**34**:1182–8	Time point	Study design
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Excluded article	Reasons for exclusion	
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Koppers RJH, Vos PJE, Boot CRL, Folgering HT. Exercise performance improves in patients with COPD due to respiratory muscle endurance training. *Chest* 2006;**129**:886–92	Time point	–
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Excluded article	Reasons for exclusion	
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Excluded article	Reasons for exclusion	
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Lawlor M, Kealy S, Agnew M, Korn B, Quinn J, Cassidy C, *et al.* Early discharge care with ongoing follow-up support may reduce hospital readmissions in COPD. *Int J Chron Obstruct Pulmon Dis* 2009;**4**:55–60.	Study design	Study design
Leal HM, Abellan AJ, Martinez CJ, Nicolas BA. [Written information on the use of aerosols in COPD patients. Can we improve their use?] *Aten Prim* 2004;**33**:6–10	Time point	Outcome
Lee CY, Yeh LL, Chen CZ, Lin PY, Hsiue TR, Wang WL. [Exploring self-management in patients with chronic obstructive pulmonary disease.] *Hu Li Tsa Chih* 2008;**55**:45–55	Time point	Study design
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Lewczuk J, Piszko P. [Rehabilitation of patients with chronic obstructive pulmonary diseases.] *Pneumonol Alergol Pol* 1997;**65**:691–9	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Lewis MI, Fournier M, Storer TW, Bhasin S, Porszasz J, Ren SG, *et al.* Skeletal muscle adaptations to testosterone and resistance training in men with COPD. *J Appl Physiol* 2007;**103**:1299–310	Outcome	Outcome
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Linneberg A, Rasmussen M, Buch TF, Wester A, Malm L, Fannikke G, *et al.* A randomised study of the effects of supplemental exercise sessions after a 7-week chronic obstructive pulmonary disease rehabilitation program. *Clin Respir J* 2012;**6**:112–19	Time point	–
Lisansky DP, Clough DH. A cognitive–behavioral self-help educational program for patients with COPD. A pilot study. *Psychother Psychosomat* 1996;**65**:97–101	Time point	Study design
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Littlejohns P, Baveystock CM, Parnell H, Jones PW. Randomised controlled trial of the effectiveness of a respiratory health worker in reducing impairment, disability, and handicap due to chronic airflow limitation. *Thorax* 1991;**46**:559–64	Time point	–
Liu WT, Wang CH, Lin HC, Lin SM, Lee KY, Lo YL, *et al.* Efficacy of a cell phone-based exercise programme for COPD. *Eur Respir J* 2008;**32**:651–9	Time point	–
Liu Y-F. [Effects of the comprehensive pulmonary rehabilitation programme on the quality of life of the patients with COPD in recovery period.] *Chin J Clin Rehabil* 2002;**6**:3170–1	Time point	Study design
Livermore N, Sharpe L, McKenzie D. Prevention of panic attacks and panic disorder in COPD. *Eur Respir J* 2010;**35**:557–63	Time point	–
Lolak S, Connors GL, Sheridan MJ, Wise TN. Effects of progressive muscle relaxation training on anxiety and depression in patients enrolled in an outpatient pulmonary rehabilitation program. *Psychother Psychosomat* 2008;**77**:119–25	Population	Population

Excluded article	Reasons for exclusion	
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Lomundal BK, Steinsbekk A. Five-year follow-up of a one-year self-management program for patients with COPD. *Int J Chron Obstruct Pulmon Dis* 2012;**7**:87–93	Time point	Study design
Conference proceedings. Long-Term Benefits of Pulmonary Rehabilitation on the Exercise Capacity and Shortness of Breath in Patient With Chronic Obstructive Pulmonary Disease (COPD). Series: Diseases of the Chest. The College; 1996. Vol. 110, no. 4, p. 159S	Unavailable	Unavailable
Lopez ME, Jara PM, Diaz EA, Gonzalez SM, Servian Carroquino RM, Vera VM. [Evaluation of an educational intervention for the use of inhalers in Primary Health Care.] *MEDIFAM – Revista de Medicina Familiar y Comunitaria* 2000;**10**:290–5	Time point	Study design
Lord VM, Cave P, Hume VJ, Flude EJ, Evans A, Kelly JL, *et al.* Singing teaching as a therapy for *Chron Respir Dis*: a randomised controlled trial and qualitative evaluation. *BMC Pulm Med* 2010;**10**:41	Time point	–
Lorenzi CM, Cilione C, Rizzardi R, Furino V, Bellantone T, Lugli D, *et al.* Occupational therapy and pulmonary rehabilitation of disabled COPD patients. *Respiration* 2004;**71**:246–51	Time point	Study design
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Lorig KR, Ritter PL, Gonzalez VM. Hispanic chronic disease self-management: a randomized community-based outcome trial. *Nurs Res* 2003;**52**:361–9	Population	Population
Lotters F, van Tol B, Kwakkel G, Gosselink R. Effects of controlled inspiratory muscle training in patients with COPD: a meta-analysis. *Eur Respir J* 2002;**20**:570–6	Publication type	Publication type
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Lucioni C, Donner CF, De BF, Lusuardi M, Mazzi S, Paggiaro PL, *et al.* [The costs of COPD.] *Pharmacoecon* 2005;**7**:119–34	Intervention	Intervention
Macfarlane J, Holmes W, Gard P, Thornhill D, Macfarlane R, Hubbard R. Reducing antibiotic use for acute bronchitis in primary care: blinded, randomised controlled trial of patient information leaflet. *BMJ* 2002;**324**:91–4	Population	Population
Mackay L. Health education and COPD rehabilitation: a study. *Nurs Stand* 1996;**10**:34–9	Time point	Study design
Madariaga VB, Iturri JB, Manterola AG, Buey JC, Sebastian NT, Pena VS. [Comparison of 2 methods for inspiratory muscle training in patients with chronic obstructive pulmonary disease.] *Arch Bronconeumol* 2007;**43**:431–8	Time point	–
Mador MJ, Bozkanat E, Aggarwal A, Shaffer M, Kufel TJ. Endurance and strength training in patients with COPD. *Chest* 2004;**125**:2036–45	Time point	–
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Excluded article	Reasons for exclusion	
	Review 1	Review 4
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Magadle R, McConnell AK, Beckerman M, Weiner P. Inspiratory muscle training in pulmonary rehabilitation program in COPD patients. *Respir Med* 2007;**101**:1500–5	Time point	–
Maixner J. [Effect of respiratory rehabilitation in patients with pulmonary emphysema.] *Cesk Zdrav* 1963;**11**:486–93	Time point	Study design
Malicdem MG, Cruz BOD, Punzal P, De GT. Outcome of pulmonary rehabilitation among difficult to wean patients admitted at the Philippine heart center – a randomized controlled study. 15th Congress of the Asian Pacific Society of Respirology, 22–25 November 2010, Manila, The Philippines. *Respirology* 2010;**99**	Population	Population
Malik SK. Aerosol therapy and rehabilitation in chronic obstructive pulmonary disease (COPD). *Indian J Chest Dis* 1968;**10**:142–8	Time point	Study design
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Maltais F. *Pulmonary Rehabilitation at Home Versus at the Gymnasium*; 2005. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Martins JA, de Andrade AD, Britto RR, Lara R, Parreira VF. Effect of slow expiration with glottis opened in lateral posture (ELTGOL) on mucus clearance in stable patients with chronic bronchitis. *Respir Care* 2012;**57**:420–6	Time point	Study design
Mattke S, Seid M, Ma S. Evidence for the effect of disease management: is $1 billion a year a good investment? *Am J Manag Care* 2007;**13**:670–6	Publication type	Publication type
McBride S. Patients with chronic obstructive pulmonary disease: their beliefs about measures that increase activity tolerance. *Rehabil Nurs J* 1994;**19**:37–41	Time point	Study design
McBride S, Graydon J, Sidani S, Hall L. The therapeutic use of music for dyspnea and anxiety in patients with COPD who live at home. *J Holist Nurs* 1999;**17**:229–50	Time point	Study design
McCrory DC, Brown C, Gelfand SE, Bach PB. Management of acute exacerbations of COPD: a summary and appraisal of published evidence. *Chest* 2001;**119**:1190–209	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Mertens DJ, Shephard RJ, Kavanagh T. Long-term exercise therapy for chronic obstructive lung disease. *Respiration* 1978;**35**:96–107	Time point	Study design
Meulepas MA, Jacobs JE, Smeenk FWJM, Smeele I, Lucas AEM, Bottema BJAM, *et al.* Effect of an integrated primary care model on the management of middle-aged and old patients with obstructive lung diseases. *Scand J Prim Health Care* 2007;**25**:186–92	Time point	Study design
Miller MB, Conrad WF. Pharmacist involvement in an education program for patients with chronic obstructive pulmonary disease. *Am J Hosp Pharm* 1975;**32**:909–11	Publication type	Publication type
Minoguchi H, Shibuya M, Miyagawa T, Kokubu F, Yamada M, Tanaka H, *et al.* Cross-over comparison between respiratory muscle stretch gymnastics and inspiratory muscle training. *Intern Med* 2002;**41**:805–12	Time point	Study design
Miravitlles M, Guerrero T, Mayordomo C, Sanchez-Agudo L, Nicolau F, Segu JL. Factors associated with increased risk of exacerbation and hospital admission in a cohort of ambulatory COPD patients: a multiple logistic regression analysis. *Respiration* 2000;**67**:495–501	Intervention	Intervention
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Mochizuki A, Tomohisa H, Nakayama S, Kashiwazaki T, Komuro T. [Promotion of self care and organization of a social network for patients with chronic obstructive lung diseases.] *Kango Gijutsu* 1988;**34**:1786–90	Study design	Study design
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Monninkhof E, van der Aa M, van der Valk P, van der Palen J, Zielhuis G, Koning K, *et al.* A qualitative evaluation of a comprehensive self-management programme for COPD patients: effectiveness from the patients' perspective. *Patient Educ Couns* 2004;**55**:177–84	Time point	Study design
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Excluded article	Reasons for exclusion	
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Mota S, Güell R, Barreiro E, Solanes I, Ramirez-Sarmiento A, Orozco-Levi M, *et al.* Clinical outcomes of expiratory muscle training in severe COPD patients. *Respir Med* 2007;**101**:516–24	Time point	–
Moullec G, Favreau H, Lavoie KL, Labrecque M. Does a self-management education program have the same impact on emotional and functional dimensions of HRQoL? *COPD* 2012;**9**:36–45	Time point	Study design
Mousing CA, Lomborg K. Self-care 3 months after attending chronic obstructive pulmonary disease patient education: a qualitative descriptive analysis. *Patient Prefer Adherence* 2012;**6**:19–25	Time point	Study design
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Moxham J. *The Effects of a Home Exercise Video Programme for Patients With COPD*; 2007. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Publication type	Publication type
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Mungall IP, Hainsworth R. An objective assessment of the value of exercise training to patients with chronic obstructive airways disease. *Q J Med* 1980;**49**:77–85	Time point	Study design
Murphy K, Casey D, Devane D, Cooney A, McCarthy B, Mee L, *et al.* A cluster randomised controlled trial evaluating the effectiveness of a structured pulmonary rehabilitation education programme for improving the health status of people with chronic obstructive pulmonary disease (COPD): The PRINCE Study protocol. *BMC Pulm Med* 2011;**11**:4	Publication type	Publication type
Murphy K, Casey D, Devane D, Cooney A, McCarthy B, Mee L, *et al.* The effectiveness of a structured education pulmonary rehabilitation programme for improving the health status of people with Chronic Obstructive Pulmonary Disease (COPD): The PRINCE study. Irish Thoracic Society Annual Scientific Meeting, 11–12 November 2011, Co. Dublin, Ireland. *Ir J Med Sci* 2011:S457	Time point	Publication type
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Nakamura Y, Tanaka K, Shigematsu R, Nakagaichi M, Lnoue M, Homma T. Effects of aerobic training and recreational activities in patients with chronic obstructive pulmonary disease. *Int J Rehabil Res* 2008;**31**:275–83	Time point	–

Excluded article	Reasons for exclusion	
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Nava S. Rehabilitation of patients admitted to a respiratory intensive care unit. *Arch Phys Med Rehabil* 1998;**79**:849–54	Time point	–
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Neff DF, Madigan E, Narsavage G. APN-directed transitional home care model: achieving positive outcomes for patients with COPD. *Home Healthc Nurse* 2003;**21**:543–50	Intervention	Intervention
Newton DA, Bevans HG. Physiotherapy and intermittent positive-pressure ventilation of chronic bronchitis. *Br Med J* 1978;**2**:1525–8	Intervention	Intervention
Ng BH, Tsang HW, Jones AY, So CT, Mok TY. Functional and psychosocial effects of health qigong in patients with COPD: a randomized controlled trial. *J Altern Complement Med* 2011;**17**:243–51	Time point	–
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Nici L, Donner C, Wouters E, Zuwallack R, Ambrosino N, Bourbeau J, *et al.* American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation. *Am J Respir Crit Care Med* 2006;**173**:1390–413	Study design	Study design
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Nissen I, Jensen MS. [Nurse-supported discharge of patients with exacerbation of chronic obstructive pulmonary disease.] *Ugeskr Laeger* 2007;**169**:2220–3	Intervention	Intervention
Nissen I, Jensen MS. [Randomised controlled trial of nurse-supported discharge of patients with exacerbation of chronic obstructive pulmonary disease.] *Ugeskr Laeger* 2007;**169**:2220–3	Duplicate	Duplicate
Normandin EA, McCusker C, Connors M, Vale F, Gerardi D, Zuwallack RL. An evaluation of two approaches to exercise conditioning in pulmonary rehabilitation. *Chest* 2002;**121**:1085–91	Time point	–

Excluded article	Reasons for exclusion	
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Noseda A, Carpiaux JP, Vandeput W, Prigogine T, Schmerber J. Resistive inspiratory muscle training and exercise performance in COPD patients. A comparative study with conventional breathing retraining. *Bull Eur Physiopathol Respir* 1987;**23**:457–63	Time point	–
Nosworthy J, Barter C, Thomas S, Flynn M. An evaluation of the three elements of pulmonary rehabilitation. *Aust Physiother* 1993;**38**:189–93	Time point	–
O'Bey KA, Jim LK, Gee JP, Cowen ME, Quigley AE. An education program that improves the psychomotor skills needed for metaproterenol inhaler use. *Drug Intell Clin Pharm* 1982;**16**:945–8	Population	Population
O'Donnell DE, McGuire M, Samis L, Webb KA. General exercise training improves ventilatory and peripheral muscle strength and endurance in chronic airflow limitation. *Am J Respir Crit Care Med* 1998;**157**:1489–97	Time point	Study design
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Oga T, Nishimura K, Tsukino M, Sato S. Exercise responses during endurance testing at different intensities in patients with COPD. *Respir Med* 2004;**98**:515–21	Time point	Study design
Oh EG. The effects of home-based pulmonary rehabilitation in patients with chronic lung disease. *Int J Nurs Stud* 2003;**40**:873–9	Time point	–
O'Hara WJ, Lasachuk KE, Matheson PC. Weight training and backpacking in chronic obstructive pulmonary disease. *Respir Care* 1984;**29**:1202–10	Time point	Study design
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Oka T. [Self-care and guidance of patients: nursing of patients with chronic obstructive lung diseases. Actions by self-help groups and the significance of their activities.] *Kango gijutsu* 1988;**34**:1756–60	Study design	Study design
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O'Neill ES. Illness representations and coping of women with chronic obstructive pulmonary disease: a pilot study. *Heart Lung* 2002;**31**:295–302	Time point	Study design
Onodera A, Yazaki K. [Effects of a short-term pulmonary rehabilitation program on patients with chronic respiratory failure due to pulmonary emphysema.] *Nihon Kokyuki Gakkai Zasshi* 1998;**36**:679–83	Time point	Study design
Ortega F, Toral J, Cejudo P, Villagomez R, Sanchez H, Castillo J, *et al.* Comparison of effects of strength and endurance training in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2002;**166**:669–74	Time point	–
O'Shea SD, Taylor NF, Paratz JD. A predominantly home-based progressive resistance exercise program increases knee extensor strength in the short-term in people with chronic obstructive pulmonary disease: a randomised controlled trial. *Aust J Physiother* 2007;**53**:229–37	Time point	–

Excluded article	Reasons for exclusion	
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Ozdemir EP, Solak O, Fidan F, Demirdal US, Evcik D, Unlu M, *et al.* [The effect of water-based pulmonary rehabilitation on anxiety and quality of life in chronic pulmonary obstructive disease patients.] *Turkiye Klinikleri J Med Sci* 2010;**30**:880–7	Time point	–
Paget T, Jones C, Davies M, Evered C, Lewis C. Using home telehealth to empower patients to monitor and manage long term conditions. *Nurs Times* 2010;**106**:17–19	Population	Population
Panton LB, Golden J, Broeder CE, Browder KD, Cestaro-Seifer DJ, Seifer FD. The effects of resistance training on functional outcomes in patients with chronic obstructive pulmonary disease. *Eur J Appl Physiol* 2004;**91**:443–9	Time point	Study design
Pardy RL, Rivington RN, Despas PJ, Macklem PT. Inspiratory muscle training compared with physiotherapy in patients with chronic airflow limitation. *Am Rev Respir Dis* 1981;**123**:421–5	Time point	Study design
Park K, Robbins RA. ACP Journal Club. A COPD disease management program reduced a composite of hospitalizations or emergency department visits. *Ann Intern Med* 2011;**154**:JC3–5	Publication type	Publication type
Pascual-Pape T, Badia JR, Marrades RM, Hernandez C, Ballester E, Fornas C, *et al.* [Results of a preventive program and assisted hospital discharge for COPD exacerbation. A feasibility study.] *Med Clin* 2003;**120**:408–11	Study design	Study design
Paz-Diaz H, Montes de OM, Lopez JM, Celli BR. Pulmonary rehabilitation improves depression, anxiety, dyspnea and health status in patients with COPD. *Am J Phys Med Rehabil* 2007;**86**:30–6	Time point	–
Pereira AM, Santa-Clara H, Pereira E, Simoes S, Remedios I, Cardoso J, *et al.* Impact of combined exercise on chronic obstructive pulmonary patients' state of health. *Rev Port Pneumol* 2010;**16**:737–57	Time point	Study design
Perry JA. Effectiveness of teaching in the rehabilitation of patients with chronic bronchitis and emphysema. *Nurs Res* 1981;**30**:219–22	Time point	Study design
Petersen AM, Mittendorfer B, Magkos F, Iversen M, Pedersen BK. Physical activity counteracts increased whole-body protein breakdown in chronic obstructive pulmonary disease patients. *Scand J Med Sci Sports* 2008;**18**:557–64	Time point	–
Petty TL, Nett LM, Finigan MM, Brink GA, Corsello PR. A comprehensive care program for chronic airway obstruction. Methods and preliminary evaluation of symptomatic and functional improvement. *Ann Intern Med* 1969;**70**:1109–20	Time point	Study design
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Petty TL, Dempsey EC, Collins T, Pluss W, Lipkus I, Cutter GR, *et al.* Impact of customized videotape education on quality of life in patients with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 2006;**26**:112–17	Time point	–
Pfister T, Berrol C, Caplan C. Effects of music on exercise and perceived symptoms in patients with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 1998;**18**:228–32	Time point	Study design
Phillips WT, Benton MJ, Wagner CL, Riley C. The effect of single set resistance training on strength and functional fitness in pulmonary rehabilitation patients. *J Cardiopulm Rehabil* 2006;**26**:330–7	Time point	–
Pilotto LS, Smith BJ, Heard AR, McElroy HJ, Weekley J, Bennett P. Trial of nurse-run asthma clinics based in general practice versus usual medical care. *Respirology* 2004;**9**:356–62	Population	Population

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Pinnock H, Hanley J, Lewis S, MacNee W, Pagliari C, van der Pol M, *et al.* The impact of a telemetric chronic obstructive pulmonary disease monitoring service: randomised controlled trial with economic evaluation and nested qualitative study. *Prim Care Resp J* 2009;**18**:233–5	Publication type	Publication type
Pison C, Cano N, Cherion C, Roth H, Pichard C. [Effects of home pulmonary rehabilitation in patients with chronic respiratory failure and nutritional depletion.] *Rev Mal Respir* 2004;**21**:573–82	Publication type	Publication type
Pison CM, Cano NJ, Cherion C, Caron F, Court-Fortune I, Antonini MT, *et al.* Multimodal nutritional rehabilitation improves clinical outcomes of malnourished patients with chronic respiratory failure: a randomised controlled trial. *Thorax* 2011;**66**:953–60	Intervention	Intervention
Piszko P, Lewczuk J, Jagas J, Kowalska-Superlak K, Wrabec K. Oxygen saturation at rest, on exercise and during sleep in non oxygenated rehabilitation patients with COPD. *Eur Respir J* 2002;**20**(Suppl. 38):235	Publication type	Publication type
Piszko P, Lewczuk J, Kowalska-Superlak M, Jagas J, Ludwik B, Wrabec K. [Effect of a 2-year pulmonary rehabilitation on the 7-year prognosis in patients with advanced chronic obstructive pulmonary disease.] *Pol Arch Med Wewn* 2004;**111**:57–62	Time point	Study design
Pitta F, Brunetto AF, Padovani CR, Godoy I. Effects of isolated cycle ergometer training on patients with moderate-to-severe chronic obstructive pulmonary disease. *Respiration* 2004;**71**:477–83	Time point	Study design
Pitta F, Takaki MY, Oliveira NH, Sant'anna TJ, Fontana AD, Kovelis D, *et al.* Relationship between pulmonary function and physical activity in daily life in patients with COPD. *Respir Med* 2008;**102**:1203–07	Time point	Study design
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Poole PJ, Chase B, Frankel A, Black PN. Case management may reduce length of hospital stay in patients with recurrent admissions for chronic obstructive pulmonary disease. *Respirology* 2001;**6**:37–42	Time point	Study design
Porszasz J, Emtner M, Goto S, Somfay A, Whipp BJ, Casaburi R. Exercise training decreases ventilatory requirements and exercise-induced hyperinflation at submaximal intensities in patients with COPD. *Chest* 2005;**128**:2025–34	Time point	Study design
Porta R, Vitacca M, Gile LS, Clini E, Bianchi L, Zanotti E, *et al.* Supported arm training in patients recently weaned from mechanical ventilation. *Chest* 2005;**128**:2511–20	Intervention	Intervention
Porto EF, Castro AA, Velloso M, Nascimento O, Dal MF, Jardim JR. Exercises using the upper limbs hyperinflate COPD patients more than exercises using the lower limbs at the same metabolic demand. *Monaldi Archr Chest Dis* 2009;**71**:21–6	Time point	Study design
Potashov DA, Kokosov AN. [Characteristics and results of rehabilitation of patients with chronic obstructive bronchitis at a specialized department.] *Probl Tuberk* 1990;**3**:62–6	Time point	Study design
Pouw EM, Ten Velde GP, Croonen BH, Kester AD, Schols AM, Wouters EF. Early non-elective readmission for chronic obstructive pulmonary disease is associated with weight loss. *Clin Nutr* 2000;**19**:95–9	Study design	Study design
Premaratne U, Sterne J, Marks G, Webb J, Azima H, Burney P. Clustered randomised trial of an intervention to improve the management of asthma: Greenwich asthma study. *BMJ* 1999;**318**:1251–5	Population	Population
Preusser BA, Winningham ML, Clanton TL. High- vs low-intensity inspiratory muscle interval training in patients with COPD. *Chest* 1994;**106**:110–17	Time point	–

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Prigmore S. *Does an Individualised Self-management Plan Help Patients with Chronic Obstructive Pulmonary Disease (COPD) Initiate Early Treatment for Infective Exacerbations?* ISRCTN Register 2004. URL: www.isrctn.org (accessed 27 January 2015)	Publication type	Publication type
Prince KL, Helm M. Effectiveness of a rehabilitation programme in chronic bronchitis and emphysema. *Clin Rehabil* 1989;**3**:211–14	Time point	–
Prior H. *Randomized Controlled Trial of Home Telemonitoring for Elderly People (Dreaming)*; 2009. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Population	Population
Probst VS, Troosters T, Coosemans I, Spruit MA, Pitta FO, Decramer M, *et al.* Mechanisms of improvement in exercise capacity using a rollator in patients with COPD. *Chest* 2004;**126**:1102–7	Time point	Study design
Probst VS, Troosters T, Pitta F, Decramer M, Gosselink R. Cardiopulmonary stress during exercise training in patients with COPD. *Eur Respir J* 2006;**27**:1110–18	Time point	Study design
Probst VS, Kovelis D, Hernandes NA, Camillo CA, Cavalheri V, Pitta F. Effects of 2 exercise training programs on physical activity in daily life in patients with COPD. *Respir Care* 2011;**56**:1799–807	Time point	–
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Puente-Maestu L, Sanz ML, Sanz P, Ruiz De Ona JM, Rodriguez-Hermosa JL, Whipp BJ. Effects of two types of training on pulmonary and cardiac responses to moderate exercise in patients with COPD. *Eur Respir J* 2000;**15**:1026–32	Time point	–
Puente-Maestu L, SantaCruz A, Vargas T, Martinez-Abad Y, Whipp BJ. Effects of training on the tolerance to high-intensity exercise in patients with severe COPD. *Respiration* 2003;**70**:367–70	Time point	Study design
Puente-Maestu L, Luisa SM, Sanz P, de Ona RJ, Arnedillo A, Casaburi R. Long-term effects of a maintenance program after supervised or self-monitored training programs in patients with COPD. *Lung* 2003;**181**:67–78	Time point	–
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Puhan M, Spaar A, Frey M, Turk A, Brandli O, Ritscher D, *et al.* Timing of pulmonary rehabilitation – Swiss trial on pulmonary rehabilitation after COPD exacerbation (SOPRE). Joint Annual Meeting of the Swiss Respiratory Society, Swiss Society of Oto-Rhino-Laryngology, Head and Neck Surgery, Swiss Paediatric Respiratory Society and Swiss Society for Thoracic Surgery, 4–5 May 2011, Interlaken, Switzerland. *Respiration* 2011:**92**	Intervention	Publication type
Puhan MA, Busching G, Schunemann HJ, van Oort E, Zaugg C, Frey M. Interval versus continuous high-intensity exercise in chronic obstructive pulmonary disease: a randomized trial. [Summary for patients in *Ann Intern Med* 2006;**145**:I49.] *Ann Intern Med* 2006;**145**:816–25	Time point	–
Puhan MA, Schunemann HJ, Buesching G, van Oort E, Spaar A, Frey M. COPD patients' ability to follow exercise influences short-term outcomes of rehabilitation. *Eur Respir J* 2008;**31**:304–10	Time point	Study design
Punzal PA, Ries AL, Kaplan RM, Prewitt LM. Maximum intensity exercise training in patients with chronic obstructive pulmonary disease. *Chest* 1991;**100**:618–23	Time point	Study design
Pushparajah S, McClellan R, Henry A, Kuitert LM. Use of a chronic disease management programme in COPD to reduce hospital admissions. *Chron Respir Dis* 2006;**3**:187–93	Study design	Study design
Putt MT, Watson M, Seale H, Paratz JD. Muscle stretching technique increases vital capacity and range of motion in patients with chronic obstructive pulmonary disease. *Arch Phys Med Rehabil* 2008;**89**:1103–7	Time point	Study design

Excluded article	Reasons for exclusion	
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Rasekaba TM, Williams E, Hsu-Hage B. Can a chronic disease management pulmonary rehabilitation program for COPD reduce acute rural hospital utilization? *Chron Respir Dis* 2009;**6**:157–63	Time point	Study design
Rea H, McAuley S, Stewart A, Lamont C, Roseman P, Didsbury P. A chronic disease management programme can reduce days in hospital for patients with chronic obstructive pulmonary disease. *Intern Med J* 2004;**34**:608–14	Time point	–
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Reema T, Adepu R, Sabin T. Impact of clinical pharmacist intervention on knowledge, attitude and practice (KAP) of patients with chronic obstructive pulmonary disease. *Int J Pharm Pharm Sci* 2010;**2**:54–7	Time point	Study design
Rees PJ. A disease-specific self-management program reduced hospital utilization and improved health status in COPD. *ACP J Club* 2012;**139**:65	Publication type	Publication type
Regiane R, V, Gorostiza A, Galdiz JB, Lopez de Santa ME, Casan CP, Güell RR. [Benefits of a home-based pulmonary rehabilitation program for patients with severe chronic obstructive pulmonary disease.] *Arch Bronconeumol* 2007;**43**:599–604	Time point	–
Reid WD, Samrai B. Respiratory muscle training for patients with chronic obstructive pulmonary-disease. *Phys Ther* 1995;**75**:996–1005	Publication type	Publication type
Rejbi IB, Trabelsi Y, Chouchene A, Ben TW, Ben SH, Zbidi A, *et al.* Changes in six-minute walking distance during pulmonary rehabilitation in patients with COPD and in healthy subjects. *Int J Chron Obstruct Pulmon Dis* 2010;**5**:209–15	Population	Population
Ren L, Li Q-Y, Du J-B, Zhou J-M, Weng Q-L, Chen X-H. Comparison of different strategies of pulmonary rehabilitation for patients with COPD of different severity. *J Shanghai Jiaotong Uni (Med Sci)* 2011;**31**:620–4	Time point	–
Renfroe KL. Effect of progressive relaxation on dyspnea and state anxiety in patients with chronic obstructive pulmonary disease. *Heart Lung* 1988;**17**:408–13	Population	Population
Renzi G, Renzi P. [Role of respiratory muscle training in a rehabilitation program for patients with chronic obstructive pulmonary disease.] *Union Medicale de Canada* 1985;**114**:897–901	Time point	Study design
Resnikoff PM, Ries AL. Pulmonary rehabilitation for chronic lung disease. *J Heart Lung Transpl* 1998;**17**:643–50	Publication type	Publication type
Riario-Sforza GG, Incorvaia C, Paterniti F, Pessina L, Caligiuri R, Pravettoni C, *et al.* Effects of pulmonary rehabilitation on exercise capacity in patients with COPD: a number needed to treat study. *Int J Chron Obstruct Pulmon Dis* 2009;**4**:315–19	Time point	Study design
Rice KL, Dewan N, Bloomfield HE, Grill J, Schult TM, Nelson DB, *et al.* Disease management program for chronic obstructive pulmonary disease: a randomized controlled trial. *Am J Respir Crit Care Med* 2010;**182**:890–6	Time point	–
Richards S, Coast J, Gunnell D, Peters T, Poundsford J, Darlow M-A. Randomised controlled trial comparing effectiveness and acceptability of an early discharge, hospital at home scheme with acute hospital care. *BMJ* 1998;**316**:1796–806	Population	Population
Richardson J, Dunn L, Pardy R. Inspiratory resistive endurance training in patients with chronic obstructive pulmonary disease: a pilot study. *Physiother Can* 1989;**41**:85–92	Time point	Study design

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Riera HS, Rubio TM, Ruiz FO, Ramos PC, Del Castillo OD, Hernandez TE, *et al.* Inspiratory muscle training in patients with COPD: effect on dyspnea, exercise performance, and quality of life. *Chest* 2001;**120**:748–56	Time point	–
Ries AL, Archibald CJ. Endurance exercise training at maximal targets in patients with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 1987;**7**:594–601	Time point	Study design
Ries AL, Moser KM. Comparison of isocapnic hyperventilation and walking exercise training at home in pulmonary rehabilitation. *Chest* 1986;**90**:285–9	Time point	–
Ries AL, Ellis B, Hawkins RW. Upper extremity exercise training in chronic obstructive pulmonary disease. *Chest* 1988;**93**:688–92	Time point	–
Ries AL, Kaplan RM, Limberg TM, Prewitt LM. Effect of pulmonary rehabilitation program on hospital days of COPD patients. *Ann Intern Med* 1995;**122**:823–32	Unavailable	Unavailable
Ries AL, Kaplan RM, Limberg TM, Prewitt LM. Effects of pulmonary rehabilitation on physiologic and psychosocial outcomes in patients with chronic obstructive pulmonary disease. *Ann Intern Med* 1995;**122**:823–32	Time point	–
Ries AL, Kaplan RM, Myers R, Prewitt LM. Maintenance after pulmonary rehabilitation in chronic lung disease: a randomized trial. *Am J Respir Crit Care Med* 2003;**167**:880–8	Population	Population
Ries AL, Make BJ, Lee SM, Krasna MJ, Bartels M, Crouch R, *et al.* The effects of pulmonary rehabilitation in the national emphysema treatment trial. *Chest* 2005;**128**:3799–809	Time point	Study design
Ries AL, Bauldoff GS, Carlin BW, Casaburi R, Emery CF, Mahler DA, *et al.* Pulmonary rehabilitation: Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. *Chest* 2007;**131**(Suppl. 5):4–42S	Publication type	Publication type
Ringbaek TJ, Broendum E, Hemmingsen L, Lybeck K, Nielsen D, Andersen C, *et al.* Rehabilitation of patients with chronic obstructive pulmonary disease. Exercise twice a week is not sufficient! *Respir Med* 2000;**94**:150–4	Time point	–
Ringbaek TJ, Nielsen LL, Admasu H, Lange P. [Early supported discharge for patients with exacerbations of chronic obstructive pulmonary disease.] *Ugeskr Laeger* 2008;**170**:47–50	Intervention	Intervention
Ringbaek T, Brondum E, Martinez G, Lange P, Pulmonary Rehabilitation Research Group. Rehabilitation in COPD: the long-term effect of a supervised 7-week program succeeded by a self-monitored walking program. *Chron Respir Dis* 2008;**5**:75–80	Time point	Study design
Ringbaek T, Brondum E, Martinez G, Thogersen J, Lange P. Long-term effects of 1-year maintenance training on physical functioning and health status in patients with COPD: a randomized controlled study. *J Cardiopulm Rehabil Prev* 2010;**30**:47–52	Intervention	Intervention
Roberts CM, Ryland I, Lowe D, Kelly Y, Bucknall CE, Pearson MG. Audit of acute admissions of COPD: standards of care and management in the hospital setting. *Eur Respir J* 2001;**17**:343–9	Study design	Study design
Roberts MM, Leeder SR, Robinson TD. Nurse-led 24-h hotline for patients with chronic obstructive pulmonary disease reduces hospital use and is safe. *Intern Med J* 2008;**38**:334–40	Time point	Study design
Roberts SE, Kettle G, Rogers S, Segal A, Purcell S, Fabris G, *et al.* Piloting and evaluating post-pulmonary rehabilitation (PR) long-term exercise (LTE) for COPD patients. British Thoracic Society Winter Meeting, 7–9 November 2011, London, UK. *Thorax* 2011:A127–8	Time point	Study design
Roberts SE, Schreuder FM, Watson T, Stern M. A randomised control trial to investigate the effectiveness of PLB in the clinical setting. British Thoracic Society Winter Meeting, 7–9 November 2011, London, UK. *Thorax* 2011:A175–6	Time point	Publication type

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Robinson S, Fletcher C, Parrington J, Norell J, Mabbett S. COPD and me: The development and implementation of an individual patient management plan and hand-held record. British Thoracic Society Winter Meeting, 1–3 December 2010, London, UK. *Thorax* 2010; A174–5	Time point	Study design
Robinson T. Living with severe hypoxic COPD: the patients' experience. *Nurs Times* 2005;**101**:38–42	Time point	Study design
Rodgers S, Dyas J, Molyneux AW, Ward MJ, Revill SM. Evaluation of the information needs of patients with chronic obstructive pulmonary disease following pulmonary rehabilitation: a focus group study. *Chron Respir Dis* 2007;**4**:195–203	Time point	Study design
Romagnoli M, Dell'Orso D, Lorenzi C, Crisafulli E, Costi S, Lugli D, *et al.* Repeated pulmonary rehabilitation in severe and disabled COPD patients. *Respiration* 2006;**73**:769–76	Time point	–
Roomi J, Yohannes AM, Connolly MJ. The effect of walking aids on exercise capacity and oxygenation in elderly patients with chronic obstructive pulmonary disease. *Age Ageing* 1998;**27**:703–6	Time point	Study design
Rootmensen GN, van Keimpema AR, Looysen EE, van der Schaaf L, de Haan RJ, Jansen HM. The effects of additional care by a pulmonary nurse for asthma and COPD patients at a respiratory outpatient clinic: results from a double blind, randomized clinical trial. *Patient Educ Couns* 2008;**70**:179–86.	Population	Population
Rooyackers JM, Berkeljon DA, Folgering HT. Eccentric exercise training in patients with chronic obstructive pulmonary disease. *Int J Rehabil Res* 2003;**26**:47–4	Time point	–
Rosser R, Denford J, Heslop A, Kinston W, Macklin D, Minty K, *et al.* Breathlessness and psychiatric morbidity in chronic bronchitis and emphysema: a study of psychotherapeutic management. *Psychol Med* 1983;**13**:93–110	Intervention	Intervention
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Ruiz de Ona Lacasta JM, Garcia de PJ, Puente ML, Llorente ID, Celdran GJ, Cubillo Marcos JM. [Effects of muscle training on breathing pattern in patients with severe chronic obstructive pulmonary disease.] *Arch Bronconeumol* 2004;**40**:20–3.	Time point	–
Ruzicka J, Zvonar J, Kolesar J, Redhammer R, Kristufek P, Karpatiova A, *et al.* [Effectiveness of load training in the rehabilitation of patients with chronic obstructive lung disease.] *Studia Pneumologica et Phtiseologica Cechoslovaca* 1989;**49**:544–8	Time point	Study design
Ruzicka J, Zvonar J, Kolesar J, Redhammer R, Kristufek P, Karpatiova A, *et al.* [Resisted inspiration training and re-education of *respiration* in the rehabilitation programme on patients with chronic pulmonary obstructive disease.] *Studia Pneumologica et Phtiseologica Cechoslovaca* 1989;**49**:538–43	Time point	Study design
Sabapathy S, Kingsley RA, Schneider DA, Adams L, Morris NR. Continuous and intermittent exercise responses in individuals with chronic obstructive pulmonary disease. *Thorax* 2004;**59**:1026–31	Time point	Study design
Sala E, Alegre L, Carrera M, Ibars M, Orriols FJ, Blanco ML, *et al.* Supported discharge shortens hospital stay in patients hospitalized because of an exacerbation of COPD. *Eur Respir J* 2001;**17**:1138–42	Intervention	Study design
Sala E, Roca J, Marrades RM, Alonso J, Gonzalez De Suso JM, Moreno A, *et al.* Effects of endurance training on skeletal muscle bioenergetics in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1999;**159**:1726–34	Population	Population
Sandland CJ, Morgan MD, Singh SJ. Detecting oxygen desaturation in patients with COPD: incremental versus endurance shuttle walking. *Respir Med* 2008;**102**:1148–52	Intervention	Intervention

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Santiworakul A, Jarungjitaree S, Jalayondeja W, Chantarothorn S, Supaibulpipat S. Effect of lower extremity exercise on muscle strength and physical capacity in COPD patients. *J Med Assoc Thailand* 2009;**92**:556–63	Time point	Study design
Santos C, Santos J, Morais L, Rodrigues F, Rbara C. Pulmonary rehabilitation in COPD: Effects of two aerobic exercise intensity in patient-centered outcomes: a randomized study. European Respiratory Society Annual Congress, 18–22 September 2010, Barcelona, Spain, p. 2835	Publication type	Publication type
Santos C, Santos J, Morais L, Rodrigues F, Barbara C. Pulmonary rehabilitation in COPD: effects of two aerobic exercise intensity in patient-centered outcomes: a randomized study. CHEST conference, 22–26 November 2011, Honolulu, HI, USA. *Chest* 2011:(var. pagings)	Time point	Publication type
Sasaki Y. [Pulmonary rehabilitation.] *Hokkaido igaku zasshi* 1986;**61**:340–3	Study design	Study design
Sassi-Dambron DE, Eakin EG, Ries AL, Kaplan RM. Treatment of dyspnea in COPD. A controlled clinical trial of dyspnea management strategies. *Chest* 1995;**107**:724–9	Time point	–
Satake M, Shioya T, Takahashi H, Kawatani M. Ventilatory responses to six-minute walk test, incremental shuttle walking test, and cycle ergometer test in patients with chronic obstructive pulmonary disease. *Biomed Res* 2003;**24**:309–16	Time point	Study design
Saudny-Unterberger H, Martin JG, Gray-Donald K. Impact of nutritional support on functional status during an acute exacerbation of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1997;**156**:794–9	Intervention	Intervention
Saunders KB, White JE. Controlled trial of breathing exercises. *Br Med J* 1965;**2**:680–2	Time point	–
Savci S, Ince DI, Arikan H. A comparison of autogenic drainage and the active cycle of breathing techniques in patients with chronic obstructive pulmonary diseases. *J Cardiopulm Rehabil* 2000;**20**:37–43	Time point	–
Scherer TA, Spengler CM, Owassapian D, Imhof E, Boutellier U. Respiratory muscle endurance training in chronic obstructive pulmonary disease: impact on exercise capacity, dyspnea, and quality of life. *Am J Respir Crit Care Med* 2000;**162**:1709–14	Time point	–
Scherer YK, Janelli LM, Schmieder LE. Chronic obstructive pulmonary disease: does participating in a Help Yourself to Better Breathing Program make a difference? *J Cardiopulm Rehabil* 1989;**9**:492–6	Time point	Study design
Scherer YK, Janelli LM, Schmieder LE. A time-series perspective on effectiveness of a health teaching program on chronic obstructive pulmonary disease. *J Healthc Educ Train* 1992;**6**:7–13	Time point	Study design
Scherer YK, Schmieder LE. The effect of a pulmonary rehabilitation program on self-efficacy, perception of dyspnea, and physical endurance. *Heart Lung* 1997;**26**:15–22	Time point	Study design
Scherer YK, Schmieder LE, Shimmel S. The effects of education alone and in combination with pulmonary rehabilitation on self-efficacy in patients with COPD. *Rehabil Nurs J* 1998;**23**:71–7	Time point	Study design
Schlozman DL. Rehabilitation of patients with chronic obstructive lung disease. *Pneumonologia Polska* 1986;**54**:217–21	Publication type	Publication type
Schols AM, Soeters PB, Mostert R, Pluymers RJ, Wouters EF. Physiologic effects of nutritional support and anabolic steroids in patients with chronic obstructive pulmonary disease. A placebo-controlled randomized trial. *Am J Respir Crit Care Med* 1995;**152**:1268–74	Intervention	Intervention
Schomberg LEE, Garner JL, Porter JW, Bahadur K, Ross L, Kosky CA, *et al.* Does the provision of a rescue pack keep patients with chronic obstructive pulmonary disease (COPD) at home? British Thoracic Society Winter Meeting, 7–9 November 2011, London, UK. *Thorax* 2011:A174	Conference abstract	Publication type

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Schonlau M, Mangione-Smith R, Chan KS, Keesey J, Rosen M, Louis TA, *et al.* Evaluation of a quality improvement collaborative in asthma care: does it improve processes and outcomes of care? *Ann Fam Med* 2005;**3**:200–8	Population	Population
Schucher B, Criee C-P. [Respiratory muscle training.] *Atemweg Lungenkrank* 2009;**35**:312–17	Study design	Study design
Schultz K, Schwiersch M, Petro W, Muhlig S, Petermann F. [Individualized, modular structured patient behavioral training in obstructive airway diseases during inpatient rehabilitation.] *Pneumologie* 2000;**54**:296–305	Publication type	Publication type
Schultz K, Stark HJ, Petro W. [New educational tasks in the rehabilitation of respiratory diseases.] *Atemwegs- und Lungenkrankheiten* 1996;**22**:38–44	Time point	Study design
Schulz M, Verheyen F, Muhlig S, Muller JM, Muhlbauer K, Knop-Schneickert E, *et al.* Pharmaceutical care services for asthma patients: a controlled intervention study. *J Clin Pharmacol* 2001;**41**:668–76	Population	Population
Sedeno MF, Nault D, Hamd DH, Bourbeau J. A written action plan for early treatment of COPD exacerbations: an important component to the reduction of hospitalizations. *Proc ATS* 2006;**3**:A603	Publication type	Publication type
Sedeno MF, Nault D, Hamd DH, Bourbeau J. A self-management education program including an action plan for acute COPD exacerbations. *COPD* 2009;**6**:352–8	Time point	Study design
Seron P, Riedemann P, Munoz S, Doussoulin A, Villarroel P, Cea X. [Effect of inspiratory muscle training on muscle strength and quality of life in patients with chronic airflow limitation: A randomized controlled trial.] *Arch Bronconeumol* 2005;**41**:601–6	Population	Population
Serres I, Varray A, Vallet G, Micallef JP, Prefaut C. Improved skeletal muscle performance after individualized exercise training in patients with chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 1997;**17**:232–8	Time point	Study design
Sewell L, Singh SJ, Williams JE, Collier RJ, Morgan MDL. Goal directed pulmonary rehabilitation does not significantly improve health status and domestic function. *Eur Respir J* 2001;**18**(Suppl. 33):187s	Time point	Publication type
Sewell L, Singh SJ, Williams JE, Collier R, Morgan MD. Can individualized rehabilitation improve functional independence in elderly patients with COPD? *Chest* 2005;**128**:1194–200	Time point	–
Sewell L, Singh SJ, Williams JE, Collier R, Morgan MD. How long should outpatient pulmonary rehabilitation be? A randomised controlled trial of 4 weeks versus 7 weeks. *Thorax* 2006;**61**:767–71	Time point	–
Seymour JM, Moore L, Jolley CJ, Ward K, Creasey J, Steier JS, *et al.* Outpatient pulmonary rehabilitation following acute exacerbations of COPD. *Thorax* 2010;**65**:423–8	Intervention	–
Shahin B, Germain M, Kazem A, Annat G. Benefits of short inspiratory muscle training on exercise capacity, dyspnea, and inspiratory fraction in COPD patients. *Int J Chron Obstruct Pulmon Dis* 2008;**3**:423–7	Time point	Study design
Shakur H. A COPD self management programme reduced hospital use and improved health status. *Evid Based Nurs* 2003;**6**:111	Publication type	Publication type
Shao L-Z. [Effects of the behavioral intervention on the life quality of the patients with chronic obstructive pulmonary disease in remission period.] *Chin J Clin Rehabil* 2003;**7**:4078–9	Time point	–
Shepperd S, Harwood D, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis. *BMJ* 1998;**316**:1791–6	Intervention	Intervention
Sheridan N, Kenealy T, Salmon E, Rea H, Raphael D, Schmidt-Busby J. Helplessness, self blame and faith may impact on self management in COPD: a qualitative study. *Prim Care Resp J* 2001;**20**:307–14	Time point	Study design

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Conference proceedings. Short-Term In-hospital Rehabilitation Program (SRP) in COPD Patients. Functional and Clinical Effectiveness. Series: Diseases of the chest. The College; 1996. Vol. 110, no. 4. p. 137S	Unavailable	Unavailable
Silverman M, Musa D, Kirsch B, Siminoff LA. Self care for chronic illness: older African Americans and whites. *J Cross Cult Gerontol* 1999;**14**:169–89	Time point	Study design
Simpson K, Killian K, McCartney N, Stubbing DG, Jones NL. Randomised controlled trial of weightlifting exercise in patients with chronic airflow limitation. *Thorax* 1992;**47**:70–5	Time point	–
Sin DD, McAlister FA, Man SF, Anthonisen NR. Contemporary management of chronic obstructive pulmonary disease: scientific review. *JAMA* 2003;**290**:2301–12	Publication type	Publication type
Sinclair DJ, Ingram CG. Controlled trial of supervised exercise training in chronic bronchitis. *BMJ* 1980;**280**:519–21	Study design	Study design
Sindhwani G, Verma A, Biswas D, Srivastava M, Rawat J. A pilot study on domiciliary pulmonary rehabilitation programme in the management of severe chronic obstructive pulmonary disease. *Singapore Med J* 2011;**52**:689–93	Time point	Study design
Singh V, Khandelwal DC, Khandelwal R, Abusaria S. Pulmonary rehabilitation in patients with chronic obstructive pulmonary disease. *Indian J Chest Dis Allied Sci* 2003;**45**:13–17	Time point	–
Singh VP, Rao V, Prem V, Sahoo RC, Kenshav Pai K. Comparison of the effectiveness of music and progressive muscle relaxation for anxiety in COPD: a randomized controlled pilot study. *Chron Respir Dis* 2009;**6**:209–16	Time point	–
Sirey JA, Raue PJ, Alexopoulos GS. An intervention to improve depression care in older adults with COPD. *Int J Geriatr Psychiatry* 2007;**22**:154–9	Intervention	Intervention
Sirinoglu Y, Sancar M, Karagoz T, Izzettin FV. The effect of pharmacist-led education on skills of patients with chronic obstructive pulmonary disease in using inhaler device. 39th ESCP European Symposium on Clinical Pharmacy and 13th SFPC Congress: Clinical Pharmacy at the Front Line of Innovations, 21–23 October 2010, Lyon, France. *Int J Clin Pharm* 2011:(var. pagings):316	Time point	Study design
Sívori M, Rhodius E, Kaplan P, Talarico M, Gorojod G, Carreras B, *et al.* [Exercise training in chronic obstructive pulmonary disease. Comparative study of aerobic training of lower limbs vs. combination with upper limbs.] *Medicina* 1998;**58**:717–27	Time point	–
Skumlien S, Aure SE, Skrede RM, Bjortuft O. Endurance or resistance training in primary care after in-patient rehabilitation for COPD? *Respir Med* 2008;**102**:422–9	Time point	Study design
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Smith J. Telehealth Research Across The Community (TRAC): an evaluation of telehealth home monitoring of home care clients with chronic obstructive pulmonary disease or chronic heart failure compared to usual care. *ANZCTR* 2009	Intervention	Intervention

Excluded article	Reasons for exclusion	
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Soicher JE, Mayo NE, Gauvin L, Hanley JA, Bernard S, Maltais F, *et al.* Trajectories of endurance activity following pulmonary rehabilitation in COPD patients. *Eur Respir J* 2012;**39**:272–8	Time point	Study design
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Spohn S, Wittmann M, Petro W. [The education program for patients with COPD from Bad Reichenhall.] *Pneumologie* 2001;**55**:470–4	Study design	Study design
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Sridhar M, Taylor R, Dawson S, Roberts NJ, Partridge MR. A nurse led intermediate care package in patients who have been hospitalised with an acute exacerbation of chronic obstructive pulmonary disease. *Thorax* 2008;**63**:194–200	Time point	–
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Excluded article	Reasons for exclusion	
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Stellefson M, Chaney BH, Chaney JD. Using exploratory focus groups to inform the development of targeted COPD self-management education DVDs for rural patients. *Int J Telemed Appl* 2010;**2010**:450418	Time point	Study design
Steuten L, Vrijhoef B, Van Merode F, Wesseling GJ, Spreeuwenberg C. Evaluation of a regional disease management programme for patients with asthma or chronic obstructive pulmonary disease. *Int J Qual Health Care* 2006;**18**:429–36	Time point	Study design
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Storer TW. Exercise in chronic pulmonary disease: resistance exercise prescription. *Med Sci Sports Exerc* 2001;**33**(Suppl. 7):S680–92	Publication type	Publication type
Strijbos JH, Koeter GH, Meinesz AF. Home care rehabilitation and perception of dyspnea in chronic obstructive pulmonary disease (COPD) patients. *Chest* 1990;**97**(Suppl. 3):109–10S	Publication type	Publication type
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Su C-L, Chiang L-L, Chiang T-Y, Yu C-T, Kuo H-P, Lin H-C. Domiciliary positive expiratory pressure improves pulmonary function and exercise capacity pulmonary with chronic obstructive pulmonary disease. *J Formosan Med Assoc* 2007;**106**:204–11	Time point	–
Subin, Rao V, Prem V, Sahoo. Effect of upper limb, lower limb and combined training on health-related quality of life in COPD. *Lung India* 2010;**27**:4–7	Time point	–
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Excluded article	Reasons for exclusion	
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Bazian Ltd. The effects of education on patient adherence to medication. *Evid Based Healthc Public Health* 2005;**9**:398–404	Publication type	Publication type
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Tierney WM, Overhage JM, Murray MD, Harris LE, Zhou XH, Eckert GJ, *et al.* Can computer-generated evidence-based care suggestions enhance evidence-based management of asthma and chronic obstructive pulmonary disease? A randomized, controlled trial. *Health Serv Res* 2005;**40**:477–97	Intervention	Intervention
Toevs CD, Kaplan RM, Atkins CJ. The costs and effects of behavioral programs in chronic obstructive pulmonary disease. *Med Care* 1984;**22**:1088–100	Population	Population
Toshima MT, Blumberg E, Ries AL, Kaplan RM. Does rehabilitation reduce depression in patients with chronic obstructive pulmonary disease? *J Cardiopulm Rehabil* 1992;**12**:261–9	Time point	–
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Tougaard L, Krone T, Sorknaes A, Ellegaard H. Economic benefits of teaching patients with chronic obstructive pulmonary disease about their illness. The PASTMA Group. *Lancet* 1992;**339**:1517–20	Time point	Study design
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Trappenburg JC, Niesink A, de Weert-van Oene GH, van der Zeijden H, van Snippenburg R, Peters A, *et al.* Effects of telemonitoring in patients with chronic obstructive pulmonary disease. *Telemed J E-Health* 2008;**14**:138–46	Time point	Study design
Trappenburg JC, Koevoets L, de Weert-van Oene GH, Monninkhof EM, Bourbeau J, Troosters T, *et al.* Action Plan to enhance self-management and early detection of exacerbations in COPD patients: a multicenter RCT. *BMC Pulm Med* 2009;**9**:52	Publication type	Publication type
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Excluded article	Reasons for exclusion	
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Utens CM, Goossens LM, Smeenk FW, van Schayck OC, van Litzenburg W, Janssen A, *et al.* Effectiveness and cost-effectiveness of early assisted discharge for chronic obstructive pulmonary disease exacerbations: the design of a randomised controlled trial. *BMC Public Health* 2010;**10**:618	Publication type	Publication type
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Van der Schans CP. Conventional chest physical therapy for obstructive lung disease. *Respir Care* 2007;**52**:1198–206	Publication type	Publication type
Van Gestel AJ, Kohler M, Steier J, Teschler S, Russi EW, Teschler H. The effects of controlled breathing during pulmonary rehabilitation in patients with COPD. *Respiration* 2012;**83**:115–24	Time point	–
Van Wetering CR, Hoogendoorn M, Broekhuizen R, Geraerts-Keeris GJ, De Munck DR, Rutten-van Mölken MP, *et al.* Efficacy and costs of nutritional rehabilitation in muscle-wasted patients with chronic obstructive pulmonary disease in a community-based setting: a prespecified subgroup analysis of the INTERCOM trial. *J Am Med Direct Assoc* 2010;**11**:179–87	Time point	Population
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Vandivier W. *Advanced eHealth for Chronic Obstructive Pulmonary Disease (COPD) in Colorado*; 2013. URL: www.clinicaltrials.gov (accessed 27 January 2015)	Publication type	Publication type
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Vitacca M, Clini E, Bianchi L, Ambrosino N. Acute effects of deep diaphragmatic breathing in COPD patients with chronic respiratory insufficiency. *Eur Respir J* 1998;**11**:408–15	Time point	Study design

Excluded article	Reasons for exclusion	
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Vivodtzev I, Pepin JL, Vottero G, Mayer V, Porsin B, Levy P, *et al.* Improvement in quadriceps strength and dyspnea in daily tasks after 1 month of electrical stimulation in severely deconditioned and malnourished COPD. *Chest* 2006;**129**:1540–8	Intervention	Intervention
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Vogiatzis I, Nanas S, Roussos C. Interval training as an alternative modality to continuous exercise in patients with COPD. *Eur Respir J* 2002;**20**:12–19	Time point	–
Vogiatzis I, Terzis G, Nanas S, Stratakos G, Simoes DC, Georgiadou O, *et al.* Skeletal muscle adaptations to interval training in patients with advanced COPD. *Chest* 2005;**128**:3838–45	Time point	–
Vonbank K, Strasser B, Mondrzyk J, Marzluf BA, Richter B, Losch S, *et al.* Strength training increases maximum working capacity in patients with COPD – randomized clinical trial comparing three training modalities. *Respir Med* 2012;**106**:557–63	Time point	–
Votto J, Bowen J, Scalise P, Wollschlager C, Zuwallack R. Short-stay comprehensive inpatient pulmonary rehabilitation for advanced chronic obstructive pulmonary disease. *Arch Phys Med Rehabil* 1996;**77**:1115–18	Intervention	Study design
Vrijhoef HJ, Van Den Bergh JH, Diederiks JP, Weemhoff I, Spreeuwenberg C. Transfer of care for outpatients with stable chronic obstructive pulmonary disease from respiratory care physician to respiratory nurse: a randomized controlled study. *Chron Illn* 2007;**3**:130–44	Intervention	Intervention
Wadell K, Sundelin G, Henriksson-Larsen K, Lundgren R. High intensity physical group training in water: an effective training modality for patients with COPD. *Respir Med* 2004;**98**:428–38	Time point	–
Wakabayashi R, Kida K, Yamada K, Jones RCM, Hyland ME. A randomised controlled trial of a patient education programme versus normal care for COPD using the lung information needs questionnaire (LINQ) [Abstract.] *Eur Respir J* 2006;**28**(Suppl. 50):554	Time point	Publication type
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Walker K, LeBlanc C. Neuromuscular respiratory rehabilitation. *Can J Respir Ther* 2001;**37**:36–41	Publication type	Publication type
Walters J. *Pathways to Lung Health: a comprehensive Self-Management Programme for Chronic Obstructive Pulmonary Disease in the community*; ANZCTR 2008. URL: www.anzctr.org.au (accessed 27 January 2015)	Publication type	Publication type
Wang QX, Zhang XY, Li QA. Effects of a flutter mucus-clearance device on pulmonary function test results in healthy people 85 years and older in China. *Respir Care* 2010;**55**:1449–52	Population	Population
Wang QY, Bourbeau J. Outcomes and health-related quality of life following hospitalization for an acute exacerbation of COPD. *Respirology* 2005;**10**:334–40	Study design	Study design
Wang Z, Zeng H, Chen H. [Rehabilitative treatment in patients with chronic obstructive pulmonary disease at stable stage.] *Chin Nurs Res* 2004;**18**:1608–9	Time point	–
Wanke T, Formanek D, Lahrmann H, Brath H, Wild M, Wagner C, *et al.* Effects of combined inspiratory muscle and cycle ergometer training on exercise performance in patients with COPD. *Eur Respir J* 1994;**7**:2205–11	Time point	–

Excluded article	Reasons for exclusion	
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Warlies F, Saladin M, Hellmann A. [Evaluation of a standardized specific education program 'Lebensrhythmus Atmen': a prospective, randomized, controlled study for COPD patients: a pilot study.] *Pravention und Rehabilitation* 2006;**18**:68–79	Time point	–
Warm D, Lewis K. *A New Model for Continuous Care of Chronic Patients: eCare and eLearning for Patients with Chronic Obstructive Pulmonary Disease (COPD).* ISRCTN Register 2008. URL: www.isrctn.org (accessed 27 January 2015)	Publication type	Publication type
Wasson J, Gaudette C, Whaley F, Sauvigne A, Baribeau P, Welch HG. Telephone care as a substitute for routine clinic follow-up. *JAMA* 1992;**267**:1788–93	Population	Population
Waterhouse J, Walters S, Lawson R. *Can Telephone Encouragement Maintain the Benefits of Pulmonary Rehabilitation for People with COPD? Data Eighteen Months Post Rehab. A Report of the CoCoRT Study of Pulmonary Rehabilitation*. Lausanne: e-Learning Resources; 2007	Study design	Study design
Waterhouse JC, Walters SJ, Oluboyede Y, Lawson RA. A randomised 2 x 2 trial of community versus hospital pulmonary rehabilitation, followed by telephone or conventional follow-up. *Health Technol Assess* 2010;**14**(6)	Time point	–
Watson PB, Town GI, Holbrook N, Dwan C, Toop LJ, Drennan CJ. Evaluation of a self-management plan for chronic obstructive pulmonary disease. *Eur Respir J* 1997;**10**:1267–71	Time point	–
Wedzicha JA, Bestall JC, Garrod R, Garnham R, Paul EA, Jones PW. Randomized controlled trial of pulmonary rehabilitation in severe chronic obstructive pulmonary disease patients, stratified with the MRC dyspnoea scale. *Eur Respir J* 1998;**12**:363–9	Time point	–
Weekes CE, Emery PW, Elia M. Dietary counselling and food fortification in stable COPD: a randomised trial. *Thorax* 2009;**64**:326–31	Time point	–
Weinberger M, Oddone EZ, Henderson WG. Does increased access to primary care reduce hospital readmissions? *N Engl J Med* 1996;**334**:1441–7	Intervention	Intervention
Weinberger M, Murray MD, Marrero DG, Brewer N, Lykens M, Harris LE, *et al.* Effectiveness of pharmacist care for patients with reactive airways disease: a randomized controlled trial. *JAMA* 2002;**288**:1594–602	Population	Population
Weiner P, Azgad Y, Ganam R. Inspiratory muscle training combined with general exercise reconditioning in patients with COPD. *Chest* 1992;**102**:1351–6	Time point	–
Weiner P, Azgad Y, Ganam R, Weiner M. Inspiratory muscle training in patients with bronchial asthma. *Chest* 1992;**102**:1357–61	Population	Population
Weiner P, Magadle R, Berar-Yanay N, Davidovich A, Weiner M. The cumulative effect of long-acting bronchodilators, exercise, and inspiratory muscle training on the perception of dyspnea in patients with advanced COPD. *Chest* 2000;**118**:672–8	Time point	–
Weiner P, Magadle R, Beckerman M, Weiner M, Berar-Yanay N. Comparison of specific expiratory, inspiratory, and combined muscle training programs in COPD. *Chest* 2003;**124**:1357–64	Time point	–
Weiner P, Magadle R, Beckerman M, Weiner M, Berar-Yanay N. Specific expiratory muscle training in COPD. *Chest* 2003;**124**:468–73	Time point	–
Weiner P, Magandle R, Beckerman M, Weiner M, Berar-Yanay N. Maintenance of inspiratory muscle training in COPD patients: one year follow-up. *Eur Respir J* 2004;**23**:61–5	Time point	–
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Welch HG, Johnson DJ, Edson R. Telephone care as an adjunct to routine medical follow-up. A negative randomized trial. *Eff Clin Pract* 2000;**3**:123–30	Population	Population

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Wen H, Gao Y, An JY. [Comparison of high-intensity and anaerobic threshold programs in rehabilitation for patients with moderate to severe chronic obstructive pulmonary disease.] *Chung-Hua Chieh Ho Ho Hu Hsi Tsa Chih* 2008;**31**:571–6	Time point	–
Wen Y-L, Huang D-F, Huang M, Huang Y-P. [Evaluation on the effect of systematic exercise rehabilitation intervention in patients with chronic obstructive pulmonary disease.] *Chin J Clin Rehabil* 2004;**8**:2224–5	Time point	–
White RJ, Rudkin ST, Harrison ST, Day KL, Harvey IM. Pulmonary rehabilitation compared with brief advice given for severe chronic obstructive pulmonary disease. *J Cardiopulm Rehabil* 2002;**22**:338–44	Time point	–
Whitten P, Mickus M. Home telecare for COPD/CHF patients: outcomes and perceptions. *J Telemed Telecare* 2007;**13**:69–73	Population	Population
Wijkstra PJ, Strijbos JH. Home-based rehabilitation for patients with chronic obstructive pulmonary disease. *Monaldi Arch Chest Dis* 1998;**53**:450–3	Study design	Study design
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Wijkstra PJ, van der Mark TW, Kraan J, van Altena R, Koeter GH, Postma DS. Effects of home rehabilitation on physical performance in patients with chronic obstructive pulmonary disease (COPD). *Eur Respir J* 1996;**9**:104–10	Time point	–
Wijkstra PJ, van der Mark TW, Kraan J, van Altena R, Koeter GH, Postma DS. Long-term effects of home rehabilitation on physical performance in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1996;**153**:1234–41	Time point	–
Wilkinson TM, Donaldson GC, Hurst JR, Seemungal TA, Wedzicha JA. Early therapy improves outcomes of exacerbations of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 2004;**169**:1298–303	Time point	Study design
Wilson A, Parker H, Wynn A, Jagger C, Spiers N, Jones J, *et al*. Randomised controlled trial of effectiveness of Leicester hospital at home scheme compared with hospital care. *BMJ* 1999;**319**:1542–6	Population	Population
Wilson A, Wynn A, Parker H. Patient and carer satisfaction with 'hospital at home': quantitative and qualitative results from a randomised controlled trial. *Br J Gen Pract* 2002;**52**:9–13	Population	Population
Wittmann M, Spohn S, Schultz K, Pfeifer M, Petro W. [Patient education in COPD during inpatient rehabilitation improves quality of life and morbidity.] *Pneumologie* 2007;**61**:636–42	Time point	–
Wolkove N, Kamel H, Rotaple M, Baltzan M. Use of a mucus clearance device enhances the bronchodilator response in patients with stable COPD. *Chest* 2002;**121**:702–7	Intervention	Intervention
Wolkove N, Baltzan MA, Jr, Kamel H, Rotaple M. A randomized trial to evaluate the sustained efficacy of a mucus clearance device in ambulatory patients with chronic obstructive pulmonary disease. *Can Respir J* 2004;**11**:567–72	Time point	–
Woo J, Chan W, Yeung F, Chan WM, Hui E, Lum CM, *et al.* A community model of group therapy for the older patients with chronic obstructive pulmonary disease: a pilot study. *J Eval Clin Pract* 2006;**12**:523–31	Time point	Study design
Wood-Baker R, McGlone S, Venn A, Walters EH. Written action plans in chronic obstructive pulmonary disease increase appropriate treatment for acute exacerbations. *Respirology* 2006;**11**:619–26	Time point	–
Worth H, Dhein Y. Does patient education modify behaviour in the management of COPD? *Patient Educ Couns* 2004;**52**:267–70	Publication type	Publication type

Excluded article	Reasons for exclusion	
	Review 1	Review 4
Wright P. Effects of a resistance training on pulmonary function and performance measurements in patients with chronic obstructive pulmonary disease. *Eur J Sport Sci* 2003;**3**:1–10	Time point	–
Wu X, Hou L, Bai W. [Effects of breathing training on quality of life and activities of daily living in elderly patients with stable severe chronic obstructive pulmonary disease.] *Chin J Rehabil Med* 2006;**21**:307–10	Time point	Study design
Wurtemberger G, Bastian K. [Functional effects of different training in patients with COPD.] *Pneumologie* 2001;**55**:553–62	Time point	–
Xie S-L, Zhu M-G, Cui H-B, Liu H-Y. Influence of home-based training program on patients with COPD. *Chin J Clin Rehabil* 2003;**7**:2554–5	Time point	–
Xu Y-H, Wang J-H, Li H-F, Zhu X-H, Wang G. [Efficacy of integrative respiratory rehabilitation training in exercise ability and quality of life of patients with chronic obstructive pulmonary disease in stable phase: a randomized controlled trial.] *J Chin Integr Med* 2010;**8**:432–7	Time point	–
Yamaguti WP, Claudino RC, Neto AP, Chammas MC, Gomes AC, Salge JM, *et al.* Diaphragmatic breathing training program improves abdominal motion during natural breathing in patients with chronic obstructive pulmonary disease: a randomized controlled trial. *Arch Phys Med Rehabil* 2012;**93**:571–7	Time point	–
Yan Q, Sun Y. Quantitative research for improving respiratory muscle contraction by breathing exercise. *Chin Med J* 1996;**109**:771–5	Time point	–
Yeh GY, Roberts DH, Wayne PM, Davis RB, Quilty MT, Phillips RS. Tai chi exercise for patients with chronic obstructive pulmonary disease: a pilot study. *Respir Care* 2010;**55**:1475–82	Time point	–
Zajac B. Measuring outcomes of a chronic obstructive pulmonary disease management program. *Dis Manag* 2002;**5**:9–23	Study design	Study design
Zhang ZQ, Chen RC, Yang QK, Li P, Wang CZ, Zhang ZH. [A randomized controlled trial study of pulmonary rehabilitation with respiratory physiology as the guide on prognosis in patients with chronic obstructive pulmonary disease.] *Zhongguo Wei Zhong Bing Ji Jiu Yi Xue* 2008;**20**:607–10	Time point	–
Zimmer JG, Groth-Juncker A, McCusker J. A randomized controlled study of a home health care team. *Am J Public Health* 1985;**75**:134–41	Population	Population
Zwar N, Hermiz O, Hasan I, Comino E, Middleton S, Vagholkar S, *et al.* A cluster randomised controlled trial of nurse and GP partnership for care of chronic obstructive pulmonary disease. *BMC Pulm Med* 2008;**8**:8	Publication type	Publication type

Appendix 3 Conference abstracts, relevant to review 1, between 2010 and 2012

American Thoracic Society 2012

Controlled trial of short term (3 weeks) pulmonary rehabilitation in COPD following acute exacerbation

MS Ali, D Talwar, RK Singh, D Pabreja

India

European Respiratory Society 2012

Do telephone interventions of patients with COPD prevent readmission?

M Lavesen, R Overgaard, S Mazurek, A Just, D Overgaard

Denmark

Effect on prevention of readmissions of a home-based education and exercise program implemented early after a severe exacerbation of COPD

R Coll-Fernandez, N Martínez, M Arranz, H Prados, X Pomares, A Moreno, M Teixidó, F Epelde, F Caballero, E Monsó

Spain

Appendix 4 List of ongoing trials relevant to reviews 1–4

Citation	Relevant to review			
	1	2	3	4
Optimizing the effect of COPD rehabilitation	–	–	–	Y
A multi-center study of rehabilitation to stable chronic obstructive pulmonary disease (COPD) patients	–	–	–	Y
Effectiveness of incorporating tai chi in pulmonary rehabilitation program for patients with chronic obstructive pulmonary disease in primary health care	–	–	–	Y
Long-term respiratory rehabilitation programs in chronic obstructive pulmonary disease (COPD) patients: study of cost-effectiveness	–	–	–	Y
Early pulmonary rehabilitation following acute COPD exacerbation	–	–	–	Y
Benefits and costs of home-based pulmonary rehabilitation in chronic obstructive pulmonary disease	–	–	–	Y
Effects of home-based pulmonary rehabilitation in patients with severe or very severe chronic obstructive pulmonary disease (COPD)	–	–	–	Y
Home-based in chronic obstructive pulmonary disease	–	–	–	Y
Nutritional rehabilitation in chronic obstructive pulmonary disease (COPD) patients with muscle atrophy	–	–	–	Y
Effects of inspiratory muscle training on dyspnea in subjects with chronic obstructive pulmonary disease	–	–	–	Y
Eccentric exercise training as novel rehabilitation for chronic obstructive pulmonary disease (COPD)	–	–	–	Y
Physical activity counseling during pulmonary rehabilitation	–	–	–	Y
Long-term physical training in chronic obstructive pulmonary disease	–	–	–	Y
Multicomponent intervention to decrease chronic obstructive pulmonary disease (COPD)-related hospitalizations	–	–	–	Y
Impact of a hospital physical therapy program on chronic obstructive pulmonary disease (COPD) patients	Y	–	Y	Y
Comprehensive disease management program in chronic obstructive pulmonary disease (COPD) patients in the community	–	–	–	Y
Nurse managed sequential strength training and bicycle training in chronic obstructive pulmonary disease (COPD)	–	–	–	Y
Effects of mud bath therapy in chronic obstructive pulmonary disease	–	–	–	Y
Randomized trial of physical activity self-management intervention for patients with COPD	–	–	–	Y
Validation of an exercise DVD for maintenance after pulmonary rehabilitation	–	–	–	Y
Effects of respiratory muscle training and respiratory exercise in exercise tolerance, performing daily life activities and quality of life of patients with chronic obstructive pulmonary disease	–	–	–	Y
Balance training in patients with chronic obstructive pulmonary disease (COPD)	–	–	–	Y
A comprehensive care programme for patients with chronic obstructive pulmonary disease	Y	–	Y	Y
Problem-solving therapy for people with major depression and chronic obstructive pulmonary disease	–	–	–	Y
Life-long monitoring of COPD in veneto region	–	–	–	Y
Breathing control in patients with chronic obstructive pulmonary disease (COPD)	–	–	–	Y
Randomized trial of physical activity self-management intervention for patients with COPD	–	–	–	Y
Multicomponent intervention to decrease chronic obstructive pulmonary disease (COPD)-related hospitalizations	–	–	–	Y

Citation	Relevant to review			
	1	2	3	4
Effectiveness of Interventions to Teach Respiratory Inhaler Technique (E-TRaIN)	–	–	–	Y
The COPD on Oxygen Patient Management European Trial (COMET)	–	–	–	Y
A randomized controlled trial to determine outcome and cost effectiveness of case management of chronic obstructive pulmonary disease (COPD) patients	–	–	–	Y
Home telehealth follow-up after hospital discharge for chronic obstructive pulmonary disease (COPD) patients	Y	Y	Y	Y
Effectiveness of incorporating tai chi in pulmonary rehabilitation program for patients with chronic obstructive pulmonary disease in primary health care	–	–	–	Y
Educational intervention for managing inhalers in chronic obstructive pulmonary disease (COPD) patients	–	–	–	Y
Disease management in asthma or chronic obstructive pulmonary disease (COPD) patients	–	–	–	Y
Stepping up to health – for veterans with chronic obstructive pulmonary disease (COPD)	–	–	–	Y
Coping skills for patients with chronic obstructive pulmonary disease (COPD) and their caregivers	–	–	–	Y
Prigmore S. Does an individualised self-management plan help patients with chronic obstructive pulmonary disease (COPD) initiate early treatment for infective exacerbations? ISRCTN Register 2012	–	–	–	Y
Educational interventions for chronic obstructive pulmonary disease (COPD) self-management in ethno-cultural communities. Clinicaltrials.gov 2012	–	–	–	Y

Y, yes for inclusion.

Appendix 5 Mortality data from randomised controlled trials: review 1

Study year	Brief intervention	Brief control	Mortality outcome, description	Follow-up (months)	Reassessment		Effect size/*p*-value
					Intervention	Control	
Behnke 2000[64]	Home-based walking exercise programme, *N* = 23	Control: advised to exercise, no instruction, *N* = 23	Deaths	6	1/23 (4.3%)	1/23 (4.3%)	NR
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	Total deaths	3	9/84 (10.7%)	10/93 (10.8%)	NR
Hernandez 2003[68]	Home hospitalisation, *N* = 121	UC, *N* = 101	Deaths	2	5/121 (4.1)	7/101 (6.9)	NR
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	Deaths	6	3/77	6/80	NR
Casas 2006[71]	Integrated care with SM intervention, *N* = 65	UC, *N* = 90	Total deaths	6, 12	7/65 (10.8%), 12/65 (18.5%)	11/90 (12.2%), 14/90 (15.6%)	NR
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	Total deaths	6, 12	6/44 (13.6%), 11/44 (25.0%)	8/69 (11.6%), 10/69 (14.5%)	NR
Bucknall 2012[63]	Supported SM, *N* = 232	UC, *N* = 232	COPD deaths, all-cause deaths	12	23/232 (10%), 30/232 (13%)	16/232 (7%), 22/232 (9%)	HRs: time to death, 1.36 (95% CI 0.71 to 2.61), 1.35 (95% CI 0.77 to 2.38)

NR, not reported.

Appendix 6 Hospital readmissions data from randomised controlled trials: review 1

Study year	Brief		Outcome description	Follow-up (months)	End point		Effect size/*p*-value
	Intervention	Control			Intervention	Control	
Egan 2002[69]	Case management, *N* = 33	UC, *N* = 33	Unscheduled readmissions; no detail	3	*N* = 33/33 Mean (range): 2.1 (1–5)	*N* = 33/33 Mean (range): 2.6 (1–6)	Reported no significant difference
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	All-cause hospitalisation (also number of admissions; number of admissions due to acute respiratory disease)	3	*N* = 84/84 Hospitalisation on one or more occasion 16/84 (24%) 25 readmissions 12 for acute respiratory condition	*N* = 93/93 Hospitalisation on one or more occasion 14/93 (18%) 19 readmissions 14 for acute respiratory condition	
Lee 2002[66]	Care protocol (including SM) to nursing home staff and patients, *N* = 48 completers	UC, *N* = 41 completers	Mean COPD-related readmissions Mean COPD-related hospital-days Time to first hospital readmission (days)	6	*N* = 48 **COPD admission, mean (SD)** 1.54 (1.75) **COPD hospital-days, mean (SD)** 14.35 (19.27) **Days to first readmission, mean (SD)** 33.58 (42.58)	*N* = 41 1.39 (1.51) 14.98 (20.18) 25.49 (35.67)	 0.666 0.882 0.325
Behnke 2003[65]	Home-based walking exercise programme, *N* = 14	Control: no instruction *N* = 12	Total number of admissions within three consecutive 6-month periods	18	*N* = 14 **Total admissions, months** • 0–6: 1 • 6–12: 2 • 12–18: 0	*N* = 12 • 0–6: 1 • 6–12: 5 • 12–18: 8	 0.026
Dheda 2004[73]	SM hospital outpatient followed up, *N* = 15	SM primary care followed up, *N* = 18	Number of readmissions	6	*N* = 10, two readmissions	*N* = 15, nine readmissions	

Study year	Brief		Outcome description	Follow-up (months)	End point		Effect size/*p*-value
	Intervention	Control			Intervention	Control	
Hernandez 2003[68]	Home hospitalisation, *N* = 121	UC, *N* = 101	Readmissions (number of admissions, duration of admission)	2	*N* = 121	*N* = 101	
					Inpatient hospital readmissions		
					• Patients *n* (%) 23 (20) • No. of episodes 0.24 ± 0.57	• Patients *n* (%) 26 (27.7) • No. of episodes 0.38 ± 0.7	0.02
					Emergency room readmissions		
					• Patients *n* (%) 11 (9.6) • No. of episodes 0.13 ± 0.43	• Patients *n* (%) 21 (22.3) • No. of episodes 0.31 ± 0.62	0.01
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	Readmissions at 28 days, 6 months, unplanned readmissions, total hospital days duration of admission)	28 days	*N* = 70	*n* = 79	
					Hospital readmissions		
					28 days: *n* (%) 33 (47)	28 days: *n* (%) 29 (37)	0.244
					6 months: *n* (%) 53 (76)	6 months: *n* (%) 49 (62)	0.08
					Unplanned readmissions, mean ± SD (median)		
					1.5 ± 1.4 (1)	1.5 ± 2.2 (1)	0.319
					Total hospital-days, mean ± SD (median)		
					20.3 ± 25.3 (12.5)	19.2 ± 25.6 (12)	0.410

Study year	Brief		Outcome description	Follow-up (months)	End point		Effect size/*p*-value
	Intervention	Control			Intervention	Control	
Wong 2005[74]	SM telephone followed up, *N* = 30	Routine care, *N* = 30	Health-care use (1, 3 months) (total, inpatient, outpatient)	1, 3	*N* = 30, health-care use	*N* = 30, health-care use	
					Total 1 month		
			Frequency at 1 month (inpatient)		6/30 (21.4%)	9/30 (31.0%)	0.410
					Inpatient 1 month		
			Frequency at 3 months (inpatients)		5/30 (83.3%)	8/30 (88.9%)	0.410
					Total 3 months		
			Days of readmission at 1 month		13/30 (43.3%)	19/30 (63.3%)	0.195
					Frequency 1 month		
			Note that hospitalisations were attributable to respiratory problems		Inpatient, mean (SD) = 1.2 (0.4); median: 1.0	Inpatient, mean (SD) = 1.0 (0.00); median 1.0	0.206
					Outpatient: 5	Outpatient: 6	
					Frequency 3 months		
					Admissions: mean (SD) = 0.6 (1.0); median: 0	Admissions: mean (SD) = 1.1 (1.3); median: 0	0.182
					Duration admission (days) 1 month		
					Mean (SD) = 19.6 (2.5)	Mean (SD) = 17.3 (4.4)	0.354

Study year	Brief intervention	Brief control	Outcome description	Follow-up (months)	End point intervention	End point control	Effect size/*p*-value
Casas 2006[71]	Integrated care with SM intervention, *N* = 65	UC, *N* = 90	Number of patients with readmissions (mean readmissions; rate of readmissions; difference in rate compared with previous year; survival without readmissions) Implies admissions due to exacerbations	12	**Readmissions**		
					29/65 (44.6%)	60/90 (66.7%)	
					Mean (SD) readmissions during followed-up year		
					0.9 (1.3)	1.3 (1.7)	0.028
					Rate of readmissions during followed-up year		
					Mean (SD) 1.5 (2.6)	Mean (SD): 2.1 (3.1)	0.033; adjusted HR = 0.55 (95% CI 0.35 to 0.88)
					Difference in rate of readmissions per year		
					Mean (SD) 0.5 (2.6)	Mean (SD) 1.5 (3.1)	0.003
					Survival without readmissions		
					32 (49%)	28 (31%)	0.03
Bucknall 2012[63]	Supported SM, *N* = 232	UC, *N* = 232	COPD admission or COPD death, computed COPD admissions	12	**COPD admission or COPD death**		
					111/232 (48%)	108/232 (47%)	Time to admission/death, HRs: 1.05 (95% CI 0.80 to 1.38)
					COPD admissions		
					88/232 (37.9%)	92/232 (39.7%)	Time to admission/death, HRs: 1.36 (95% CI 0.71 to 2.61)

Appendix 7 General practitioner consultation data from randomised controlled trials: review 1

Study year	Brief		GP contacts – description	Follow-up	Reassessment		Effect size/*p*-value
	Intervention	Control			Intervention	Control	
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	GP contacts	3	*N* = 67	*N* = 80	
					Visited GP: 60 (90%)	Visited GP: 75 (94%)	
					Mean visits to GP		
					Patient report:		
					6.06 (*n* = 60)	5.54 (*n* = 74)	0.3
					GP report:		
					5.21 (*n* = 57)	5.11 (*n* = 64)	0.9
					GP prescribed drugs		
					42/57 (74%)	53/64 (83%)	0.2
					GP arranged follow-up		
					37/57 (65%)	41/64 (64%)	0.4
					GP provided patient with education		
					39/57 (68%)	44/64 (69%)	0.9
					GP provided carer with education		
					14/57 (25%)	11/64 (17%)	0.3
Casas 2006[71]	Integrated care with SM intervention, *N* = 65	UC, *N* = 90	Self-reported physician visits	12	*N* = 65	*N* = 90	
					Median (IQR) visits		
			Rate per year		Barcelona 2 (0–4)	Barcelona 2 (1–4)	0.437
					Leuven 10 (7–18)	Leuven 13 (9–27)	0.454

Appendix 8 Emergency department visits data from randomised controlled trials: review 1

Study year	Brief		Outcome description	Follow-up	End point		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	
Lee 2002[66]	Care protocol (including SM) to nursing home staff and patients, *N* = 48 completers	UC, *N* = 41 completers	Mean COPD-related ED usage Time to first ED usage (days)	6 months	*N* = 48	*N* = 41	
					COPD ED usage, mean (SD)		
					1.58 (1.75)	1.59 (1.73)	0.996
					Days to first ED usage, mean (SD)		
					33.58 (42.58)	24.27 (35.67)	0.251
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	All-cause hospitalisation (also number of admissions; number of admissions attributable to acute respiratory disease)	3 months	*N* = 84/84	*N* = 93/93	
					Patients visiting ED		
					2/84 = 2.4%	8/93 = 8.6%	
Hernandez 2003[68]	Home hospitalisation, *N* = 121	UC, *N* = 101	Emergency room readmissions	8 weeks	*N* = 121	*N* = 101	
					Patients, *n* (%)		
					11 (9.6)	21 (22.3)	0.02
					Number of episodes		
					0.13 ± 0.43	0.31 ± 0.62	0.01
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	Number of A&E visits	6 months	*N* = 70	*N* = 79	
					Mean ± SD (median): 2.2 ± 2.4 (2)	Mean ± SD (median): 2.3 ± 3.1 (2)	0.997
Wong 2005[74]	SM telephone followed up, *N* = 30	Routine care, *N* = 30	Frequency at 3 months (emergency room)	1, 3 months	*N* = 30	*N* = 30	
					Frequency 3 months, mean (SD)		
					0.1 (0.3), median = 0	0.4 (0.7), median = 0	0.034

Appendix 9 Health-related quality-of-life data from randomised controlled trials: review 1

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Behnke 2000[64]	Home-based walking exercise programme, *N* = 23	Control: advised to exercise, no instruction, *N* = 23	CRQ total score CRQ subdomains	3, 6	*n/N* = 15/23	*n/N* = 15/23	*n/N* = 15/23	*n/N* = 15/23	< 0.01
					CRQ total score, mean ± SD		**CRQ total score estimate from graph, mean ± SEM**		
					79.3 ± 5.3	79.5 ± 5.0	3 months: 104 ± 3.0	3 months: 83 ± 4.0	
							6 months: 116 ± 2.0	6 months: 77 ± 6.0	
					CRQ subdomains (mean ± SEM)				
					Dyspnoea:				
					13.2 ± 1.1	13.1 ± 1.0	3 months 22.1 ± 1.4	3 months 15.7 ± 1.6	
							6 months 25.3 ± 1.6	6 months 13.9 ± 1.7	
					Fatigue:				
					17 ± 1.5	15.3 ± 1.4	3 months 20.7 ± 1.1	3 months 15.7 ± 1.2	
							6 months 23.5 ± 0.8	6 months 14.5 ± 1.5	
					Emotion:				
					31.5 ± 2.6	33.1 ± 2.4	3 months 38.8 ± 2.1	3 months 33.7 ± 2.2	
							6 months 42.1 ± 1.7	6 months 31.9 ± 2.5	
					Mastery:				
					17.7 ± 1.3	17.9 ± 1.5	3 months 23.5 ± 1.2	3 months 18.9 ± 1.2	
							6 months 25.9 ± 0.6	6 months 17.5 ± 1.5	

Study year	Brief		HRQoL description	Follow-up (months)	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Egan 2002[69]	Case management, *N* = 33	UC, *N* = 33	SGRQ – total score Subdomains also given Subjective well-being score (higher score = increased well-being)	1, 3			*n/N* = 22/33	*n/N* = 24/33	
							SGRQ total		
							1 month, median change –1.6	1 month, median change –1.5	0.621
							1–3 months, median change 0.6	1–3 months, median change –3.2	0.367
							Symptoms		
							1 month, median change –17.5	1 month, median change –9.3	0.384
							1–3 months, median change 2.0	1–3 months, median change 0.5	0.959
							Activities		
							1 month, median change 0	1 month, median change 0.4	0.727
							1–3 months, median change 0	1–3 months, median change –6.4	0.01
							Impacts		
							1 month, median change –0.2	1 month, median change –0.9	0.849
							1–3 months, median change 2.5	1–3 months, median change –1.5	0.432
							SWB		
							1 months, median change 2.81	1 months, median change –2.8	0.416
							3 months, median change –2.8	1–3 months, median change 0	0.268

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	SGRQ – total score, and subdomains	3	*n/N* = 67/84	*n/N* = 80/93			
					SGRQ total, mean (SD)		**SGRQ total, mean change (95% CI)**		**SGRQ total, MD (95% CI)**
					63.71 (18.0)	60.69 (17.8)	4.33 (1.05 to 7.61)	3.00 (0.24 to 5.77)	1.32 (–2.97 to 5.62)
					Symptoms:				
					64.50	62.97	–1.54 (–5.64 to 2.56)	–4.72 (–7.69 to 1.74)	3.18 (–1.83 to 8.18)
					Activities:				
					79.29	75.54	4.46 (0.42 to 8.50)	1.49 (–2.42 to 5.39)	2.97 (–2.72 to 8.66)
					Impact:				
					54.57	51.52	6.09 (1.91 to 10.27)	6.30 (2.91 to 9.68)	–0.21 (–5.57 to 5.16)
Dheda 2004[73]	SM advice at regular hospital outpatient followed up, *N* = 15	SM primary care followed up as required, *N* = 18	SGRQ – total score Subdomain scores at 6 months SF-36	6			*n/N* = 10/15	*n/N* = 15/18	Computed MD = 20.75; *p* = 0.004 SF-36 'trend to improvement, *p* = 0.067
							SGRQ total, mean change (SD)		
							–20.98 (20.36)	+0.23 (12.55)	
							From graph:		
							Symptoms – final score, mean (SEM):		
							52 (8)	75 (3)	
							Activity – final score, mean (SEM):		
							76 (4)	83 (4)	
							Impact – final score, mean (SEM):		
							42 (5)	61 (4)	
							SF-36:		
							No results provided	No results provided	

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Behnke 2003[65]	Home-based walking exercise programme, *N* = 14	Control: no instruction, *N* = 12	CRQ total score	3, 6, 12, 18	*N* = 14	*N* = 12	*N* = 14	*N* = 12	
					CRQ total score, months, estimated mean ± SEM:		**CRQ total score, estimated mean (SEM):**		
					79.3 ± 5.3	79.5 ± 5.0	3 months: 104 (2.0)	3 months: 82 (4.0)	
							6 months: 116 ± 9.0	6 months: 84 ± 8.0	
							12 months: 116 ± 8.0	12 months: 80 ± 8.0	
							18 months: 118 ± 7.0	18 months: 76 ± 6.0	
					CRQ (mean ± SEM) 0- or 6-month time point		**CRQ (mean ± SEM)**		
					Dyspnoea:				
					13.1 ± 1.1	13.9 ± 1.1	3 months: (22.7 ± 1.4)	3 months: (15.8 ± 1.9)	
							6 months: (25.9 ± 1.6)	6 months: (14.6 ± 2.0)	< 0.001
							12 months: (25.4 ± 1.4)	12 months: (12.8 ± 1.6)	< 0.001
							18 months: (25.1 ± 1.5)	18 months: (11.2 ± 1.3)	< 0.001

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
					Fatigue:				
					16.7 ± 1.6	16.7 ± 1.5	3 months: (20.8 ± 1.1)	3 months: (16.4 ± 1.3)	
							6 months: (23.6 ± 0.9)	6 months: (15.9 ± 1.6)	< 0.01
							12 months: (23.4 ± 1.0)	12 months: (14.7 ± 1.5)	< 0.001
							18 months: (23.7 ± 1.2)	18 months: (12.8 ± 1.3)	< 0.001
					Emotion:				
					31.9 ± 2.7	35.3 ± 2.3	3 months: (39.9 ± 2.0)	3 months: (34.9 ± 2.3)	
							6 months: (42.6 ± 1.7)	6 months: (33.7 ± 2.4)	< 0.01
							12 months: (41.4 ± 1.8)	12 months: (31.3 ± 2.2)	< 0.01
							18 months: (41.1 ± 1.7)	18 months: (29.9 ± 2.2)	< 0.001
					Mastery:				
					17.7 ± 1.4	19.0 ± 1.6	3 months: (23.8 ± 1.2)	3 months: (19.3 ± 1.5)	
							6 months: (26.2 ± 0.6)	6 months: (18.4 ± 1.8)	< 0.001
							12 months: (26.3 ± 0.7)	12 months: (18.2 ± 1.7)	< 0.001
							18 months: (27.3 ± 0.8)	18 months: (17.3 ± 1.6)	< 0.001

Study year	Brief		HRQoL description	Follow-up (months)	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Hernandez 2003[68]	Home hospitalisation, *N* = 121	UC, *N* = 101	SGRQ – total score Short Form 12-item survey	2	*N* = 121	*N* = 101	*N* = 116	*N* = 94	
					SGRQ total, mean ± SD		**SGRQ total, 2 months; mean change:**		
					58 ± 17	59 ± 20	–6.9	–2.4	0.05
					SF-12 physical, mean ± SD		**Symptoms, 2 months; mean change:**		
					36 ± 8	34 ± 8	–8.7	–8.4	
					SF-12 mental, mean ± SD		**Activities, 2 months; mean change:**		
					44 ± 12	44 ± 13	–4.8	–0.09	
							Impacts, 2 months; mean change:		
							–7.6	–1.9	0.03
							SF-12-Physical, 2 months; mean change:		
							1.7	1.9	
							SF-12-Mental, 2 months; mean change:		
							2.0	–0.05	
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	GHQ	6	*N* = 67	*N* = 73	*N* = 67	*N* = 73	
					GHQ, mean ± SD				
					7.1 ± 4.1	7.6 ± 4.9	7.5 ± 5.3	7.9 ± 5.2	

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	SGRQ – total score Subdomains also given Euroqol	12			*n/N* = 21/44	*n/N* = 41/69	
							Total SGRQ, mean change (SD)		**MD (95% CI)**
							–13.41 (13.43)	–11.02 (15.57)	–2.39 (–10.56 to 5.78)
							Symptoms, mean change (SD)		**MD (95% CI)**
							–24.4 (19.68)	–17.11 (24.44)	–7.29 (–19.66 to 5.07)
							Activity, mean change (SD)		**MD (95% CI)**
							–5.08 (16.61)	–8.36 (19.95)	3.27 (–6.91 to 13.46)
							Impact, mean change (SD)		**MD (95% CI)**
							–13.7 (15.62)	–11.29 (16.34)	–2.41 (–11.24 to 6.42)
							Euroqol, mean change (SD)		**MD (95% CI)**
							1.56 (1.77)	0.93 (2.11)	0.62 (–051 to 1.75)

Study year	Brief: Intervention	Brief: Control	HRQoL description	Follow-up (months)	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Bucknall 2012[63]	Supported SM, *N* = 232	UC, *N* = 232	SGRQ – total score and subdomains EQ-5D	12	*N* = 232 Total SGRQ 70.5 (16.7)	*N* = 232 Total SGRQ 69.7 (16.1)	**SGRQ total, mean change (SD)**		
							–2.99 (12.56), *N* = 69	1.38 (11.33), *N* = 53	–4.52 (95% CI –9.07 to 0.04)
							Symptom		
							–6.01 (20.85), *N* = 116	–4.16 (22.52), *N* = 90	–2.17 (95% CI –7.80 to 3.46)
							Activity		
							1.44 (13.27), *N* = 91	0.95 (11.05), *N* = 69	0.80 (95% CI –2.58 to 4.18)
							Impact		
							–3.19 (17.12), *N* = 78	4.23 (15.51), *N* = 63	–6.89 (95% CI –12.40 to –1.39)
							***N* (%) with four-point improvement**		
							30/69 (43%)	18/53 (34%)	OR = 1.71 (95% CI 0.75 to 3.89)
							EQ-5D (AUC), mean (SD)		
							132.8 (95.5), *N* = 107	139.8 (100.3), *N* = 75	–6.9 (95% CI –36.1 to 22.4)

AUC, area under the curve; SEM, standard error of the mean; SF-12, Short Form questionnaire-12 items; SWB, Subjective Wellbeing.

Appendix 10 Exercise outcome data from randomised controlled trials: review 1

Study year	Brief		Exercise – description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Behnke 2003[65]	Home-based walking exercise programme, *N* = 23	Control, *N* = 23	6-minute treadmill distance	3, 6, 12, 18 months Results averaged over 18-month trial period	*N* = 14	*N* = 12	*N* = 14	*N* = 12	
					Mean metres (SEM)		**Mean (SEM), estimated**		
					273 ± 97	226 ± 67	3 months: 473 ± 40	3 months: 217 ± 30	
							6 months: 493 ± 40	6 months: 227 ± 30	
							12 months: 513 ± 39	12 months: 216 ± 30	
							18 months: 532 ± 39	18 months: 177 ± 20	
							Average over 18 months		
							Mean (95% CI): 518 (438 to 597)	Mean (95% CI): 208 (148 to 270)	< 0.001
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	6-MWD	6 months	*N* = 71	*N* = 75	*N* = 67	*N* = 73	
					Mean ± SD: 162 ± 79	Mean ± SD: 145 ± 71	Mean ± SD: 174 ± 98	Mean ± SD: 150 ± 89	

6-MWD, 6-Minute Walk Distance; SEM, standard error of the mean.

Appendix 11 Lung function data from randomised controlled trials: review 1

Study year	Brief		Lung function description	Follow-up	Baseline		Reassessment		Effect size/*p*-value
	Intervention	Brief control			Intervention	Control	Intervention	Control	
Behnke 2000[64]	Home-based walking exercise programme, *N* = 23	Control: advised to exercise, no instruction, *N* = 23	FEV_1, FVC	Day 11, 3, 6 months	*N* = 15	*N* = 15	*N* = 15	*N* = 15	
					% predicted, mean ± SEM		**Mean ± SEM**		
					FEV_1				
					34.1 ± 7.4	37.5 ± 6.6	Day 11: 2.0 ± 0.07	Day 11: 1.15 ± 0.11	
					0.99 ± 0.06	1.02 ± 0.07	3 months: 1.16 ± 0.08	3 months: 1.05 ± 0.08	
							6 months: 1.22 ± 0.11	6 months: 1.03 ± 0.08	
					FVC				
					72.0 ± 3.8	73.5 ± 3.4	Day 11: 3.2 ± 0.2	Day 11: 2.9 ± 0.2	
					2.8 ± 0.2	2.7 ± 0.2	3 months: 3.1 ± 0.2	3 months: 2.6 ± 0.2	
							6 months: 3.0 ± 0.1	6 months: 2.5 ± 0.2	
Behnke 2003[65]	Home-based walking exercise programme, *N* = 23	Control, *N* = 23	FEV_1 Averaged over 18-month period Measurement of FEV_1 at time points	18 months	*N* = 14	*N* = 12	*N* = 14	*N* = 12	No significant difference between groups although difference in the time course as indicated by interaction term; *p* = 0.0016
					FEV_1				
					% predicted, mean ± SEM		**Mean + 95% CI**		
					34.9 ± 7.1	37.5 ± 6.9	41.6 (32.9 to 50.3)	35.7 (29.5 to 41.9)	
					FEV_1 (l)				
					Mean ± SEM, estimated from graph				
					0.96 ± 1.2	1.0 ± 0.1	Day 11 1.18 ± 0.1	Day 11 1.08 ± 0.1	
							3 months: 1.12 ± 0.1	3 months: 1.02 ± 0.1	

Study year	Brief intervention	Brief control	Lung function description	Follow-up	Baseline intervention	Baseline control	Reassessment intervention	Reassessment control	Effect size/*p*-value
							6 months: 1.14 ± 0.1	6 months: 1.06 ± 0.1	
							12 months: 1.15 ± 0.09	12 months: 1.00 ± 0.1	
							18 months: 1.12 ± 0.09	18 months: 0.94 ± 0.09	
Lee 2002[66]	Care protocol (including SM) to nursing home staff and patients, *N* = 48 completers	UC, *N* = 41 completers	% predicted FEV_1	6 months	*N* = 48	*N* = 41	*N* = 48	*N* = 41	0.329
					% predicted, mean (SD)				
					30.6 (10.1)	34.0 (15.1)	31.1 (13.3)	30.6 (13.1)	
Hernandez 2003[68]	Home-based hospitalisation, *N* = 121	UC, *N* = 101	FEV_1, FVC, FEV_1/FVC	8 weeks			*N* = 121	*N* = 101	
							FEV_1 (l), mean ± SD (%)		
							2.4. ± 0.9 (64)	2.2. ± 0.9 (60)	
							FVC (l), mean ± SD (%) predicted		
							1.2 ± 0.6 (43)	1.1 ± 0.4 (41)	
							FEV_1/FVC (%)		
							50 ± 13.3	50 ± 13.1	
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	FEV_1 (l), FEV_1/FVC (%)	12 months			*N* = 21	*N* = 41	
					FEV_1, median (IQR)		**FEV_1, mean change (SD)**		**MD (95% CI)**
					1.2 (0.8–1.4)	1.0 (0.8–1.5)	–0.01 (0.14)	0.06 (0.35)	–0.05 (–0.24 to 0.14)
					FEV_1/FVC%, mean (SD)		**FEV_1/FVC**		**MD (95% CI)**
					48 (17)	51 (18)	–0.82 (8.18)	–1.66 (17.94)	0.84 (–8.27 to 10.66)

SEM, standard error of the mean.

Appendix 12 Anxiety and depression outcome data from randomised controlled trials: review 1

Study year	Brief		Anxiety/depression – description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Egan 2002[69]	Case management, *N* = 33	UC, *N* = 33	Hospital anxiety and depression score	1 months, 3 months			**Median change, 1 month**		
							Anxiety:		
							–1.0 (*N* = 25)	–2.5 (*N* = 26)	0.437
							Depression:		
							0.5 (*N* = 26)	–1 (*N* = 27)	0.383
							1–3 months		
							Anxiety:		
							0 (*N* = 24)	–1.5 (*N* = 24)	0.764
							Depression:		
							–0.5 (*n* = 24)	0.5 (*n* = 24)	0.325
Lee 2002[66]	Care protocol (including SM) to nursing home staff and patients, *N* = 48 completers	UC, *N* = 41 completers	GHQ 28-item; 4 subscales: Somatic symptoms, anxiety and insomnia, social dysfunction, depression. Likert scale 0–3 Total score = 84 obtained by summation Lower score = better psychological well-being	6 months	*N* = 48	*N* = 41	*N* = 48	*N* = 41	
					Total, mean (SD)				
					24.44 (6.70)	22.90 (8.82)	18.38 (4.38)	22.61 (8.19)	
					Somatic, mean (SD)				
					7.19 (2.69)	6.76 (3.59)	4.9 (2.10)	6.1 (2.99)	
					A&I, mean (SD)				
					4.31 (2.60)	3.54 (2.83)	2.8 (1.52)	4.3 (2.49)	
					Social, mean (SD)				
					8.10 (2.20)	7.93 (1.46)	7.2 (0.63)	7.7 (1.51)	
					Depression, mean (SD)				
					4.83 (2.40)	4.68 (3.31)	3.3 (1.86)	4.3 (2.66)	

Study year	Brief		Anxiety/depression – description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Kwok 2004[70]	Community nurse-supported discharge programme, *N* = 77	UC, *N* = 80	GHQ	6 months	*N* = 77	*N* = 80	*N* = 67	*N* = 73	
					GHQ	GHQ	GHQ	GHQ	
					Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
					7.5 ± 4.5	7.5 ± 4.8	7.5 ± 5.3	7.9 ± 5.2	
Bucknall 2012[63]	Supported SM, *N* = 232	UC, *N* = 232	HADS	12 months	*N* = 232	*N* = 232			
					Anxiety, mean (SD)				**Effect (95% CI)**
					10.00 (4.5)	9.3 (4.6)	–0.37 (3.77), *N* = 104	0.93 (3.29), *N* = 82	–1.06 (–2.08 to –0.03); *p* = 0.044
					Depression, mean (SD)				**Effect (95% CI)**
					8.5 (3.9)	8.3 (4.1)	0.54 (3.26), *N* = 109	0.75 (2.78), *N* = 84	–0.27 (–1.13 to 0.59); *p* = 0.538

A&I, anxiety and insomia.

Appendix 13 Dyspnoea outcome data from randomised controlled trials: review 1

Study year	Brief		Dyspnoea description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Behnke 2000[64]	Home-based walking exercise programme, *N* = 23	Control: advised to exercise, no instruction, *N* = 23	**Baseline/transitional Dyspnoea Index** (functional impairment, magnitude of effort, magnitude of task) *Lower scores indicate greater impairment*	Day 11, 1, 2, 3 and 6 months	*N* = 15 Mean (SD) BDI 3.9 ± 0.6	*N* = 15 Mean (SD) BDI 3.8 ± 0.4	*N* = 15 **Focal transitional score reported, mean change (SEM)** Day 11: +6.9 ± 0.6	*N* = 15 Day 11: +3.1 ± 0.8	<0.001
							1 month, estimated: +5.4 ± 0.9	1 month, estimated: +2.0 ± 0.7	
							2 months, estimated: +4.5 ± 0.7	2 months, estimated: +0.3 ± 0.7	
							3 months: +4.6 ± 0.7	3 months: +0.3 ± 0.9	<0.001
							6 months: +4.4 ± 0.8	6 months: –2.8 ± 1.1	<0.001
			Dyspnoea domain of CRQ *Lower scores indicate greater impairment*	3 and 6 months	13.2 ± 1.1	13.1 ± 1.0	3 months: 22.1 ± 1.4	3 months: 15.7 ± 1.6	<0.001
							6 months: 25.3 ± 1.6	6 months: 13.9 ± 1.7	<0.001

Study year	Brief		Dyspnoea description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Behnke 2003[65]	Home-based walking exercise programme, *N* = 23	Control, *N* = 23			*N* = 14, 2.4 ± 1.1	*N* = 12, 2.5 ± 1.4	*N* = 14	*N* = 12	
			Borg scale at rest	Results averaged over 18-month trial period			**Mean (95% CI)**		
							0.7 (0.2 to 1.3)	2.1 (1.4 to 2.9)	< 0.01
				3, 6, 12, 18 months			**Mean ± SEM, estimated from graph**		
							3 months: 0.7 ± 0.3	3 months: 1.9 ± 0.3	
							6 months: 0.7 ± 0.3	6 months: 1.9 ± 0.4	
							12 months: 0.6 ± 0.3	12 months: 2.1 ± 0.3	
							18 months: 0.9 ± 0.3:	18 months: 2.7 ± 0.4	
			Baseline/transitional Dyspnoea Index (functional impairment, magnitude of effort, magnitude of task)	Results averaged over 18-month trial period			**Mean (95% CI)**		< 0.05
							4.4 (4.4 to 2.9)	–3.9 (–5.4 to –0.7)	
				3, 6, 12, 18 months			**Mean ± SEM, estimated from graph**		
					3.9 ± 2.2	3.8 ± 1.4	3 months: 5.0 ± 0.9	3 months: 0.7 ± 0.9	
							6 months: 4.8 ± 0.9	6 months: –2.4 ± 1.5	
							12 months: 4.4 ± 0.9	12 months: –2.8 ± 1.0	
							18 months: 4.5 ± 0.9	18 months: –4.2 ± 1.0	

Study year	Brief		Dyspnoea description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
			Dyspnoea domain of CRQ *Lower scores indicate greater impairment*	3, 6, 12, 18 months	13.1 ± 1.1	13.9 ± 1.1	3 months: 22.7 ± 1.4 6 months: 25.9 ± 1.6 12 months: 25.4 ± 1.4 18 months; 25.1 ± 1.5	3 months: 15.8 ± 1.9 6 months: 14.6 ± 2.0 12 months: 12.8 ± 1.6 18 months: 11.2 ± 1.3	
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	**MRC Dyspnoea Scale**	12 months	Median (IQR) 3 (3–4)	4 (3–5)	*N* = 21 Mean change (SD) –0.52 (1.12)	*N* = 41 –0.15 (1.44)	Effect size estimated using linear regression: –0.38 (95% CI –1.1 to 0.34)

BDI, Baseline Dyspnoea Index; SEM, standard error of the mean.

Appendix 14 Behaviour change outcomes data from randomised controlled trials: review 1

Study year	Brief		Behaviour change outcome – description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Hermiz 2002[67]	Home-based care focused on SM, *N* = 84	UC, *N* = 93	**Behaviour change** as measured by • smoking • those receiving influenza vaccine or pneumococcal vaccination **Knowledge** including name of condition, role of vaccination, awareness of condition, when to seek help	3 months	*N* = 67	*N* = 80	*n/N* (%) Smoking 15/67 (22) Influenza vaccination 48/67 (72) Pneumococcal vaccination 42/67 (63) Name of disease 36 (54) Role of vaccination 41 (61) Factors that prevent worsening of condition 26 (39) When to seek help 57 (85)	*n/N* (%) 26/80 (33) 60/80 (75) 42/80 (53) Test of difference (*p*-value) 26 (33) 16 (20) 10 (13) 55 (69)	 0.17 0.65 0.28 5.9 (0.04) 26.1 (< 0.01) 21.9 (< 0.01) 7.8 (0.07)
Hernandez, 2002[68]	Home-based hospitalisation, *N* = 121	UC, *N* = 101	**Disease knowledge** **Compliance on inhalation technique** **Rehabilitation at home** No details about questionnaires/ measures used				Disease knowledge 58% Compliance on inhalation technique 81% Rehabilitation at home 51%	 27% 48% 21%	 < 0.01 < 0.001 < 0.01

Study year	Brief: Intervention	Brief: Control	Behaviour change outcome – description	Follow-up	Baseline: Intervention	Baseline: Control	Reassessment: Intervention	Reassessment: Control	Effect size/ *p*-value
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	**Life-style factors, SM, medical treatment**	12 months			*N* (%), (*N* = 21)	*n* (%), (*N* = 41)	
							Current smokers		
							5 (24)	6 (15)	0.349
							Physical activity		
							18 (86)	34 (83)	0.778
							Regular walking/exercise		
							18 (86)	32 (78)	0.470
							Knowledge about name of disease		
							17 (81)	18 (44)	0.005
							Identification of exacerbation		
							17 (85)	9 (22)	< 0.001
							Early treatment of an exacerbation		
							19 (90)	27 (66)	0.036
							Adherence to oral treatment (MAS)		
							19 (90)	35 (85)	0.570
							Adherence to inhaled treatment (IAS scale)		
							15 (71)	15 (37)	0.009
							Correct inhaler manoeuvre		
							18 (86)	9 (24)	< 0.001
							Influenza vaccination		
							19 (90)	32 (78)	0.442
							Pneumococcal vaccination		
							16 (76)	25 (61)	0.348
Bucknall 2012[63]	Supported SM, *N* = 232	UC, *N* = 232	Initiating treatment for an exacerbation (successful SM)	12 months	75/180 (42%)	Not available			

IAS, Inhaler Adherence Scale; MAS, Medication Adherence Scale.

Appendix 15 Self-efficacy outcome data from randomised controlled trials: review 1

Study year	Brief		Self-efficacy outcome – description	Follow-up	Baseline		Reassessment		Effect size/ *p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Wong 2005[74]	SM telephone followed up, *N* = 30	Routine care, *N* = 30	Modified Chinese Self Efficacy Scale: 31 items with five subscales measured using five-point Likert Scale: • negative affect (11 items) • intense emotional arousal (seven items) • physical exertion (six items) • weather or environment (five items) • behavioural risk factors (two items) *Higher score = more confident*	3 months			*N* = 30	*N* = 30	
					Median (IQR):				
					Negative affect				
					3.9 (0.9)	3.8 (0.9)	4.1 (0.7)	3.9 (1.0)	0.260
					Intense emotional arousal				
					4.0 (0.6)	3.9 (0.9)	4.3 (0.6)	4.0 (0.8)	0.342
					Physical exertion				
					3.3 (1.0)	3.2 (1.4)	3.9 (1.0)	3.1 (1.0)	0.001
					Weather or environment				
					3.7 (0.7)	3.7 (0.8)	4.0 (0.8)	3.7 (1.2)	0.009
					Behavioural risk factors				
					4.0 (0.8)	4.0 (0.6)	4.1 (1.0)	4.0 (1.1)	0.901
					Total				
					3.8 (0.6)	3.6 (0.8)	4.0 (0.6)	3.8 (1.0)	0.009
Bucknall 2012[63]	Supported SM, *N* = 232	UC *N* = 232	COPD self-efficacy score *Higher score = more confident*	12 months	*N* = 232	*N* = 232	119/232 (48%)	94/232 (47%)	Effect (95% CI): 2.65 (–5.85 to 11.14); *p* = 0.540
					Mean (SD)		Mean change		
					68.2 (27.5)	69.8 (25.5)	–1.73 (34.04)	–5.55 (33.72)	

Appendix 16 Patient satisfaction outcome data from randomised controlled trials: review 1

Study year	Brief		Satisfaction – description	Follow-up	Baseline		Reassessment		Effect size/*p*-value
	Intervention	Control			Intervention	Control	Intervention	Control	
Hermiz 2002[67]	Home-based care focused on SM *N* = 84	UC, *N* = 93	**Patient satisfaction with GP care**	3 months			*N* = 67, 56/60 (93%)	*N* = 80, 72/75 (96%)	
Lee, 2002[66]	Care protocol (including SM) to nursing home staff and patients, *N* = 48 completers	UC, *N* = 41 completers	**Patient satisfaction** 13 items with 1–5 Likert response 10 items: satisfaction about nursing home care 3 items: satisfaction about community nurse care *Higher score = high satisfaction*	6 months			*N* = 48	*N* = 41	Significant (< 0.001) increased level of satisfaction in the intervention arm with care provided by nursing home staff
Hernandez 2003[68]	Home hospitalisation, *N* = 121	UC, *N* = 101	**Patient satisfaction** Questionnaire given, no details provided	8 weeks			*N* = 121, mean score 8	*N* = 101, mean score 7.5	0.03
Garcia-Aymerich 2007[72]	Integrated care included supported SM, *N* = 44	UC, *N* = 69	**Health-care satisfaction**	12 months			*N* = 21 **Satisfaction with health care, *n* (%)** 21 (100)	*N* = 41 34 (92)	0.180

Appendix 17 Search strategies for cost-effectiveness studies: review 3

MEDLINE (via Ovid)

URL: https://ovid.sp.com

Date range searched: 1946 to May week 1 2012.

Date of search: 15 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp Pulmonary Disease, Chronic Obstructive/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. Pulmonary Emphysema/
8. exp Bronchitis/
9. emphysema.ti,ab.
10. or/1-9
11. exp Self Care/
12. (self adj2 (support$ or care or caring or manage$)).ti,ab.
13. post discharge.ti,ab.
14. early discharge.ti,ab.
15. home care.ti,ab.
16. home care services/ or home nursing/
17. patient centred care.ti,ab.
18. patient centered care.ti,ab.
19. patient education/ or patient education.ti,ab.
20. patient participation.ti,ab.
21. post hospital care.ti,ab.
22. action planning.ti,ab.
23. discharge planning.ti,ab.
24. continuity of patient care/
25. (support$ adj2 discharge).ti,ab.
26. (support$ adj2 manag$).ti,ab.
27. patient focus$.ti,ab.
28. management plan$.ti,ab.
29. management program$.ti,ab.
30. rehabilitation.mp. or exp Rehabilitation/
31. or/11-30
32. 10 and 31
33. economics/
34. exp 'costs and cost analysis'/
35. cost of illness/
36. exp health care costs/
37. economic value of life/

38. exp economics medical/
39. exp economics hospital/
40. economics pharmaceutical/
41. exp 'fees and charges'/
42. (econom$ or cost or costs or costly or costing or price or pricing or pharmacoeconomic$).tw.
43. (expenditure$ not energy).tw.
44. (value adj1 money).tw.
45. budget$.tw.
46. or/33-45
47. 32 and 46

EMBASE (via Ovid)

URL: https://ovidsp.ovid.com

Date range searched: 1980 to 2012 week 19.

Date of search: 15 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp chronic obstructive lung disease/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. pulmonary emphysema.mp. or exp lung emphysema/
8. emphysema.ti,ab.
9. bronchitis.mp. or exp bronchitis/
10. or/1-9
11. self care.mp. or exp self care/
12. (self adj2 (support$ or care or caring or manage$)).ti,ab.
13. post discharge.ti,ab.
14. early discharge.ti,ab.
15. exp home care/
16. home nursing.ti,ab.
17. patient centred care.ti,ab.
18. patient centered care.ti,ab.
19. patient education/
20. patient education.ti,ab.
21. patient participation.ti,ab.
22. post hospital care.ti,ab.
23. action planning.ti,ab.
24. discharge planning.ti,ab.
25. continuity of patient care.ti,ab.
26. (support$ adj2 discharge).ti,ab.
27. (support$ adj2 manage$).ti,ab.
28. patient focus$.ti,ab.
29. management plan$.ti,ab.
30. management program$.ti,ab.
31. rehabilitation.mp. or exp rehabilitation/

32. or/11-31
33. 10 and 32
34. cost benefit analysis/
35. cost effectiveness analysis/
36. cost minimization analysis/
37. cost utility analysis/
38. economic evaluation/
39. (cost or costs or costed or costly or costing).tw.
40. (economic$ or pharmacoeconomic$ or price$ or pricing).tw.
41. (technology adj assessment$).tw.
42. or/34-41
43. 33 and 42

The Cochrane Library Cochrane (Wiley) NHS Economic Evaluation Database

URL: https://cochranelibrary.com

Date range searched: 1993–2012 issue 4 of 12.

Date of search: 15 May 2012.

Search strategy

#1 copd

#2 chronic next obstructive next pulmonary disease

#3 MeSH descriptor Pulmonary Disease, Chronic Obstructive explode all trees

#4 chronic next obstructive next airway next disease

#5 chronic next respiratory next disorder*

#6 smoking next related next lung next disease*

#7 emphysema

#8 MeSH descriptor Pulmonary Emphysema explode all trees

#9 MeSH descriptor Bronchitis explode all trees

#10 bronchitis

#11 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10)

#12 self next care

#13 MeSH descriptor Self Care explode all trees

#14 self near/2 (support* or care or caring or manage*)

#15 post next discharge

#16 early next discharge

#17 MeSH descriptor Home Care Services explode all trees

#18 home next nursing

#19 patient next centred next care

#20 patient next centered next care

#21 MeSH descriptor Patient Education as Topic explode all trees

#22 patient next education

#23 patient next participation

#24 post next hospital next care

#25 action next planning

#26 discharge next planning

#27 continuity near/1 patient

#28 support* near/2 discharge

#29 support* near/2 manage*

#30 patient next focus*

#31 management next plan*

#32 management next program*

#33 rehabilitation

#34 MeSH descriptor Rehabilitation explode all trees

#35 (#12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34)

#36 (#11 AND #35)

MEDLINE (via Ovid)

URL: https://ovidsp.ovid.com

Date range searched: 1946 to May week 1 2012.

Date of search: 15 May 2012.

Search strategy

1. chronic obstructive pulmonary disease.mp. or exp Pulmonary Disease, Chronic Obstructive/
2. copd.ti,ab.
3. chronic obstructive lung disease.ti,ab.
4. chronic obstructive airway disease.ti,ab.
5. chronic respiratory disorder$.ti,ab.
6. smoking-related lung disease$.ti,ab.
7. Pulmonary Emphysema/
8. exp Bronchitis/
9. emphysema.mp.
10. or/1-9
11. exp Self Care/
12. (self adj2 (support$ or care or caring or manage$)).ti,ab.
13. post discharge.ti,ab.
14. early discharge.ti,ab.
15. home care.ti,ab.
16. home care services/ or home nursing/
17. patient centred care.ti,ab.
18. patient centered care.ti,ab.
19. patient education/ or patient education.ti,ab.
20. patient participation.ti,ab.
21. post hospital care.ti,ab.
22. action planning.ti,ab.
23. discharge planning.ti,ab.
24. continuity of patient care/
25. (support$ adj2 discharge).ti,ab.
26. (support$ adj2 manag$).ti,ab.
27. patient focus$.ti,ab.
28. management plan$.ti,ab.
29. management program$.ti,ab.
30. rehabilitation.mp. or exp Rehabilitation/
31. or/11-30
32. 10 and 31
33. decision support techniques/
34. markov.ti,ab.
35. exp models economic/
36. decision analysis.ti,ab.
37. cost benefit analysis/
38. or/33-37
39. 32 and 38

Appendix 18 Chronic obstructive pulmonary disease-adjusted all-cause mortality rates by age and sex: review 3

Appendix 18 lists the COPD-adjusted all-cause mortality rates applied in the economic model. These were derived from all-cause and COPD-related mortality rates by sex and age for a UK population, obtained from the Office for National Statistics.

	All-cause mortality (%)		Deaths caused by COPD (%)		COPD-adjusted mortality (%)	
Age (years)	Male	Female	Male	Female	Male	Female
60	0.8342	0.5361	4.205241	5.111524	0.7828	0.509483
61	0.8871	0.581			0.8325	0.552154
62	0.9507	0.6165			0.8921	0.585891
63	1.0509	0.6812			0.9862	0.647379
64	1.1558	0.7478			1.0846	0.710672
65	1.2725	0.8201	6.184986	7.25799	1.1941	0.779383
66	1.4205	0.9119			1.333	0.866625
67	1.5369	0.9737			1.4422	0.925356
68	1.7243	1.0949			1.6181	1.040539
69	1.9125	1.2158			1.7947	1.155436
70	2.1149	1.3856			1.9846	1.316806
71	2.3225	1.4768			2.1794	1.403478
72	2.5652	1.6469			2.4072	1.565133
73	2.7907	1.8063			2.6188	1.716619
74	3.1141	2.0492			2.9223	1.947459
75	3.3999	2.2567	6.654892	6.476441	3.1905	2.144656
76	3.8443	2.5538			3.6075	2.427006
77	4.2217	2.8839			3.9616	2.740716
78	4.7005	3.2547			4.4109	3.093106
79	5.2482	3.6732			4.9249	3.490828
80	5.944	4.1742			5.5778	3.966954
81	6.6343	4.662			6.2256	4.430535
82	7.4283	5.3215			6.9707	5.057291
83	8.1907	6.0585			7.6861	5.7577
84	9.2142	6.7739			8.6466	6.437581
85	10.2895	7.5849	5.575312	3.413472	9.6556	7.208315
86	11.2992	8.5749			10.6031	8.149162
87	12.7193	9.5838			11.9358	9.107971
88	14.0875	10.779			13.2197	10.24383
89	16.0713	12.1602			15.0813	11.55645

	All-cause mortality (%)		Deaths caused by COPD (%)		COPD-adjusted mortality (%)	
Age (years)	Male	Female	Male	Female	Male	Female
90	16.6367	13.5352			15.6118	12.86319
91	17.8196	14.6525			16.7219	13.92501
92	18.8878	16.0748			17.7243	15.2767
93	21.4681	18.0517			20.1456	17.15545
94	23.7662	20.2789			22.3021	19.27207
95	25.6292	22.3947			24.0504	21.28282
96	27.5704	24.0167			25.872	22.82429
97	29.48	25.97			27.67	24.68
98	31.56	27.82			29.61	26.44
99	32.73	29.69			30.71	28.22
100	34.46	31.82			32.34	30.24

Appendix 19 Annual disease progression risks by age and smoking status: review 3

Appendix 19 lists the annual disease progression rates applied in the economic model. These were obtained from a published COPD Markov model by Atsou *et al.*[86]

Age	GOLD stage 2 to 3 Ex-smoker (%)	GOLD stage 3 to 4 Ex-smoker (%)	GOLD stage 2 to 3 Smoker (%)	GOLD stage 3 to 4 Smoker (%)
60	5.803	5.12	9.338	7.823
61	5.926	5.229	9.535	7.989
62	6.049	5.338	9.733	8.155
63	6.104	5.386	9.822	8.229
64	6.159	5.434	9.912	8.304
65	6.213	5.482	10.001	8.379
66	6.268	5.53	10.091	8.454
67	6.322	5.579	10.18	8.529
68	6.367	5.618	10.252	8.589
69	6.412	5.658	10.324	8.65
70	6.457	5.698	10.396	8.71
71	6.502	5.737	10.468	8.77
72	6.547	5.777	10.54	8.831
73	6.561	5.789	10.562	8.849
74	6.575	5.801	10.584	8.868
75	6.589	5.814	10.607	8.887
76	6.603	5.826	10.629	8.905
77	6.617	5.838	10.651	8.924
78	6.638	5.857	10.686	8.953
79	6.659	5.876	10.72	8.982
80	6.681	5.895	10.755	9.011
81	6.702	5.914	10.789	9.04
82	6.724	5.933	10.824	9.069
83	6.792	5.993	10.935	9.161
84	6.861	6.054	11.045	9.254
85	6.93	6.114	11.156	9.347
86	6.998	6.175	11.266	9.439
87	7.067	6.236	11.377	9.532
88	7.136	6.296	11.487	9.624
89	7.204	6.357	11.598	9.717
90	7.273	6.417	11.708	9.81
91	7.342	6.478	11.819	9.902

Age	GOLD stage 2 to 3 Ex-smoker (%)	GOLD stage 3 to 4 Ex-smoker (%)	GOLD stage 2 to 3 Smoker (%)	GOLD stage 3 to 4 Smoker (%)
92	7.41	6.538	11.929	9.995
93	7.479	6.599	12.04	10.088
94	7.547	6.659	12.15	10.18
95	7.616	6.72	12.261	10.273
96	7.685	6.781	12.372	10.365
97	7.753	6.841	12.482	10.458
98	7.822	6.902	12.593	10.551
99	3.61	7.891	12.703	10.643
100	3.61	7.891	12.703	10.643

Appendix 20 Cost of other self-management programmes in populations with chronic obstructive pulmonary disease: review 3

Appendix 20 lists cost estimates extracted from SM programmes targeted at patients with COPD, not provided within 6 weeks of discharge. Costs are listed in the year and currency they were reported and also 2012 GB pound sterling (£) prices. Costs were converted using mid-year exchange rates for the reporting year and inflated assuming an average inflation rate of 3.5%.

Author	Type of programme	Main activities	Cost, year, currency (as reported)	Costs 2012, GB£ (estimated)
Khdour 2011[279]	Pharmacy-led SM programme	A consultation with a pharmacist, lasting 1 hour Two follow-up telephone calls lasting 20 minutes Two follow-up consultations	381, 2006, GB£	458
Sridhar 2008[155]	Nurse-led intermediate care programme	A 1-hour group session A home visit by a respiratory nurse A follow-up telephone call	107, 2006, GB£	129
Dewan 2012[299]	Disease management programme	A group session lasting 1.5 hours Development of an action plan Provision of a refillable prescriptions Access to helpline Series of follow-up telephone calls	849, 2011, US$	544
Monninkhof 2004[300]	SM programme	Five group sessions lasting 2 hours Provision of education booklet Two group training sessions lasting 1 hour	642, 2002, euros	508
Tinkelman 2003[301]	Disease management programme	A telephone education session Ongoing access to case management support via telephone service Series of follow-up telephone calls Reassessment at 6 months	635, 2002, US$	573

Appendix 21 Outcomes as reported by studies included for review 4 but not included in analyses

Studies	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea	Last follow-up (weeks)
Alexander 2008[302]	0	0	0	1	0	0	0	0	10.0
Ambrosino 1981[303]	0	0	0	1	1	0	0	0	4.3
Bauldoff 1996[304]	0	0	0	1	0	0	0	1	8.0
Belman 1988[305]	0	0	0	1	1	0	0	0	5.0
Berry 1996[306]	0	0	0	1	1	0	0	1	12.0
Berry 2003[307]	0	0	0	1	1	0	0	1	–
Bjerre-Jepsen 1981[308]	0	0	0	1	1	0	0	0	6.0
Borghi-Silva 2009[309]	0	0	0	1	1	0	0	1	–
Bosch 2007[310]	1	0	0	1	1	1	0	1	–
Carrieri-Kohlman 1996[311]	0	1	0	1	0	0	0	1	–
Carrieri-Kohlman 2001[312]	0	1	0	1	0	0	0	1	12.0
Casaburi 2004[313]	0	0	0	1	0	0	0	0	10.0
Chen 1985[314]	0	0	0	1	1	0	0	0	4.0
Clark 1996[315]	0	0	0	1	1	0	0	0	12.0
Clark 2000[316]	0	0	0	1	1	0	0	1	12.0
Cooper 2009[317]	0	0	0	1	1	0	0	1	8.0
Coppoolse 1999[318]	0	0	0	1	1	0	0	1	8.0
Costi 2009[319]	0	0	0	1	0	0	0	1	26.0
de Godoy 2003[320]	0	1	1	1	0	0	0	0	12.0
Dekhuijzen 1991[321]	0	1	1	1	1	0	0	0	10.0
Epstein 1997[322]	0	0	0	1	1	0	0	0	8.0
Esteve 1996[323]	0	0	0	0	1	0	0	0	4.0
Falk 1985[324]	0	0	0	1	1	0	0	1	13.0
Gallefoss 1999[325]	0	0	0	0	0	1	0	0	52.0
Cabedo Garcia 2010[326]	0	0	0	0	1	0	0	1	–

Studies	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea	Last follow-up (weeks)
Gift 1992[327]	0	1	0	0	1	0	0	1	4.0
Gormley 1993[328]	0	0	0	1	0	0	0	0	4.0
Harver 1989[329]	0	0	0	0	1	0	0	1	8.0
Heijdra 1996[330]	0	0	0	1	1	0	0	0	10.0
Hoff 2007[331]	0	0	0	1	1	0	0	1	8.0
Incalzi 2008[332]	0	0	0	0	0	0	0	0	26.0
Izumizaki 2008[333]	0	0	0	1	1	0	0	1	–
Jin 2002[334]	0	0	0	1	1	0	0	1	–
Jones 1985[335]	0	0	1	1	1	0	0	1	10.0
Kheirabadi 2008[336]	0	0	0	0	0	0	0	0	13.0
Kongsgaard 2004[337]	0	0	0	1	1	0	0	0	12.0
Kirsten 1998[338]	0	0	0	1	1	0	0	1	1.6
Kurabayashi 2000[339]	0	0	0	0	1	0	0	0	8.7
Ruiz de Ona Lacasta 2004[340]	0	0	0	1	0	0	0	0	52.0
Lake 1990[341]	0	0	0	1	1	0	0	1	8.0
Levine 1986[342]	0	1	1	1	1	0	0	0	6.0
Lisboa 1995[343]	0	0	1	1	1	0	0	1	–
Lisboa 1997[344]	0	0	0	1	1	0	0	1	10.0
Louie 2004[345]	0	1	0	0	0	0	0	1	–
Marrara 2008[346]	0	0	0	1	1	0	0	1	6.0
Martinez 1993[347]	0	0	0	1	0	0	0	1	10.0
McKeon 1986[348]	0	0	0	1	1	0	0	0	6.0
Mehri 2007[349]	0	0	0	1	0	0	0	0	4.0
Mendes de Oliveira 2010[350]	0	0	0	1	1	0	0	1	12.0
Nasis 2009[351]	0	0	0	1	1	0	0	1	10.0

Studies	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea	Last follow-up (weeks)
Nava 1998[352]	0	0	0	1	1	0	0	1	–
Noseda 1987[353]	0	0	0	1	1	0	0	0	8.7
Nosworthy 1993[354]	0	0	0	1	1	0	0	0	13.0
Phillips 2006[355]	0	0	0	1	0	0	0	0	8.0
Preusser 1994[356]	0	0	0	1	1	0	0	0	13.0
Puente-Maestu 2000[357]	0	0	0	1	1	0	0	0	8.0
Ramirez-Sarmiento 2002[358]	0	0	0	1	1	0	0	0	5.0
Reardon 1994[359]	0	0	0	1	0	0	0	1	6.0
Ries 1986[360]	0	0	0	1	1	0	0	0	6.0
Ries 1988[361]	0	0	0	1	1	0	0	1	8.0
Saunders 1965[362]	0	0	0	0	1	0	0	1	13.0
Savci 2000[363]	0	0	0	1	1	0	0	1	4.0
Singh 2009[364]	1	1	0	0	1	0	0	1	–
Spohn 2002[365]	0	0	0	0	0	0	0	0	–
Strijbos 1996[366]	0	0	0	1	1	0	0	1	12.0
Strijbos 1996[367]	0	0	0	1	1	0	0	1	–
Su 2007[368]	0	0	0	1	1	0	0	1	4.0
Tandon 1978[369]	0	0	0	1	1	0	0	1	39.0
Tiep 1986[370]	0	0	0	0	1	0	0	0	–
Toshima 1992[371]	0	0	1	1	1	0	0	1	52.0
Vallet 1994[372]	0	0	0	1	1	0	0	1	–
Vallet 1997[373]	0	0	0	1	1	0	0	0	4.0
Varga 2007[374]	0	0	0	1	1	0	0	1	8.0
Vogiatzis 2005[375]	0	0	0	1	0	0	0	1	10.0
Wanke 1994[376]	0	0	0	1	1	0	0	1	8.0

Studies	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea	Last follow-up (weeks)
Weiner 1992[377]	0	0	0	1	1	0	0	0	26.0
Weiner 2000[378]	0	0	0	1	1	0	0	1	22.0
Weiner 2003[379]	0	0	0	1	1	0	0	1	13.0
Weiner 2003[380]	0	0	0	1	1	0	0	1	13.0
Weiner 2004[381]	0	0	0	1	1	0	0	1	–
Weiner 2006[382]	0	0	0	0	1	0	0	0	8.0
Wen 2004[383]	0	0	0	1	1	0	0	1	–
Wen 2008[384]	0	0	0	1	1	0	0	1	–
Wijkstra 1996[385]	0	0	0	1	1	0	0	1	12.0
Wijkstra 1996[386]	0	0	0	1	1	0	0	1	–
Wolkove 2004[387]	0	0	0	1	1	0	0	1	4.3
Wurtemberger 2001[388]	0	0	0	1	1	0	0	1	–
Xie 2003[389]	0	0	0	1	1	0	0	1	12.0
Yan 1996[390]	0	0	0	0	1	0	0	0	20.0

Appendix 22 Summary of characteristics of population and study information: review 4

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Aimonino Ricauda 2008 Italy[75]	104	79.7 (3.2)	65	42.5	ED	Hospital at home	Inpatient care	26
Arnardottir 2006 Sweden[216]	63	66. 6 (2)	50	37.5 (2.5)	Secondary care outpatient	Endurance, resistance training and calisthenics	Resistance training and calisthenics	52
Arnardottir 2007 Sweden[217]	100	64.5 (7.6)	15	33.4 (11.5)	PR programme	Interval training	Continuous training	16
Barakat 2008 France[249]	80	64.8 (11.1)	84	42.6 (3.1)	Secondary care outpatient	PR	Control	14
Bauldoff 2002 USA[108]	24	68.1 (8.0)	17	41.3 (13.0)	PR programme	Music (distractive auditory stimulation)	Control	8
Bauldoff 2005 USA[109]	30	63.0 (11)	43	41.3 (18)	Secondary care outpatient	(1) Moderate distractive auditory stimulation during exercise; and (2) slow distractive auditory stimulation during exercise	Attention control	4
Beckerman 2005 Israel[253]	42	67.3 (15.8)	76	42.5 (11.7)	Community	IMT	Sham training	52
Behnke 2000, Behnke 2003, Germany[64,65]	46	66.0 (2.1)	77	36.0 (7.0)	Secondary care inpatient	Home-based exercise	Control	26, 78
Bendstrup 1997 Denmark[222]	47	64.5 (2.5)	88	NR	Secondary care	PR	Control	24
Bernard 1999 Canada[191]	45	65.3 (7.9)	78	42.5 (13.8)	NR	Aerobic and strength training	Aerobic training	12
Berry 2010 USA[110]	176	66.0 (10.0)	50	51.8 (19.4)	Mixed	Lifestyle activity intervention	Traditional exercise therapy	52
Bestall 2003 UK[141]	66	68.7 (7.5)	NR	37.5 (11.5)	PR programme	Exercise	Control	52
Bjornshave 2005 Denmark[223]	31	62.6	35	34.8	Secondary care	Middle intensity training	Low-intensity training	4
Blake Jr 1990 USA[111]	94	63.4	81	NR	Secondary care outpatient	Psychosocial intervention	Control	52
Bonilha 2009 Brazil[232]	43	71.7 (7.5)	75	51.1 (20.5)	Mixed	Singing classes	Control	25
Bourbeau 2003, Bourbeau 2006, Gadoury 2005 Canada[192,270,271]	191	69.5 (7.0)	57	NR	Secondary care	SM programme	UC	52, 104, 52
Boxall 2005 Australia[160]	60	76.7 (7.9)	57	39.1 (15.5)	Secondary care outpatient	Home-based PR	Control	26
Breyer 2010 Austria[245]	60	60.3 (8.5)	45	46.3 (17.6)	NR	Nordic walking	Control	39
Brooks 2002 Canada[193]	109	68.0 (7.4)	59	32.0 (12.0)	PR programme	Enhanced follow-up	Conventional follow-up	52
Bucknall 2012 UK[63]	464	69.1 (9.3)	37	40.5 (13.6)	Mixed	Supported SM	UC	52
Busch 1988 Canada[194]	20	65.1 (15.5)	79	26.3 (10.0)	Unclear	Home exercise	Control	18
Cai 2006 China[199]	82	61.0 (9.0)	95	NR	Secondary care	Education	Control	26
Carr 2009 Canada[195]	34	68.0 (8.1)	44	NR	Primary and secondary care	Repeat PR	UC	52

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	Y	N	Y	N	Y	N	N	Y	N	N
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	N	N	N	N	Y	Y	Y	N	Y
Y	Y	N	N	N	N	Y	Y	Y	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	Y	N	N	N	N	Y	N	N
Y	N	N	N	N	N	N	Y	N	N	Y
Y	Y	Y	N	N	N	Y	Y	Y	Y	N
Y	Y	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	N	Y	Y	Y	N	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	Y	N	N	N	N	Y	N	N	Y
Y	N	N	N	N	N	Y	N	Y	N	N

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Casas 2006, Garcia-Aymerich 2007 Spain and Belgium[71,72]	155	71.2 (9.0)	83	41.8 (17.3)	Secondary care inpatient	Integrated care	UC	52
Chan 2010, 2011 Hong Kong[212,272]	206	73.0 (7.7)	91	NR	Secondary care outpatient	(a) T'ai chi qigong; (b) exercise	Control	13
Cockcroft 1987 UK[142]	75	69.8	68	NR	Primary and secondary care	Respiratory health worker	Control	NR
Coultas 2005 USA[112]	217	69.0 (8.2)	62	NR	Primary care	(a) Nurse-assisted collaborative management; and (b) nurse-assisted medical management	UC	26
Covey 2001 USA[113]	37	66.1 (8.5)	67	37.8 (10.2)	NR	IMT	Education	16
de Blok 2006 The Netherlands[181]	21	64.0 (11.4)	43	46.8 (17.8)	PR programme	Lifestyle physical activity counselling	Control	9
Dheda 2004 UK[73]	33	70.2 (7.5)	NR	41.3 (16.5)	Secondary care inpatient	Outpatient follow up	Primary care follow-up	26
Donesky-Cuenco 2009 USA[114]	41	69.9 (9.5)	28	47.7 (15.6)	Community	Yoga therapy	UC	12
Dourado 2009 Brazil[233]	47	63.1 (87.2)	74	58.8 (25.0)	Secondary care inpatient	(a) Strength training with low-intensity general training; and (b) low-intensity general training	Strength training	12
du Moulin 2009 Germany[206]	20	65.9	70	60.6	PR programme	Home-based exercise	Control	26
Eaton 2009 New Zealand[227]	97	69. 9 (9.6)	44	35.5 (16)	Secondary care inpatient	Early PR	UC	13
Effing 2009, 2011 Australia[161,278]	142	63.4 (8.0)	59	50.1 (15.8)	Secondary care outpatient	SM sessions plus COPE-active (community-based physiotherapeutic exercise)	SM	52
Efraimsson 2008 Sweden[218]	52	67.0 (10.6)	50	n/a	Primary care	Self-care management education	Control	13
Egan 2002 Australia[69]	66	52.5	48	NR	Secondary care inpatient	Nursing-based case management	Control	13
Elci 2008 Turkey[236]	78	58.9 (10.1)	81	47	Secondary care	PR	Control	13
Elliott 2004 Australia[162]	43	66.2 (8.1)	54	45.1 (18.3)	Secondary care	(a) Hospital- and home-based rehabilitation; and (b) hospital- and community-based rehabilitation	Community rehabilitation	52
Emery 1998 USA[115]	79	66.6 (6.5)	47	42.0 (17.0)	Mixed	(a) Exercise, education and stress management; and (b) education and stress management	Waiting list control	10
Engstrom 1999 Sweden[219]	50	66.4 (5.4)	52	32.3 (10.8)	Secondary care outpatient	PR	UC	52
Fernandez 2009 Spain[171]	49	67 (8)	100	59.76 (14.14)	Secondary care	Home-based PR	Control	52
Finnerty 2001 UK[143]	100	69.5 (9.2)	68	41.0 (18.5)	Secondary care outpatient	PR	Control	26
Foy 2001 USA[116]	140	67.7 (5.9)	56	58.4 (17.8)	Mixed	Long-term exercise	Short-term exercise	78

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
Y	Y	Y	N	N	N	Y	Y	Y	N	Y
N	Y	N	Y	N	N	N	N	Y	N	N
Y	Y	N	N	N	Y	N	Y	Y	Y	N
Y	N	N	N	N	N	N	Y	N	N	Y
Y	N	N	N	N	Y	Y	N	N	N	Y
Y	Y	Y	N	N	N	N	Y	Y	N	N
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	N	N	Y	Y	Y	N	N	Y	Y
Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
Y	N	N	N	N	N	N	N	N	N	N
Y	Y	N	N	Y	Y	N	N	N	N	N
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Gallefoss 1999, 2000, 2002, 2004 Norway[255,280,281,391]	62	57.5 (9.5)	50	53.5 (9.5)	Secondary care outpatient	Education	Control	52
Ghanem 2010 Egypt[264]	39	56.8 (10.8)	NR	NR	Secondary care inpatient	Home-based PR	UC	9
Gilmore 2010 USA[117]	37	59.2 (8.3)	35	45.0 (15.8)	Secondary care outpatient	(a) COPD education guide and structured home visit; (b) COPD education guide; and (c) structured home visit	Control	NR
Gohl 2006 Germany[207]	34	62.8 (7.7)	68%	53.5 (8.7)	Mixed	Training programme	UC	52
Goldstein 1994, 1997; Guyatt 1999, Canada[196,392,393]	89	65.5 (7.5)	49	36.5 (13.2)	NR	PR	Control	26
Green 2001 UK[144]	44	68.5 (9.0)	64	NR	NR	7 weeks PR	4 weeks PR	7
Güell 2000 Spain[172]	60	65.0 (7.0)	100	35.0 (14.0)	Secondary care outpatient	PR	Control	104
Güell 2006 Spain[173]	40	65.0 (8.0)	83	35.0 (13.0)	Secondary care	PR	Control	17
Guyatt 1992 USA[118]	93	66.4 (7.6)	NR	NR	Secondary care	Respiratory muscle training	Sham training	26
Hermiz 2002 Australia[67]	177	66.9	46	n/a	Secondary care	Home-based care	Control	13
Hernandez 2000 Spain[282]	60	63.8 (7.7)	NR	40.9 (16.0)	NR	Home-based training programme	Control	12
Hernandez 2003 Spain[68]	222	71.0 (10.0)	97	42.0	Secondary care	Hospital at home	UC	8
Hill 2006 Australia[163]	35	68.0 (8.6)	67	36.9 (12.0)	NR	IMT	Sham IMT	8
Holland 2004 Australia[164]	40	67.8 (7.7)	63	36.6 (10.3)	Secondary care outpatient	Upper limb and lower limb training	Lower limb plus sham training	6
Hoogendoorn 2009; Van Wetering 2010; Hoogendoorn 2010 The Netherlands[182,273,274]	199	66.5 (8.9)	71	58.8 (16.1)	Secondary care	INTERCOM: Interdisciplinary community-based COPD management programme	UC	104
Hospes 2009 The Netherlands[183]	39	62.18 (8.7)	60	64.7 (16.1)	Secondary care inpatient	Exercise counselling	UC	12
Hsiao 2003 Taiwan[259]	42	69.9 (5.3)	87	51.4 (13.0)	Secondary care	(a) Targeted, resistive IMT; and (b) pressure threshold IMT	Control	8
Hynninen 2010 Norway[256]	51	61.0 (8.9)	49	58.8 (23.62)	Mixed	Cognitive–behavioural therapy	UC	35
Janaudis-Ferreira 2011 Canada[197]	36	66.0 (9.0)	58	35.0 (15.1)	Secondary care	Unsupported upper extremity resistance training	Sham training	6
Jang 2006 Korea[267]	36	NR	100	48.7 (16.52)	Unclear	PR	Education control	8
Jarab 2012 Jordan[266]	133	62.5 (14.5)	41	53.3 (16.9)	Secondary care outpatient	Pharmacist intervention	Control	26
Karapolat 2007 Turkey[237]	54	65.8 (9.0)	88	54.9 (16.0)	NR	PR	Control	12
Katiyar 2006 India[240]	48	52.2 (2.85)	84	48 (2.77)	NR	Pranayama (yogic breathing)	Control	14

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	Y	N	N	N	N	N	Y	Y	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	N	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	Y	Y	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	Y	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	Y	N	N
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	Y	N	N	N	N	N	N	Y	Y	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	N	Y	N	N	N	N	Y	Y	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Y	N	N	N	N	Y	Y	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	Y	Y	N	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	Y	N	N	N	N	Y	Y	Y	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Kayahan 2006 Turkey[238]	45	65.8 (8.4)	87	NR	Secondary care outpatient	PR	Control	9
Khdour 2009, 2011 Ireland[251,279]	173	64.5 (9.7)	44	52.0 (16.9)	Secondary care outpatient	Pharmacy-led disease management programme	Control	52
Kim 1993 USA[119]	129	64.8 (7.4)	76	40.0 (13.4)	NR	IMT	Control	26
Ko 2011 Hong Kong[213]	60	73.6 (7.10)	98	54.6 (18.5)	Secondary care inpatient	Early pulmonary rehabilitation	UC	52
Koff 2009 USA[120]	40	65.8 (8.7)	48	32.4 (9.7)	Secondary care outpatient	Integrated care	UC	13
Koppers 2006 The Netherlands[184]	39	55.7 (8.1)	47	54.0 (14.5)	PR programme	Respiratory muscle endurance training	Sham training	5
Kunik 2008 USA[121]	238	66.3 (10.3)	96	46.0 (17.2)	Mixed	Cognitive–behavioural therapy	Education	52
Kwok 2004 Hong Kong[70]	157	74.7 (6.4)	71	NR	Secondary care	Community nursing programme	Control	26
Lamers 2010 The Netherlands[185]	187	71 (6.7)	60	NR	Primary care	Minimal psychological intervention plus UC	UC	39
Larson 1988 USA[122]	22	64.4 (4.6)	91	31.1 (15.7)	Mixed	IMT 30% load	IMT 15% load	8
Larson 1999 USA[123]	130	65.0 (6.0)	66	50.3 (17.3)	Mixed	(a) IMT; (b) cycle ergometry training; and (c) IMT and cycle ergometry training	Health education	17
Lee 2002 Hong Kong[66]	112	80.4 (6.3)	53	NR (severe)	Secondary care inpatient	Care protocol nurse follow-up	Control	26
Leung 2010 Australia[165]	36	71.5 (7.5)	70	54.5 (17.5)	PR programme	Walking	Cycling	8
Li 2002 China[200]	74	NR	NR	61.8 (17.3)	Secondary care	Nutritional support	Control	13
Liddell 2010 UK[145]	30	69 (8.1)	67	51 (21.2)	PR programme	Twice-weekly PR	Once-weekly PR	8
Lindsay 2005 Hong Kong[214]	50	69.7 (9.8)	76	NR	Secondary care outpatient	PR (plus tiotropium)	UC (plus tiotropium)	13
Linneberg 2012 Denmark[224]	118	NR	38	42.2	PR programme	Supplemental exercise post PR programme	No supplemental exercise post-PR	45
Littlejohns 1991 UK[146]	152	62.7 (7.7)	65	47.8 (22.7)	Secondary care outpatient	Respiratory health worker	UC	52
Liu 2008 Taiwan[260]	60	72.1 (7.4)	100	45.6 (13.9)	NR	Cell phone-based exercise programme	Control	52
Livermore 2010 Australia[166]	41	73.4 (7.3)	44	54.1 (20.8)	Secondary care	Cognitive–behavioural therapy	UC	78
Lord 2010 UK[147]	36	63.7 (8.1)	NR	37.2 (18.6)	Secondary care outpatient	Singing	Control	7
Madariaga 2007 Spain[174]	34	63.2 (10.4)	NR	46.9 (9.5)	Secondary care outpatient	(a) RMT with a threshold device; and (b) RMT with a resistive device	Control	6
Mador 2004 USA[126]	32	70.8 (6.9)	NR	41.8 (13.9)	Secondary care outpatient	Endurance, strength training and education	Endurance training and education	8

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	Y	Y	N	N	N	N	Y	Y	Y	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	Y	N	N	N	Y	Y	Y	Y	N
Y	Y	Y	N	N	N	N	N	Y	Y	N
Y	N	N	N	N	N	N	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	Y	N	Y
N	Y	N	N	N	N	Y	N	N	Y	N
Y	N	N	N	Y	Y	N	N	N	N	N
Y	N	N	N	N	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
N	Y	N	N	Y	Y	N	Y	N	Y	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	N	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	Y	Y	Y	Y	Y	N	N
Y	Y	Y	Y	N	N	Y	Y	N	N	N
Y	Y	N	N	Y	Y	N	Y	N	N	N
Y	N	N	N	Y	Y	Y	N	N	N	N
Y	N	N	N	N	N	N	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Mador 2005 USA[125]	38	70.3 (2.0)	NR	44.4 (4.7)	PR programme	Endurance training plus hyperpneic (combined) training)	Endurance training	8
Mador 2009 USA[124]	48	71.8 (7.4)	NR	44.6 (13.9)	Mixed	Interval training	Continuous training	8
Magadle 2007 Israel[254]	34	65.6 (13.0)	74	45.5 (10.0)	PR programme	General exercise reconditioning programme plus IMT	General exercise reconditioning programme plus sham IMT	26
Maltais 2008 Canada[198]	252	66.0 (9.0)	56	44.5 (13.0)	Secondary care outpatient	Home-based PR	Hospital-based PR	52
Man 2004 UK[148]	42	70.2 (9.3)	41	39.2 (17.0)	Secondary care inpatient	Early PR	UC	13
Martin 2004 New Zealand[228]	96	70.1 (15.6)	50	34.8 (12.0)	Primary care	Individualised care plans	UC	52
McGeoch 2006 New Zealand[229]	159	70.9 (10.9)	65	53.9 (18.4)	Primary care	SM plan	UC	52
Monninkhof 2003, 2004 The Netherlands[186,300]	248	65.0 (7.0)	68	57.0 (15.0)	Secondary care outpatient	SM programme	UC	52
Moore 2009 UK[284]	20	70.0	50	40.8	Mixed	Home exercise video programme	Control	6
Mota 2007 Spain[175]	18	63.5 (6.7)	NR	28.0 (8.0)	NR	EMT	Sham training	5
Mularski 2009 USA[127]	86	67.4 (2.2)	99	NR	Mixed	Mindfulness-based breathing therapy	Support group control	8
Murphy 2005 Ireland[252]	26	66.0 (10.4)	74	40.0 (12.0)	Secondary care inpatient	Home-based exercise	Control	26
Nakamura 2008 Japan[261]	42	68.9 (6.8)	NR	51.5 (19.7)	Secondary care outpatient	(a) Aerobic and strength training; and (b) aerobic training and recreational activities	Control	12
Ng 2011 Hong Kong[215]	80	72.4 (7.6)	89	36.9 (13.7)	Secondary care outpatient	Health qigong	Control	26
Nguyen 2008 USA[128]	50	69.3 (8.8)	50	50.3 (17.3)	Community	Face-to-face dyspnoea SM programme	Internet-based dyspnoea SM programme	26
Nguyen 2009 USA[129]	17	68.2 (10.5)	94	40.9 (17.1)	Secondary care	Mobile coached	Mobile self-monitored	26
Nield 2007 USA[130]	40	65.0 (9.0)	95	39.0 (13.0)	Secondary care outpatient	(a) Pursed lips breathing; and (b) EMT	Control	12
Ninot 2011 France[250]	45	63.1	84	55.1	Secondary care	SM education programme and exercise	UC	52
Normandin 2002 USA[131]	54	68.0 (8.1)	53	49.5 (18.1)	PR programme	High intensity endurance	Low intensity calisthenics	8
Norweg 2005 USA[132]	43	75.3 (7.0)	30	55.9 (17.8)	Secondary care outpatient	(a) Exercise training and activity training; and (b) exercise training and lecture series	Exercise training alone	24
Oh 2003 South Korea[283]	34	65.5 (9.6)	61	43.1 (16.0)	Secondary care outpatient	Home-based PR	Control	8
O'Neill 2007 UK[150]	91	68.5 (7.9)	67	41.3 (17.8)	PR programme	Twice-weekly PR	Once-weekly PR	26
Ortega 2002 Spain[176]	54	64.2 (7.7)	87	38.3 (12.5)	NR	(a) Strength training and endurance training; and (b) endurance training	Strength training	24

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	Y	N	N	N	Y	Y	N	N	Y
Y	Y	N	N	N	N	Y	N	N	Y	Y
Y	Y	N	N	N	N	N	N	Y	Y	N
Y	Y	N	N	Y	Y	N	N	Y	Y	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	Y	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	Y	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	N	N	N	N	Y	N	Y	Y	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
O'Shea 2007 Australia[167]	54	67.7 (8.6)	39	50.5 (23.6)	Mixed	Progressive resistance exercise	Control	24
Ozdemir 2010 Turkey[239]	50	62.5 (8.9)	100	54.3 (12.7)	Secondary care outpatient	Water-based PR	Control	4
Paz-Diaz 2007 Venezuela[269]	24	64.1 (6.3)	75	31.7 (9.9)	Secondary care outpatient	PR	Control	9
Petersen 2008 Denmark[225]	19	66.0 (2.0)	32	31.0 (3.0)	NR	Lifestyle training	Control	7
Petty 2006 USA[133]	214	68.8 (9.4)	56	NR	Mixed	(a) Customised video; and (b) standardised video	Control	16
Pomidori 2012 Italy[243]	36	72.0 (8.0)	75	48.5 (12.5)	Secondary care outpatient	Paced speed walking	Walking (known distance, fixed time)	52
Prince 1989 Edinburgh[151]	39	67.5	64	NR	Secondary care outpatient	Rehabilitation	Control	6
Probst 2011 Brazil[234]	63	66.0 (8.6)	54	39.5 (13.5)	NR	High-intensity endurance and strength training	Low-intensity calisthenics and breathing	12
Puente-Maestu 2000, 2003 Spain[177,275]	49	64.4 (4.5)	NR	40.6 (6.2)	PR programme	Supervised exercise	Self-monitored exercise	8, 56
Puhan 2006 Switzerland[257]	100	69.0 (9.2)	66	34.3 (8.5)	PR programme	Interval exercise	High-intensity continuous exercise	5
Rea 2004 New Zealand[230]	135	68.0	42	51.1	Primary care	Disease management programme	UC	52
Regiane Resqueti 2007 Spain[178]	38	67.7 (4.3)	92	28.6 (8.5)	Secondary care outpatient	Home-based PR	Control	26
Ren 2011 China[201]	89	NR	NR	NR	Secondary care	(a) PR strategy group 1; and (b) PR strategy group 2	Control	52
Rice 2010 USA[140]	743	69.9 (9.6)	98	37.1 (14.5)	Secondary care	Disease management programme	UC	52
Riera 2001 Spain[179]	20	67.3 (4.5)	90	39.8 (12.0)	Secondary care outpatient	IMT	Sham training	26
Ringbaek 2000 Denmark[226]	45	63.1 (7.2)	16	47.1 (15.8)	Secondary care outpatient	PR	Control	8
Romagnoli 2006 Italy[244]	35	69.5 (8.0)	66	36.5 (8.0)	PR programme	Two repeat PR sessions	One repeat PR session	52
Rooyackers 2003 The Netherlands[187]	24	59.0 (11.6)	83	41.5 (12)	NR	General exercise training and eccentric exercise training	General exercise training	10
Sassi-Dambron 1995 USA[134]	98	67.4 (8.0)	61	50.0 (22.0)	Mixed	Dyspnoea management strategy	Attention control	26
Scherer 2000 Zurich[258]	34	69.0 (1.9)	63	51.3 (4.0)	Secondary care outpatient	RMT	Control	9
Sewell 2005 UK[152]	180	68.3 (8.6)	62	NR	PR programme	Individually targeted exercise programme	General exercise training	7
Sewell 2006 UK[153]	100	70.1 (8.0)	56	NR	PR programme	7-week PR	4-week PR	26
Seymour 2010 UK[154]	60	66.0 (10.0)	55	52.0 (17.1)	Secondary care inpatient	Post-exacerbations pulmonary rehabilitation	UC	13

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	Y	Y	N	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	Y	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	Y	N	N	N	N	Y	Y	Y	Y	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
N	N	Y	N	N	N	Y	Y	N	N	Y
Y	Y	N	Y	N	N	N	N	Y	Y	N
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	Y	Y	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	Y	Y	N	N	N	Y	Y	N	Y	N

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Shao 2003 China[202]	38	63.4 (5.1)	85	NR	Secondary care	Rehabilitation (behavioural intervention)	Control	52
Simpson 1992 USA[135]	34	71.5 (7.6)	54	38.0	Secondary care outpatient	Weight training	Control	8
Singh 2003 India[241]	40	59.4 (6.4)	80	27.0 (7.3)	NR	PR	Control	4
Sívori 1998 Argentina[263]	28	64.6 (9.33)	NR	36.1 (14.6)	Secondary care outpatient	Upper limb and lower limb training	Lower limb training	8
Smith 1999 Australia[168]	96	69.9 (8.3)	62	NR	Secondary care	Home nurse	Control	52
Soler 2006 Spain[180]	26	73.5 (8.1)	NR	42.8 (15.7)	Secondary care	Education and monitoring programme	UC	52
Solomon 1998, Gourley 1998 USA[136,285]	98	69.3 (7.9)	100	NR	Secondary care	Pharmaceutical care	Conventional care	26
Spencer 2010 Australia[169]	59	66.4 (8.0)	46	56.9 (19.5)	PR programme	Supervised out-patient exercise (plus PR)	Unsupervised home-based exercise (plus PR)	52
Spruit 2002 Belgium[247]	48	63.5 (7.6)	87	38.0 (17.0)	Secondary care outpatient	Endurance training	Resistance training	12
Sridhar 2008 UK[155]	122	69.8 (10.0)	49	42.0 (16.3)	Secondary care outpatient	Nurse-led intermediate care programme	Control	104
Stulbarg 2002, Carrieri-Kohlman 2005, Davis 2006 USA[137,394,395]	115	66.0 (8.0)	55	44.8 (14.0)	Mixed	(a) Dyspnoea SM programme with 24 training sessions; and (b) dyspnoea SM programme with four training sessions	Dyspnoea SM programme	52
Subin 2010 India[242]	30	58.7 (8.4)	NR	41.7 (9.5)	Secondary care	Upper and lower limb training	Upper limb training	4
Theander 2009 Sweden[220]	30	64.9 (2.0)	50	33.6 (8.7)	Secondary care outpatient	PR	Control	12
Toshima 1990, Ries 1995 USA[138,276]	129	62.6 (7.2)	74	52.0	Secondary care	PR	Control	26, 312
Trappenburg 2011 The Netherlands[188]	233	65.7 (10.8)	69	55.7 (21.0)	Primary and secondary care	Individualised action plan	UC	26
Troosters 2000 Belgium[248]	100	61.5 (8.1)	87	42.0 (14.0)	Secondary care outpatient	Training programme	Control	78
Van Gestel 2012 Germany[208]	43	66.1 (6.4)	43	45.9 (17.4)	Secondary care outpatient	Respiratory biofeedback training	Control	4
Vogiatzis 2002 Greece[265]	45	68.0 (2.0)	83	45.0 (4.0)	Secondary care outpatient	Interval training	Continuous training	13
Vonbank 2012 Austria[246]	43	60.2 (6.5)	69	55.8 (16.4)	Secondary care outpatient	(a) Strength and endurance training; and (b) endurance training	Strength training	12
Wadell 2004 Sweden[221]	30	66.1 (8.1)	30	54.6 (11.5)	Secondary care outpatient	a) Water physical aerobic training; and (b) land physical aerobic training	Control	12
Wakabayashi 2011 Japan[262]	102	71.7 (7.6)	86	60.3 (21.0)	Secondary care outpatient	Integrated care	UC	52

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	N	N	N	Y	Y	N	N	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	Y	N	N	N	N	Y	N	Y	N	Y
Y	Y	N	Y	N	N	N	Y	Y	Y	Y
Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
Y	Y	N	N	N	N	N	N	Y	Y	Y
Y	Y	Y	N	Y	Y	Y	Y	N	Y	N
Y	N	N	N	N	N	Y	N	N	N	N
Y	Y	N	Y	N	N	N	Y	Y	Y	Y
Y	N	N	N	N	N	Y	Y	Y	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	N
Y	Y	N	N	N	Y	Y	Y	N	Y	Y
Y	Y	Y	N	Y	Y	N	N	Y	Y	N
Y	N	N	Y	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	Y	N

Author, year, setting	Sample size	Age, mean (SD)	Males%	FEV_1% (SD)	Recruited from	Intervention details	Control details	Follow-up (weeks)
Wang 2004 China[203]	100	NR	87	NR	Secondary care	Resistance breathing exercises	Breathing exercises	13
Warlies 2006 Germany[209]	60	63.3	67	NR	Secondary care	Education	UC	26
Waterhouse 2010 UK[277]	240	68.9 (7.9)	52	46.8 (18.0)	Mixed	Hospital rehabilitation	Community rehabilitation	78
Watson 1997 New Zealand[231]	69	67.5 (9.0)	65	37.5 (15.0)	Primary care	SM plan	Control	26
Wedzicha 1998 UK[157]	126	70.5 (7.0)	51	37.3 (13.1)	Secondary care outpatient	PR	Control	8
Weekes 2009 UK[158]	66	69.1	51	31.75 (13.7)	Secondary care outpatient	Dietary counselling and food fortification	Control	52
White 2002 UK[159]	103	67.0 (9.0)	69	26.9 (7.8)	Secondary care outpatient	PR	Brief advice	13
Wijkstra 1994 The Netherlands[189]	45	63.3 (5.0)	91	44.4 (10.4)	NR	Home rehabilitation	Control	12
Wijkstra 1995 The Netherlands[190]	45	62.7 (5.0)	83	43.8 (10.8)	PR programme	(a) Rehabilitation with weekly visits to a physiotherapist; and (b) rehabilitation with monthly visits to a physiotherapist	Control	78
Wittmann 2007 Germany[210]	212	53.9 (6.9)	80	NR	Secondary care	PR plus education	PR	52
Wong 2005 China[74]	60	73.6 (7.8)	78	NR	Secondary care inpatient	Nurse-initiated telephone follow-up	UC	13
Wood-Baker 2006 Australia[170]	139	70.0 (8.1)	84	45.0 (16.0)	Primary care	Action plan	UC	52
Wright 2003 Germany[211]	28	55.7 (6.9)	43	55.9 (12.8)	NR	Resistance training	Control	12
Xu 2010 China[204]	80	57.1 (7.6)	53	NR	Secondary care	(a) Integrative rehabilitation (traditional and modern); (b) modern rehabilitation; and (c) traditional rehabilitation	UC	52
Yamaguti 2012 Brazil[235]	30	66.5 (22.6)	73	42.9 (52.9)	Secondary care	Diaphragmatic breathing	Control	4
Yeh 2010 USA[139]	10	65.5 (6.0)	60	50.0 (7.0)	Secondary care	T'ai chi plus UC	UC	12
Zhang 2008 China[205]	60	69.5 (3.3)	85	NR	Secondary care	(a) PR plus PLB; and (b) PR	Control	8

n/a, not applicable; NR, not reported; PLB, pursed lip breathing.

QoL	Hospital (re) admissions	Exacerbations	Mortality	Anxiety	Depression	Exercise capacity	Lung function	Health service utilisation	ED visits	Dyspnoea
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	N	N	N	N	N
Y	N	N	N	N	N	Y	N	Y	N	N
Y	N	N	N	N	N	N	Y	Y	N	N
Y	N	N	N	N	Y	Y	Y	N	N	N
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	Y	Y	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	N
Y	Y	N	N	N	N	Y	Y	N	N	N
N	Y	N	N	N	N	N	N	Y	N	N
Y	Y	N	N	N	N	Y	Y	Y	Y	N
Y	N	N	N	N	N	Y	Y	N	N	N
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y
Y	N	N	N	N	N	Y	Y	N	N	Y
Y	N	N	N	N	N	Y	N	N	N	Y

Appendix 23 Characteristics of interventions of studies included in review 4

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Aimonino Ricauda 2008[75]	Hospital at home – multidimensional geriatric assessment, patient and carer education	8	Inpatient control – routine hospital care	0	2	Individual
Arnardottir 2006[216]	Mixed exercise training – endurance training: 30 minutes, 2× per week with either resistance: 30 minutes, 1× per week; or calisthenics: 15 minutes 1× per week plus relaxation: 15 minutes, 1× per week	2	Resistance training: 30 minutes and calisthenics: 15 minutes with relaxation: 15 minutes	2	8	Group
Arnardottir 2007[217]	Interval training: 90 minutes, 2× per week	2	Continuous training: 90 minutes, 2× per week	2	16	Group
Barakat 2008[249]	PR – exercise and education: 1 hour, 3× per week	3	UC	0	14	Group
Bauldoff 2002[108]	Music as a form of distractive auditory stimulation to accompany home walking programme: 20–45 minutes, 2–5× per week	2	Control	1	8	Individual
Bauldoff 2005[109]	(1) Moderate tempo distractive auditory stimulation with upper extremity training: 15 minutes 2–3× per week plus warm-up; (2) slow tempo distractive auditory stimulation: 15 minutes, 2–3× per week plus warm-up	1	Attention control	1	4	Individual
Beckerman 2005[253]	IMT using threshold device: 15 minutes 2× per day, 6 days per week, gradual increase in load; training in centre for 1 month then home with daily telephone call and weekly visit by respiratory therapist	1	Sham training, as intervention group with very low load	1	52	Unclear
Behnke 2000, Behnke 2003[64,65]	Ten-day inpatient walking training programme and breathing exercise; then walking training at home: 3× per day, with fortnightly supervision for 3 months	3	Control – advised to do exercise, without specific instructions	2	26	Individual
Bendstrup 1997[222]	PR: group exercise supervised by physiotherapist 1 hour, 3× per week; 12 educational sessions and 2× occupational therapy sessions	9	Control – UC, waiting list until follow-up	0	12	Group
Bernard 1999[191]	Aerobic and strength training: aerobic – 30 minutes, 3× per week; strength – 45 minutes, 3× per week	1	Aerobic training: 30 minutes, 3× per week plus 45 minutes' relaxation and breathing	4	12	Group
Berry 2010[110]	Behavioural lifestyle activity programme to promote physical activity: centre-based exercise programme 1 hour, 3× per week (reducing in frequency) plus fortnightly educational classes plus discussion about self-regulation and maintenance of exercise, individual counselling and telephone support	3	Exercise programme 1 hour 3× per week plus fortnightly educational classes for 3 months	2	48	Mixed

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Bestall 2003[141]	Exercise and education group programme: 2× per week	11	Education programme: 2× per week	10	8	Group
Bjornshave 2005[223]	Middle-intensity home-based exercise training (steps and walking): 30 minutes, 5× per week	1	Low-intensity home-based exercise: 30 minutes 2× per week	1	4	Unclear
Blake Jr 1990[111]	Psychosocial intervention (stress management strategies – relaxation, guided imagery, breathing exercises): one session of 60–90 minutes Individualised plan developed, audiotape and reading material provided At least 1 telephone contact and 2× follow-up visits, 2–4 weeks apart	5	Control	0	8	Individual
Bonilha 2009[232]	Singing group class with physiotherapist and singing teacher, 1 hour per week (5 minutes' relaxation, 10 minutes' related respiratory exercise, 15 minutes' vocalisation exercises and 30 minutes' singing training)	4	Physiotherapy and handcraft classes, 1× per week (5 minutes' relaxation and 50 minutes' exercises)	2	24	Group
Bourbeau 2003, Bourbeau 2006, Gadoury 2005[192,270,271]	Living Well with COPD programme: 8 × 1-hour home visits by health professional who was case manager	12	UC	0	8	Individual
Boxall 2005[160]	Home-based PR programme: graduated exercise programme 1× per day; physiotherapist visits 1× per week for 6 weeks, then 1× per 2 weeks; education by physiotherapist, nurse and occupational therapy staff Around six education sessions and 11 home visits in total	8	UC	0	12	Individual
Breyer 2010[245]	Initial 2-hour instruction then supervised outdoor Nordic walking 1 hour, 3× per week; educational session 1× per week	7	One educational session per week	6	13	Group
Brooks 2002[193]	Group discussion about home programme and exercise sessions 2 hours per month led by physical therapist; telephone support from physical therapist 1× per month	5	Visit to physical therapist every 3 months to discuss home programme	4	52	Mixed

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Bucknall 2012[63]	Supported self-management – nurse visits: 4 × 40 minutes for 2 months then every 6 months	6	UC	0	52	Individual
Busch 1988[194]	Home exercise programme: endurance and resistance exercise 5× per week, fortnightly visit by physiotherapist	2	No home exercise, but visits by physiotherapist every 3 weeks to monitor activity level	0	18	Individual
Cai 2006[199]	Education – disease and disease management	6	Control	0	26	Group
Carr 2009[195]	9–15 × 2-hour PR-type sessions in 3 weeks (inpatient or outpatient setting)	6	UC	6	3	Mixed
Casas 2006, Garcia-Aymerich 2007[71,72]	Integrated care – comprehensive assessment of patients at discharge; SM education programme by specialised respiratory nurse: 2 hours before discharge, with reinforcement sessions via telephone: 1× per week for 1 month; individually tailored care plan; access to specialised nurse through ICT platform including a web-based call centre	10	UC: scheduled visits from physician usually every 6 months	0	–	Individual
Chan 2010, Chan 2011[212,272]	(1) T'ai chi qigong – 13 movements of breathing regulating led by a qualified t'ai chi qigong master: 60 minutes, 2× per week; patients advised to practise exercises for 1 hour daily, DVD and pictures given;	4	Control – usual activities (arranged to join community activities to ensure consistent attendance)	0	13	Group
	(2) exercise – PLB and diaphragmatic breathing; advised to perform breathing and walking: 1 hour per day; leaflets with instructions/pictures given (arranged to join community activities to ensure consistent attendance)	3				
Cockcroft 1987[142]	Respiratory health worker home visit (health education and support): approximately 1× per month	3	Control	0	–	Individual
Coultas 2005[112]	Nurse-assisted management: 2 × 4-hour sessions		UC	1	26	Mixed
	(1) nurse-assisted collaborative management including self-management skills: additional 8 hours;	5				
	(2) nurse-assisted medical management	5				

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Covey 2001[113]	IMT with loaded threshold device at home: 30 minutes per day, 5 days per week; home visit by nurse 1× per week	1	Education programme: nurse visit 1–1.5 hours every 2 weeks	6	16	Individual
de Blok 2006[181]	PR plus lifestyle physical activity counselling programme with feedback (pedometer) Physical therapist-led individual exercise counselling sessions, 30 minutes pre-week 1, week 1 and week 5 of programme	3	PR	3	9	Mixed
Dheda 2004[73]	Regular outpatient follow-up, post discharge – review of inhaler technique/medications, smoking cessation advice, exercise and nutrition advice, introduction to a support group: ≤ 4 × over 6 months	6	Control – primary care follow-up, post discharge: visits made to primary care teams on need to basis	0	26	Unclear
Donesky-Cuenco 2009[114]	Yoga training – 24 × 1-hour sessions	4	UC	1	12	Mixed
Dourado 2009[233]	(1) Strength training and low intensity general exercise: 31 × hour sessions over 3 weeks; (2) low-intensity general exercise training: 31 × hour sessions over 3 weeks	2 2	Strength training programme: 3 × 1-hour sessions over 3 weeks	1	12	Individual
du Moulin 2009[206]	Outpatient PR programme 6 hours per day, 5 days per week Plus maintenance walking and 4-weekly telephone call for motivation	7	Outpatient PR programme: 6 hours per day, 5 days per week	6	3	Remote
Eaton 2009[227]	Inpatient PR with COPD nurse, plus exercise 30 minutes per day Outpatient visit 1 hour, 2× per week	11	Review by COPD nurse standardised care including advice	1	8	Mixed
Effing 2009, Effing 2011[161,278]	Four weekly 2-hour SM sessions with training in self-management exacerbation (respiratory nurse and physiotherapist)	11	Four weekly 2-hour SM sessions without training in SM exacerbation (respiratory nurse and physiotherapist)	11	7	Group

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Efraimsson 2008[218]	Self-care education with motivational interviewing from primary care nurse 2 routine consultations 3–5 months apart, plus two additional nurse sessions	13	Two routine consultations 3–5 months apart	0	13	Individual
Egan 2002[69]	Case manager assessment, education and review: on admission, during hospitalisation and 1 and 6 weeks post discharge	5	UC	0	6	Individual
Elci 2008[236]	PR 1 × 30 minutes session with nurse, then home rehabilitation: 20 minutes exercise 2× per day, 5 days per week. 24 sessions up to 90 minutes	7	UC plus instructions on use of respiratory medicines	0	13	Remote
Elliott 2004[162]	(1) Hospital rehabilitation: group circuit training and aerobic exercise, 1.5 hours, 2× per week for 3 months plus home (unsupervised circuit and aerobic), 1.5 hours, 2× per week for 9 months;	3	Community PR: 1.5 hours, 2× per week (low-intensity group exercise)	3	52	Mixed
	(2) hospital rehabilitation, 1.5 hours, 2× per week for 3 months plus 9 months community, 1.5 hours, 2× per week	3				
Emery 1998[115]	(1) Exercise, education and stress management: 37 exercise sessions, 16 educational lectures, 10 stress management classes; 4 hours per day for 5 weeks, then 3× per week for 5 weeks;	4	Waiting list control	0	10	Group
	(2) education and stress management: 16 educational lectures, 10 stress management classes	3				
Engstrom 1999[219]	Exercise training sessions at hospital: 45 minutes 2× per week for 6 weeks, weekly for 6 weeks, fortnightly for 6 weeks then monthly; educational sessions 2× as group, others individualised	7	Usual outpatient care	0	52	Mixed
Fernandez 2009[171]	Hospital based rehabilitation (physiotherapist): 21 × hour sessions; four home visits over 2 months for 1 hour; one home visit/month for 9 months (physiotherapist)	7	UC plus three sessions of respiratory education	3	52	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Finnerty 2001[143]	PR: 2 hours 2× per week for 6 weeks plus invitation to patient support group and encouragement to exercise at home a minimum of 5× per week	7	Control: outpatient department at 3-monthly intervals	0	6	Group
Foy 2001[116]	Long-term exercise therapy: 1 hour 3× per week	1	Short-term exercise therapy: 1 hour 3× per week for 3 months	1	78	Unclear
Gallefoss 1999, Gallefoss 2000, Gallefoss 2002, Gallefoss 2004[255,280,281,391]	Educational intervention: booklet plus multidisciplinary group education, 2 × 2 hours, individual treatment plan, 1 or 2 individual nurse and/or physiotherapist sessions	10	Follow-up by GP	0	–	Mixed
Ghanem 2010[264]	Healthy lifestyle lectures and 4× one-to-one education sessions including exercise instruction Post discharge: Home-based exercise training (RMT, endurance and strength) alternate days with outpatient department supervision every 2 weeks	7	Standard medical therapy	0	8	Individual
Gilmore 2010[117]	Factorial design (1) COPD educational SM booklet; (2) standardised home visit, including disease management, safe home environment and family support	7 4	Control	3	–	Individual
Gohl 2006[207]	Rehabilitation/training programme – fitness studios for strength training and home training mainly on bicycle; practical and theoretical training under guidance from a trainer 90 minutes, 1× per week Mean training time between 2.4 (first phase) and 4.2 hours per week (last phase) Total training time 166 hours on average per person	2	Medication according to guidelines only	0	52	Group
Goldstein 1994, Goldstein 1997, Guyatt 1999[196,392,393]	Inpatient programme for 2 months: exercise, education and relaxation; 4 month graduated discharge programme with outpatient rehabilitation, home rehabilitation, home visits from physiotherapist weekly for 1 month, fortnightly for 1 month and then monthly	4	Conventional community care from GP and respiratory specialist	0	24	Mixed

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Green 2001[144]	PR – 14 education sessions from a range of health-care professionals; exercise, 2× per week	2	PR – education from a range of health-care professionals; exercise: 4 weeks	2	7	Group
Güell 2000[172]	Outpatient rehabilitation: Months 1–3: 30 minutes 2× per week breathing retraining Months 4–6: 30 minutes 5× per week supervised exercise for 3 months Months 7–12: Weekly supervised breathing exercises and home exercise	5	UC	0	26	Group
Güell 2006[173]	PR: relaxation, breathing retraining, postural drainage strategies 2 months, 2 × 30 minutes/week. 4 × 45- to 60-minute educational sessions Exercise training, 5 × 30-minutes sessions weekly on cycle ergometer further 2 months	6	UC	0	16	Group
Guyatt 1992[118]	Intervention 1: IMT with inspiratory resistance device and nose clip Intervention 2: IMT with inspiratory resistance device All groups: Used device 10 minutes 5× per day, 20 minutes training by nurse at start and 1× per week for 4 weeks, then fortnightly 4× to 3 months then monthly to 6 months	2	Control 1: sham training of devise with minimal resistance plus nose clip and diaphragmatic breathing Control 2: sham training of devise with minimal resistance and diaphragmatic breathing; same regime as intervention groups	2	26	Individual
Hermiz 2002[67]	Community nurse home visits for SM advice: 2 visits at 1 and 4 weeks post discharge	7	UC	0	4	Individual
Hernandez 2000[282]	Home-based exercise training: 20 minutes' distance shuttle walking externally paced with tape recording, 1 hour per day, 6 days per week, with hospital visit every 2 weeks	2	Hospital visits every 2 weeks for clinical supervision	0	12	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Hernandez 2003[68]	Assessed by specialist team in emergency room, immediate or early discharge with specialist nurse home assessment and further visits (maximum four) or telephone support; structured assessment by nurse including knowledge of disease and compliance with treatment	10	UC – admission or discharge without specialist nurse support	0	8	Individual
Hill 2006[163]	IMT with threshold loading device: supervised sessions, 21 minutes 3× per week	1	Sham training with 10% loading: supervised sessions, 21 minutes 3× per week	1	8	Unclear
Holland 2004[164]	Upper limb: 15 minutes' weighted exercises plus lower limb training: 30 minutes' walking/cycling	1	Lower limb: 30 minutes walking/cycling plus sham upper limb training	1	6	Group
Hoogendoorn 2009, Van Wetering 2010, Hoogendoorn 2010[182,273,274]	Supervised interdisciplinary rehabilitation (physiotherapist, nurse and dietitian), 30 minutes, 2 × per week plus 20 minutes' active maintenance (physiotherapy) programme with one visit per month	4	Usual care: pharmacology according to guidelines and short smoking cessation advice	2	104	Mixed
Hospes 2009[183]	Pedometer-based exercise counselling strategy, 5 × 30-minute individually tailored sessions Exercise counsellor	1	UC	0	12	Individual
Hsiao 2003[259]	(1) Targeted resistive IMT: 15 minutes, 2 × per day, 5 × per week; (2) pressure threshold IMT device: 15 minutes, 2 × per day, 5 × per week Both groups wore nose clips, training intensity set to 50% of each patient's maximal inspiratory pressure and adjusted as necessary every 2 weeks	3 3	Control	2	8	Individual
Hynninen 2010[256]	Cognitive–behavioural therapy – psychoeducation/ awareness; relaxation; cognitive therapy; behavioural activation; fear-based exposure; sleep management skills: 2 hours, 1× per week	3	UC plus telephone contact with study personnel for assessment, monitoring and giving basic information: 5–10 minutes, 1× per 2 weeks	1	7	Group
Janaudis-Ferreira 2011[197]	Supervised resistance arm training program 3 × per week; endurance exercise training, breathing exercises, relaxation and SM education	4	Sham training: Upper limb flexibility and stretching 3× per week Endurance exercise training, breathing exercises, relaxation and SM education	1	6	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Jang 2006[267]	PR – education: approximately 1 hour per week; breathing retraining and exercise training: approximately 1 hour per week, relaxation and counselling: 20 minutes per week	6	Control – education	1	8	Group
Jarab 2012[266]	Pharmacist intervention at outpatient department: education about COPD and its management, motivational interviewing to increase adherence to treatment	5	Usual outpatient department care	0	1	Individual
Karapolat 2007[237]	Hospital outpatient-based PR: education, aerobic and resistance exercise, 16 sessions	8	No rehabilitation	0	8	Group
Katiyar 2006[240]	Pranayama – six exercises (Bhastika, Kapalabhati, Vhasya, Anulom Vilom, Bhramid, Udgeeth): at least 30 minutes, 1× per day, 6× per week	2	Usual physical activity	0	13	Unclear
Kayahan 2006[238]	Rehabilitation: education, relaxation, bronchial hygiene, breathing retraining, exercise, 2.5 hours per week, 3 days per week	7	UC	0	8	Group
Khdour 2009, Khdour 2011[251,279]	Structured individually tailored education session, 1 hour from pharmacist; medication, inhaler technique, symptoms management, exercise, action plan. Reinforced at 6-month outpatient visit, and telephone at 3 and 9 months	10	UC	0	1	Mixed
Kim 1993[119]	IMT	1	Sham training with light pressure load	1	26	Individual
Ko 2011[213]	Early PR: 2 hours 3× per week; 20 minutes' home exercise recommended daily	6	UC: one consultation with nurse specialist and recommendation to walk and stretch daily	4	8	Group
Koff 2009[120]	Proactive integrated care (disease-specific education, teaching SM, enhanced communication, remote home monitoring) Respiratory therapist	6	UC	0	13	Remote
Koppers 2006[184]	Respiratory muscle endurance training using tube: home-based, 15 minutes 2× per day, daily for 5 weeks plus weekly clinic visits to monitor training	1	Sham training: home-based 15 minutes 2× per day, daily for 5 weeks plus weekly visits to monitor training	1	5	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Kunik 2008[121]	Cognitive–behavioural therapy group treatment: 8 × 1 hour	1	COPD education	8	8	Group
Kwok 2004[70]	Trained community nurse – visit patients to provide health counselling (drug and nutrition advice, inhaler technique): before discharge; home visit to review patient, health counselling (including drug and diet regime, home modifications, encourage physical exercise), psychological support: weekly home visits for 4 weeks then monthly for 6 months	8	Control – followed up by same geriatricians/ respiratory physicians involved in intervention group Physicians occasionally referred patients to community nurse, not more than once	0	26	Individual
Lamers 2010[185]	Two to ten (average four) nurse contacts at home including cognitive–behavioural therapy and SM	3	UC according to guidelines of Dutch College of General Practitioners	0	13	Individual
Larson 1988[122]	IMT (30% load) using nose clip: 15 minutes per day for 1 week, then gradually 30 minutes per day for 7 weeks	1	IMT (15% load) using nose clip: 15 minutes per day for 1 week, then gradually 30 minutes per day for 7 weeks	1	8	Unclear
Larson 1999[123]	(1) IMT with threshold loaded device: 30 minutes per day, 5× per week with weekly nurse home visit;	2	Health education: nurse home visits, 1 hour every 2 weeks for 16 weeks	1	17	Individual
	(2) cycle ergometry (interval) at home 20 minutes per day, 5× per week with weekly nurse home visit;	2				
	(3) IMT and cycle ergometry	3				
Lee 2002[66]	Care protocol for community nurses who followed up patients for 6 months	5	No care protocol after discharge to nursing home	0	26	Individual
Leung 2010[165]	Supervised indoor walking: 30–45 minutes, 3× per week	1	30–45 minutes' supervised indoor cycling 3× per week	1	8	Group
Li 2002[200]	Nutritional support; PLB and abdominal breathing: 10–15 minutes, 2× per day	2	UC (normal food and exercise)	1	13	Mixed
Liddell 2010[145]	PR (twice weekly) – supervised, individually prescribed endurance walking: 1 hour; instructions to exercise at home: ≤ 3× per week; education on managing disease delivered by multidisciplinary health professionals team: 1 hour	6	PR (once weekly) – supervised, individually prescribed endurance walking: 1 hour; instructions to exercise at home: ≤ 3× per week; education on managing disease delivered by multidisciplinary health professionals team: 1 hour	7	8	Mixed
Lindsay 2005[214]	Tiotropium plus PR – psychoeducation on knowledge of SM, motivation to exercise, psychological support: 6 weekly sessions of 2 hours	8	Tiotropium	0	13	Group

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Linneberg 2012[224]	Post 7-week comprehensive PR programme: six supervised exercise sessions at weeks 9, 11, 13, 18, 26 and 52 (from start of PR)	6	No supervised exercise sessions	6	45	Group
Littlejohns 1991[146]	Respiratory health worker – health education directed at the patient and primary care team, monitoring of treatment compliance and optimising treatment, ensuring correct inhaler technique and supervision of domiciliary oxygen, monitoring spirometry results to detect and treat exacerbations and worsening heart failure early and liaison between GP- and hospital-based services	5	UC	0	52	Individual
Liu 2008[260]	Home-based endurance exercise programme with walking tempo controlled by cell phone music: daily walking at set pace until unable to keep it up Monthly hospital visits × 3 to reset walking pace with telephone support if missed daily exercise Three-monthly clinics for 9 months Home rehabilitation programme booklet and DVD	4	Home rehabilitation programme booklet and DVD including instructions for home walking	3	52	Individual
Livermore 2010[166]	4× 1-hour sessions of cognitive–behavioural therapy	3	UC	0	4	Individual
Lord 2010[147]	30 minutes' session on breathing techniques from respiratory physiotherapists: 2× per week singing group	5	30 minute session on breathing techniques from respiratory physiotherapists	2	6	Group
Madariaga 2007[174]	Daily IMT, 15 minutes, 2× per day; increased resistance weekly to maximum tolerated load:		IMT device at minimum load, 15 minutes, 2 × per day	0	6	Individual
	intervention 1: IMT with threshold device;	1				
	intervention 2: IMT with resistive device	1				
Mador 2004[126]	Endurance training: 3× per week plus education 1 hour per week	2	Combined training – endurance exercise 3× per week; education 1 hour per week; strength 3× per week	2	8	Group
Mador 2005[125]	Combined training (calisthenics, endurance training plus hyperpnea training) 15–20 minutes per day, 3 days per week plus weekly 1-hour educational class	3	Endurance training included calisthenics with and without weights, plus weekly 1-hour educational class	2	8	Group

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Mador 2009[124]	Continuous steady-paced exercise training: 3× per week; weekly 1-hour education	2	Interval exercise training: 3× per week; weekly 1-hour education	2	8	Individual
Magadle 2007[254]	General exercise reconditioning programme plus IMT with resistive device delivered in community setting by respiratory therapist: 1 hour 3× per week	2	General exercise reconditioning programme plus IMT with resistive device set to level to provide 'sham' training: 1 hour 3× per week	1	26	Group
Maltais 2008[198]	Group-based educational programme: 2× per week for 4 weeks followed by home exercise programme: 3× per week for 8 weeks Introductory home visit at start and weekly telephone calls from exercise trainer	3	Group-based educational programme: 2× per week for 4 weeks followed by outpatient exercise programme (strength and aerobic) at hospital: 2× per week for 8 weeks	3	12	Mixed
Man 2004[148]	Community-based PR: 2 × 2 hours per week	6	UC	0	8	Group
Martin 2004[228]	Action plan agreed at one consultation with respiratory nurse, reinforcement by home visits from research nurse at 3, 6 and 12 months	2	Visits from research nurse at start, 3, 6 and 12 months for 'routine support'	0	52	Individual
McGeoch 2006[229]	Education on use of SM (action plan): early recognition of exacerbations and range of self-initiated interventions Individual 1-hour session practice nurse or respiratory educator	1	UC	6	1	Individual
Monninkhof 2003, Monninkhof 2004[186,300]	SM education course and fitness programme: Education: 5 × 2 hours; exercise: 2 × 1 hour per week	10	UC from chest physician	1	52	Group
Moore 2009[284]	Video multidisciplinary education (19 minutes) about benefits of exercise watched with physiotherapy Home exercise video programme: 30 minutes, 4× per week Also given educational booklet	8	Educational booklet only	8	6	Individual
Mota 2007[175]	EMT using expiratory threshold device under supervision of respiratory physiotherapist: 30 minutes 3× per week	3	Sham training: using expiratory threshold device under supervision of respiratory physiotherapist: 30 minutes, 3× per week	3	5	Unclear

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Mularski 2009[127]	MBBT – self-administered MBBT practice: body scan meditations, sitting and walking mindfulness, mindful movements including pleasant and unpleasant events and reactions to stress: 1× per week, plus practice at home	1	Support group control – group sessions, semistructured conversations about COPD: 1× per week	3	8	Group
Murphy 2005[252]	Twelve physiotherapists supervised exercise sessions – aerobic and upper limb strengthening: 30–40 minutes plus 15 minutes' unsupervised exercise on other days, 2× per week in home	1	UC	0	6	Individual
Nakamura 2008[261]	(1) Aerobic exercise 20 minutes' walking, 3× per week plus 60 minutes' strength training, relaxation and breathing;	4	Control: no exercise programme	0	12	Group
	(2) aerobic exercise 20 minutes walking 3× per week plus 60 minutes' recreational activities to improve balance, coordination and agility	1				
Ng 2011[215]	Health qigong: 12 PR sessions, with four consisting of 45 minutes' qigong	5	Control	4	–	Unclear
Nguyen 2008[128]	Dyspnoea SM programme; 1.5- to 2-hour consultation, independent daily exercise: 30 minutes, 14 contacts weekly 1 month, then fortnightly; six group sessions, 1 hour duration	6	Internet-based dyspnoea SM	6	26	Mixed
Nguyen 2009[129]	MOBILE-coached: individualised exercise plan and generic exacerbation with action plan and nurse; 150 minutes of moderate-intensity exercise with daily monitoring and weekly feedback	4	MOBILE-self monitored: individualised exercise plan and generic exacerbation with action plan and nurse; 150 minutes of moderate-intensity exercise	4	26	Remote
Nield 2007[130]	Breathing training at baseline, daily practice sessions, 4× per week with clinic visits for reinforcement:		Control	0	4	Individual
	(1) PLB; (2) EMT	1, 1				
Ninot 2011[250]	Two hours, 2× per week of group education and exercise	7	Usual primary care	1	4	Group
Normandin 2002[131]	Comprehensive PR, including high-intensity endurance exercise: 30 minutes, 3 hours 2× per week	2	Comprehensive PR, including low-intensity calisthenics: 30 minutes, 3 hours, 2× per week	2	8	Group

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Norweg 2005[132]	(1) Exercise training plus activity training (dyspnoea management): 15 MBBT 1-hour exercise sessions plus home exercise for 20 minutes 2–3× per week; activity training 6 × 1 hour;	2	Exercise training: 15 × 1-hour exercise sessions plus home exercise for 20 minutes, 2–3× per week	1	10	Group
	(2) exercise training plus lectures (lifestyle, stress, nutrition, relaxation): 15 × 1-hour exercise sessions plus home exercise for 20 minutes 2–3× per week	6				
	Lectures: 6 × 45 minutes					
Oh 2003[284]	Home-based PR: IMT, aerobic, resistance exercise and stretching; relaxation: 5× per day; two nurse telephone calls per week; relaxation 2× per day	11	Individual education session and booklet	7	8	Individual
O'Neill 2007[150]	PR: supervised exercise session 2× per week plus one unsupervised home session	2	PR: supervised exercise session 1× per week plus two unsupervised home sessions	2	6	Group
Ortega 2002[176]	(1) Strength and endurance training: 1 hour, 3× per week;	1	Strength training: 1 hour 3× per week	1	12	Unclear
	(2) endurance training: 1 hour 3× per week	1				
O'Shea 2007[167]	Resistance exercise programme with elasticated bands: sessions 3× per week (one hospital, two at home)	1	UC	0	12	Mixed
Ozdemir 2010[239]	Water-based PR: 35 minutes, 3× per week for 12 sessions	1	Usual medical therapy	0	4	Group
Paz-Diaz 2007[269]	PR – breathing and exercise: 3 days per week	2	Optimal care according to ATS guidance with physician visit every 3 weeks	1	8	Group
Petersen 2008[225]	Multimodal exercise training programme 2× per week for 14 sessions plus home walking	5	UC	4	7	Mixed
Petty 2006[133]	(1) Tailored video – education and exercises prescribed (type, dose, repetitions, frequency) by physician or pulmonologist from a library of segments;	2	No video	0	8	Individual
	(2) standard video – 2 tapes on PR exercise and education	2				
Pomidori 2012[243]	Externally paced speed walking with metronome: 20–30 minutes per day , 4× per week; supervision by exercise therapist, 1× per week for 1 month, then fortnightly telephone support	2	Walking (known distance, fixed time): supervision by exercise therapist, 1× per week for 1 month, then fortnightly telephone support	1	52	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Prince 1989[151]	Rehabilitation – education, smoking cessation, diaphragmatic breathing, relaxation and exercise plan: 2 hours, 2× per week	6	Outpatient attendance: informal, patient-led sessions: 1 hour, 2× per week	1	6	Group
Probst 2011[234]	High-intensity endurance and strength training: 1 hour, 3× per week	1	Low-intensity calisthenics and breathing: 1 hour, 3× per week	2	12	Group
Puente-Maestu 2000, Puente-Maestu 2003[177,275]	Supervised exercise – treadmill exercise supervised by physiotherapist: 1 hour, 4× per week	3	Self-monitored exercise: walking 3–4 km for 1 hour 4× per week plus clinic visits 1× per week	3	8	Unclear
Puhan 2006[257]	Inpatient PR: 12–15 sessions over 3 weeks plus high-intensity continuous exercise, target workload 70% plus followed by home exercise, 20 minutes per day Physical therapy led	4	Inpatient PR: 12–15 sessions over 3 weeks plus high-intensity (50%) and low-intensity (10%) interval exercise training 20 minutes per day followed by home exercise 20 minutes per day Physical therapy led	4	5	Mixed
Rea 2004[230]	Chronic disease management programme by GP and practice nurse, care plan, assessment by respiratory physician and nurse, offer of PR, flu immunisation, 3-monthly follow-up in primary care	7	Assessment by GP and practice nurse who had guidelines for COPD management and access to PR	0	52	Individual
Regiane Resqueti 2007[178]	Home-based PR: 3 × 1 hour individualised education and physical therapy; 3 × hospital exercise training; with weekly visit and telephone call by therapist for 7 weeks; home exercise for 1.5 hours, 5× per week, plus monthly telephone for 4 months	6	3 × hour individualised education and physical therapy	4	26	Individual
Ren 2011[201]	(1) PR strategy group 1: aerobic exercise training with PLB and abdominal breathing; education: 20 minutes, 5× per week; (2) PR strategy group 2 – strategy 1 plus upper and lower limb training	2 1	Control: PR education, 2× per month	0	20	Group
Rice 2010[140]	1 × 1.5 hours' group education session, individual action plan with rescue medications; monthly telephone support from case manager; telephone number of 24-hour nursing helpline	8	Leaflet with summary of COPD care and telephone number of 24-hour nursing helpline	2	52	Mixed

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Riera 2001[179]	IMT with flow meter device: home training 30 minutes per day, 6× per week with monitoring every 6 weeks	2	Sham training with no load	2	26	Individual
Ringbaek 2000[226]	PR – education and exercise: 2 hours 2× per week	5	Control: conventional community care	0	8	Group
Romagnoli 2006[244]	Two repeat PR programmes of 18 sessions each	4	One repeat PR programme of 18 sessions	4	52	Group
Rooyackers 2003[187]	Inpatient programme: general exercise training (20 minutes) plus eccentric cycle exercise training (15 minutes), 5 days per week	1	Inpatient programme: general exercise training (20 minutes) 5 days per week	1	10	Group
Sassi-Dambron 1995[134]	Weekly group sessions focusing on strategies to manage dyspnoea	4	Six weekly educational sessions not related to COPD	3	6	Group
Scherer 2000[258]	Respiratory muscle endurance training through portable device (using nose clip): 15 minutes, 2× per day, 5× per week, 8 weeks	1	Sham breathing training through incentive spirometer: 15 minutes, 2× per day, 5× per week, 8 weeks	1	8	Individual
Sewell 2005[152]	PR: 2× per week; 1 hour exercise, 1 hour education, daily home walking plus individualised supervised strengthening exercises × 10 and unsupervised home exercise	8	PR 2× per week; 1 hour exercise, 1 hour education, daily home walking plus functional exercise programme based on ADL × 10 and unsupervised at home	8	7	Mixed
Sewell 2006[153]	PR: rolling programme of 14 sessions: relaxation, disease education, chest clearance, etc., plus home exercise programme; 2 hours (1 hour supervised exercise and 1 hour education), 2× per week	8	PR: rolling programme of 14 sessions: relaxation, disease education, chest clearance, etc., plus home exercise programme; 2 hours (1 hour supervised exercise and 1 hour education), 2× per week	8	7	Group
Seymour 2010[154]	PR commencing 1 week post discharge – 2 × 2-hour exercise and education sessions/week	2	UC	1	8	Group
Shao 2003[202]	Rehabilitation behavioural intervention consisting of psychological, somatic and lifestyle interventions	5	Control	0	52	Mixed
Simpson 1992[135]	Weight training: 3× per week	2	Control: no intervention	0	8	Unclear
Singh 2003[241]	Home-based PR: breathing techniques, controlled coughing, energy conservation and walking: 1 hour per day	4	UC	0	4	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Sívori 1998[263]	Lower limb training: 75% max. capacity ergocycling 45 minutes, 3× per week for 8 weeks Plus upper limb training exercises: five different exercises with ball, bags of sand or wooden bars. 45 minutes' exercise 3× per week for 8 weeks: 24 sessions total Plus respiratory exercises	1	Lower limb training: 75% max. capacity ergocycling 45 minutes, 3× per week for 8 weeks	1	8	Group
Smith 1999[168]	Home-based nursing intervention: case conference between primary and secondary health-care team, home review, visits by specialist nurse every 2–4 weeks, addressed education, fitness advice and early identification of exacerbations	7	UC	1	52	Individual
Soler 2006[180]	Specific programme: monthly clinical visits to specialised clinic and short educational programme; nurse-led group education; an information session for patients and families also provided	6	Conventional management	4	52	Group
Solomon 1998, Gourley 1998[136,285]	Pharmacist intervention – patient assessment, therapeutic and educational interventions, collaboration with health-care team, patient follow-up through clinic visits or telephone follow-up	3	Control	0	26	Individual
Spencer 2010[169]	Supervised outpatient exercise 1 hour 1× per week plus unsupervised exercise 1 hour × 4 days (walking plus strength exercises)	1	Unsupervised exercise 1 hour × 5 days (walking plus strength exercises), booklet and diary	1	52	Group
Spruit 2002[247]	Supervised endurance training at outpatient department: 90 minutes 3× per week	1	Supervised resistance training at outpatient department: 90 minutes 3× per week	1	12	Unclear
Sridhar 2008[155]	PR 2 hours 2× per week for 4 weeks; followed by supported SM by nurse, monthly telephone, and home visit every 3 months	7	PR: 2 hours 2× per week for 4 weeks	4	104	Mixed

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Stulbarg 2002, Carrieri-Kohlman 2005, Davis 2006[137,394,395]	(1) Dyspnoea SM programme (as control) and training: 24 × 30 minutes' nurse-coached treadmill exercise sessions;	6	Dyspnoea SM programme: 3 hours' individualised dyspnoea SM education over four sessions plus manual, walking prescription, pedometer and instructions to exercise at home for 20 minutes 4× per week	6	8	Unclear
	(2) dyspnoea SM programme (as control) and exposure: 4 × 30 minutes' nurse-coached treadmill exercise sessions	6				
Subin 2010[242]	Exercise training: 5× per week		Upper limb exercise training 5× per week	2	4	Unclear
	(1) Upper and lower limbs; (2) lower limbs	2, 2				
Theander 2009[220]	PR programme: physiotherapist, dietitian (3×), occupational therapist (3×), nurse (2×); 1 hour, 2 days per week	8	UC	0	12	Group
Toshima 1990, Ries 1995[138,276]	Comprehensive PR programme: education, breathing techniques, psychosocial support and exercise, 12 sessions	12	Educational control programme – did not include exercise or behavioural elements or individualised instruction, four fortnightly sessions	4	8	Group
Trappenburg 2011[188]	Individualised action plan: consultation with nurse case manager, telephone follow-up at 1 and 4 months	9	UC plus consultation with nurse case manager	7	17	Individual
Troosters 2000[248]	Exercise training programme: 1.5 hours 3× per week for 3 months, reducing to 2× per week for the next 3 months	1	Usual medical care	0	26	Unclear
Van Gestel 2012[208]	Exercise training plus respiratory feedback training (daily practice of controlled breathing) – 1.5 hours, 3× per week for 3–4 weeks	2	Exercise training: 1.5 hours, 3× per week for 3–4 weeks	1	4	Unclear
Vogiatzis 2002[265]	PR including supervised interval training: cycling 40 minutes per day, 2× per week in supervised groups	7	PR including supervised continuous training: cycling 40 minutes per day, 2× per week in supervised groups	7	12	Group
Vonbank 2012[246]	(1) Strength and endurance training: 2× per week;	1	Strength training: 2× per week	1	12	Unclear
	(2) endurance training, building up to 60 minutes 2× per week	1				
Wadell 2004[221]	(1) Physical aerobic training in water: 45 minutes 3× per week;	1	Control	0	12	Group
	(2) physical aerobic training on land 45 minutes, 3× per week	1				

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Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Wakabayashi 2011[262]	Integrated care: 6 × 30 minutes' individual tailored education	8	UC: standard education	7	26	Individual
Wang 2004[203]	Resistance abdominal breathing exercises: 15–30 minutes, 2× per day	2	Control: simple abdominal breathing exercise	1	13	Individual
Warlies 2006[209]	Specific education programme: Usually 2 × 3 hours week-days or 2 hours on a week-day and 4 hours on Saturday Telephone hotline available after completion of the sessions Materials included brochures, diary, inhalers, peak flow meters, anatomical models	1	Routine advice (approximately 15 minutes) by practice nurse on use of inhalers, description of medication plan, self-help strategies, advice on smoking, explanation of breathing apparatus	4	26	Group
Waterhouse 2010[277]	Hospital rehabilitation: 2 hours 2× per week Half received telephone support: months 3, 4, 5, 6, 9, 12, 15	5	Community rehabilitation: 2 hours 2× per week Half received telephone support: months 3, 4, 5, 6, 9, 12, 15	5	6	Group
Watson 1997[231]	Action plan and booklet from primary care nurse plus antibiotic and prednisolone from GP	2	UC	0	1	Individual
Wedzicha 1998[157]	Exercise training and education programme: 2× per week	10	Education programme: 2× per week	9	8	Unclear
Weekes 2009[158]	Leaflet of nourishing snacks, drinks and food fortification; dietary counselling provided dietitian and supply of milk powder	1	Control: leaflet of nourishing snacks, drinks and food fortification with no discussion	1	26	Individual
White 2002[159]	PR programme with exercise and education: 2 hours 2× per week	9	Individual 1-hour educational session with booklet and exercise advice; advised 30 minutes' exercise 4× per week	9	6	Group
Wijkstra 1994[189]	Visit to physiotherapist 2× per week for exercise, plus twice daily practice; monthly home visit by nurse for education and SM strategies'; monthly visit to GP	6	Control group	0	12	Individual
Wijkstra 1995[190]	Weeks 1–12: 30 minutes' exercise at outpatient department physiotherapist 2× per week plus monthly coaching by GP and nurse; (1) weekly physiotherapy; (2) monthly physiotherapy	7	No rehabilitation	0	78	Individual

Author year	Intervention description	Number of components	Control description	Number of components	Intervention length (weeks)	Mode
Wittmann 2007[210]	As control group, with an additional component of behaviour training in group setting: 90 minutes, 4× per week; discussion with doctor to establish action plan for emergency situations: 30–60 minutes	10	Inpatient rehabilitation programme – including tailoring of medication, learning correct inhaler techniques, physical training, breathing and SM techniques; if necessary smoking cessation support, psychological help, nutritional advice	7	3	Group
Wong 2005[74]	Nurse-initiated telephone follow-up to increase self-efficacy: two telephone calls (weeks 1 and 3)	2	UC	0	3	Individual
Wood-Baker 2006[170]	Information booklet and individual exercise session with specialist nurse, plus SM plan with action plan based on early recognition exacerbation	12	Information booklet and individual exercise session with specialist nurse plus UC	11	1	Individual
Wright 2003[211]	Resistance training – muscle habituation: 2 weeks; hypertrophic training: 5 weeks each, 2× then 3× per week, 60 minutes then 120 minutes	2	Control	0	12	Group
Xu 2010[204]	(1) Integrative rehabilitation (traditional and modern) – qigong, diaphragmatic breathing, PLB, upper and lower limb training;	3	UC	0	52	Individual
	(2) modern rehabilitation – diaphragmatic breathing, PLB, upper and lower limb training;	2				
	and (3) traditional rehabilitation and qigong	2				
Yamaguti 2012[235]	Diaphragmatic breathing training programme: 45 minutes 3× per week supervised by physiotherapist	1	UC	0	4	Individual
Yeh 2010[139]	T'ai chi – warm-up exercise, five simplified t'ai chi movements and meditative breathing all delivered by two certified and experienced instructors: 1 hour, 2× per week; 35 minutes' instructional video to take home and practice at least 3× per week	3	UC	1	12	Group
Zhang 2008[205]	PR 15 minutes, 3× per day: (1) PR with PLB; (2) PR	22	No PR	0	8	Unclear

ADL, activities of daily living; ICT, information communication technology; MBBT, mind–body breathing therapy; PLB, pursed lip breathing.

Appendix 24 Mapping of components of self-management interventions across intervention and comparator arms: review 4

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Aimonino Ricauda 2008[75]	1	–	–	1	1	1	1	–
Arnardottir 2006[216]	–	–	–	–	1	–	–	–
Arnardottir 2007[217]	–	–	–	–	1	–	–	–
Barakat 2008[249]	–	–	–	–	1	–	–	–
Bauldoff 2002[108]	–	–	–	–	–	–	–	–
Bauldoff 2005[109] A	–	–	–	–	–	–	–	–
Bauldoff 2005[109] B	–	–	–	–	–	–	–	–
Bauldoff 2005[109] C	–	–	–	–	–	–	–	–
Beckerman 2005[253]	–	–	1	–	–	–	–	–
Behnke 2000[64]	–	–	–	–	1	–	–	–
Bendstrup 1997[222]	1	–	–	–	1	1	1	–
Bernard 1999[191]	–	–	–	–	–	–	–	–
Berry 2010[110]	1	–	–	–	–	–	–	–
Bestall 2003[141]	1	–	–	1	1	1	1	1
Bjornshave 2005[223]	–	–	–	–	–	–	–	–
Blake Jr 1990[111]	1	–	–	–	1	–	–	–
Bonilha 2009[232]	–	1	–	–	1	–	–	–
Bourbeau 2003[192]	1	1	–	1	1	1	–	1
Boxall 2005[160]	1	–	–	–	1	–	1	1
Breyer 2010[245]	1	–	–	–	1	1	1	1
Brooks 2002[193]	1	–	–	–	1	–	–	–
Bucknall 2012[63]	1	–	–	1	1	–	1	–
Busch 1988[194]	–	–	–	–	1	–	–	–
Cai 2006[199]	1	–	–	1	1	1	1	–
Carr 2009[195]	1	–	–	–	1	–	1	–
Casas 2006[71]	1	1	–	1	1	1	1	–
Chan 2010[212] A	1	–	–	–	1	–	–	–
Chan 2010[212] B	1	–	–	–	1	–	–	–
Chan 2010[212] C	1	–	–	–	1	–	–	–
Cockcroft 1987[142]	–	1	–	1	–	–	–	–
Coultas 2005[112] A	1	1	–	1	–	1	1	–
Coultas 2005[112] B	1	1	–	1	–	1	1	–
Coultas 2005[112] C	1	1	–	1	–	1	1	–
Covey 2001[113]	–	–	1	–	–	–	–	–
de Blok 2006[181]	–	–	–	–	–	–	–	–
Dheda 2004[73]	–	–	–	–	–	1	1	–
Donesky-Cuenco 2009[114]	1	–	–	–	1	–	–	–
Dourado 2009[233] A	–	–	–	–	–	–	–	–
Dourado 2009[233] B	–	–	–	–	–	–	–	–
Dourado 2009[233] C	–	–	–	–	–	–	–	–
du Moulin 2009[206]	1	–	–	–	1	1	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	–	–	–	1	–	1	1	–	**9**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
1	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	1	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	1	–	**3**
1	1	–	1	–	–	1	–	1	**9**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	1	**3**
1	1	–	1	1	–	1	–	–	**11**
–	–	–	–	–	–	1	–	–	**1**
–	1	–	–	–	–	1	1	–	**5**
–	1	–	–	–	–	–	–	1	**4**
1	1	–	1	1	–	1	1	–	**12**
–	1	–	1	1	–	1	–	–	**8**
1	–	–	–	–	–	1	–	–	**7**
–	1	–	–	–	–	1	1	–	**5**
–	–	–	–	–	1	–	1	–	**6**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	1	–	–	–	–	–	**6**
–	1	–	–	1	–	1	–	–	**6**
1	–	–	1	–	–	1	1	–	**10**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**3**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	–	1	–	**3**
–	–	–	–	–	–	–	–	–	**5**
–	–	–	–	–	–	–	–	–	**5**
–	–	–	–	–	–	–	–	–	**5**
–	–	–	–	–	–	–	–	–	**1**
1	1	–	–	–	–	1	–	–	**3**
1	–	–	1	–	1	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	1	–	–	–	–	1	1	–	**7**

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Eaton 2009[227]	1	–	–	1	1	–	1	1
Effing 2009[161]	1	1	–	1	1	1	1	1
Efraimsson 2008[218]	1	1	–	1	1	1	1	1
Egan 2002[69]	1	–	–	–	–	–	1	–
Elci 2008[236]	1	–	–	–	1	–	1	1
Elliott 2004[162] A	1	–	–	–	–	–	1	–
Elliott 2004[162] B	1	–	–	–	–	–	1	–
Elliott 2004[162] C	1	–	–	–	–	–	1	–
Emery 1998[115] A	1	–	–	–	–	–	1	–
Emery 1998[115] B	1	–	–	–	–	–	1	–
Emery 1998[115] C	1	–	–	–	–	–	1	–
Engstrom 1999[219]	1	–	–	–	1	1	1	–
Fernandez 2009[171]	1	–	1	1	1	–	–	–
Finnerty 2001[143]	1	–	–	1	1	–	–	–
Foy 2001[116]	–	–	–	–	–	–	–	–
Gallefoss 1999[255]	1	1	–	1	1	1	1	1
Ghanem 2010[264]	1	–	–	–	1	–	1	–
Gilmore 2010[117] A	1	–	–	1	1	1	1	–
Gilmore 2010[117] B	1	–	–	1	1	1	1	–
Gilmore 2010[117] C	1	–	–	–	–	–	1	–
Gilmore 2010[117] D	1	–	–	1	1	1	1	–
Gilmore 2010[117] E	1	–	–	1	1	1	1	–
Gilmore 2010[117] F	1	–	–	1	1	1	1	–
Gohl 2006[207]	–	–	–	–	1	–	–	–
Goldstein 1994[196]	–	–	–	–	1	–	–	–
Green 2001[144]	1	–	–	–	–	–	–	–
Güell 2000[172]	1	–	–	–	1	–	–	1
Güell 2006[173]	1	–	–	–	1	–	–	1
Guyatt 1992[118]	–	–	1	–	1	–	–	–
Hermiz 2002[67]	1	–	–	1	1	1	1	–
Hernandez 2000[282]	1	–	–	1	1	1	1	–
Hernandez 2003[68]	–	–	–	–	–	–	–	–
Hill 2006[163]	–	–	1	–	–	–	–	–
Holland 2004[164]	–	–	–	–	–	–	–	–
Hoogendoorn 2009[182]	1	–	–	–	–	1	–	–
Hospes 2009[183]	–	–	–	–	1	–	–	–
Hsiao 2003[259] A	–	–	1	–	1	–	–	–
Hsiao 2003[259] B	–	–	1	–	1	–	–	–
Hsiao 2003[259] C	–	–	1	–	1	–	–	–
Hynninen 2010[256]	–	–	–	–	1	–	–	–
Janaudis-Ferreira 2011[197]	–	1	–	–	1	–	–	–
Jang 2006[267]	1	–	1	–	1	–	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	1	1	–	1	–	1	1	–	**11**
1	1	–	–	–	–	1	1	–	**11**
1	1	1	1	–	–	1	1	–	**13**
–	–	–	–	–	1	–	1	1	**5**
1	1	–	–	–	–	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**3**
–	1	–	–	–	–	1	–	–	**4**
–	1	–	–	–	–	–	–	–	**3**
–	1	–	–	–	–	1	–	–	**4**
1	–	–	–	1	–	1	–	–	**7**
–	–	–	1	–	–	1	1	–	**7**
1	1	–	–	–	1	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**1**
–	–	1	1	–	–	1	–	–	**10**
1	–	1	1	–	–	1	–	–	**7**
–	–	–	1	–	–	1	1	–	**8**
–	–	–	1	–	–	1	–	–	**7**
–	–	–	1	–	–	–	1	–	**4**
–	–	–	1	–	–	1	1	–	**8**
–	–	–	1	–	–	1	1	–	**8**
–	–	–	1	–	–	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	1	–	**4**
–	–	–	–	–	–	1	–	–	**2**
–	1	–	1	–	–	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**5**
–	–	–	–	–	–	–	–	–	**2**
–	–	–	–	1	–	1	1	–	**8**
1	–	–	–	1	1	1	1	–	**10**
–	–	–	–	–	–	1	–	1	**2**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	–	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**2**
–	–	1	–	–	–	–	–	–	**3**
–	–	1	–	–	–	–	–	–	**3**
–	–	1	–	–	–	–	–	–	**3**
–	1	–	–	–	–	–	–	1	**3**
–	1	–	–	–	–	1	–	–	**4**
1	1	–	–	–	–	1	–	–	**6**

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Jarab 2012[266]	1	–	–	–	–	1	1	1
Karapolat 2007[237]	1	–	–	–	1	–	1	1
Katiyar 2006[240]	–	–	–	–	1	–	–	–
Kayahan 2006[238]	1	–	–	–	1	–	1	1
Khdour 2009[251]	1	–	–	1	1	1	1	1
Kim 1993[119]	–	–	1	–	–	–	–	–
Ko 2011[213]	–	–	–	–	1	1	–	–
Koff 2009[120]	1	1	–	–	1	–	1	–
Koppers 2006[184]	–	–	1	–	–	–	–	–
Kunik 2008[121]	–	–	–	–	1	–	–	–
Kwok 2004[70]	–	–	–	–	–	–	1	–
Lamers 2010[185]	–	1	–	1	1	–	–	–
Larson 1988[122]	–	–	1	–	–	–	–	–
Larson 1999[123] A	–	–	1	–	–	–	–	–
Larson 1999[123] B	–	–	–	–	–	–	–	–
Larson 1999[123] C	–	–	1	–	–	–	–	–
Larson 1999[123] D	–	–	1	–	–	–	–	–
Larson 1999[123] E	–	–	1	–	–	–	–	–
Larson 1999[123] F	–	–	1	–	–	–	–	–
Lee 2002[66]	–	–	–	–	1	–	1	–
Leung 2010[165]	–	–	–	–	1	–	–	–
Li 2002[200]	–	–	–	–	1	–	–	–
Liddell 2010[145]	1	–	–	–	1	–	1	–
Lindsay 2005[214]	1	1	–	–	1	–	–	–
Linneberg 2012[224]	1	1	–	–	–	1	1	1
Littlejohns 1991[146]	1	–	–	1	–	–	1	–
Liu 2008[260]	1	–	–	–	1	–	–	–
Livermore 2010[166]	–	–	–	1	1	–	–	–
Lord 2010[147]	1	–	–	–	1	–	–	–
Madariaga 2007[174] A	–	–	1	–	–	–	–	–
Madariaga 2007[174] B	–	–	1	–	–	–	–	–
Madariaga 2007[174] C	–	–	1	–	–	–	–	–
Mador 2004[126]	1	–	–	–	1	–	–	–
Mador 2005[125]	1	–	–	–	–	–	–	–
Mador 2009[124]	1	–	–	–	–	–	–	–
Magadle 2007[254]	–	–	1	–	1	–	–	–
Maltais 2008[198]	1	–	–	–	1	–	–	–
Man 2004[148]	–	1	–	–	1	1	1	–
Martin 2004[228]	–	–	–	1	–	–	1	–
McGeoch 2006[229]	–	–	–	1	1	–	–	–
Monninkhof 2003[186]	1	1	–	1	1	–	–	–
Moore 2009[284]	1	–	–	–	1	1	1	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	–	–	–	–	–	1	–	–	**5**
1	1	–	–	1	–	1	–	–	**8**
–	–	–	–	–	–	1	–	–	**2**
1	1	–	–	–	–	1	–	–	**7**
–	1	–	1	–	–	1	1	–	**10**
–	–	–	–	–	–	–	–	–	**1**
–	1	–	1	1	–	1	–	–	**6**
1	–	–	–	–	–	–	1	–	**6**
–	–	–	–	–	–	–	–	–	**1**
–	1	–	–	–	–	–	–	–	**2**
1	1	1	1	1	–	1	1	–	**8**
–	1	–	–	–	–	–	–	–	**4**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	1	–	**2**
–	–	–	–	–	–	1	1	–	**2**
–	–	–	–	–	–	1	1	–	**3**
–	–	–	–	–	–	–	1	–	**2**
–	–	–	–	–	–	1	1	–	**3**
–	–	–	–	–	–	1	1	–	**3**
1	–	–	1	–	–	–	1	–	**5**
–	–	–	–	–	–	1	–	–	**2**
1	–	–	–	–	–	–	–	–	**2**
1	1	–	–	–	–	1	–	–	**6**
–	1	–	1	1	1	1	–	–	**8**
–	–	–	–	–	–	1	–	–	**6**
–	–	–	1	–	–	–	1	–	**5**
–	–	–	–	–	–	1	1	1	**5**
–	1	–	–	–	–	–	–	–	**3**
–	1	–	–	–	–	1	–	1	**5**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	1	**3**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	1	–	**4**
1	–	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	–	–	–	**2**
–	–	–	–	–	–	–	–	–	**2**
1	1	–	–	1	–	1	1	1	**10**
–	1	1	–	–	–	1	1	–	**8**

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Mota 2007[175]	–	–	1	–	1	–	–	1
Mularski 2009[127]	–	–	–	–	–	–	–	–
Murphy 2005[252]	–	–	–	–	–	–	–	–
Nakamura 2008[261] A	–	–	–	–	1	–	–	1
Nakamura 2008[261] B	–	–	–	–	–	–	–	–
Nakamura 2008[261] C	–	–	–	–	1	–	–	1
Ng 2011[215]	1	–	–	–	1	–	–	–
Nguyen 2008[128]	–	1	–	1	1	–	–	–
Nguyen 2009[129]	–	–	–	–	1	–	1	–
Nield 2007[130] A	–	–	–	–	1	–	–	–
Nield 2007[130] B	–	–	1	–	–	–	–	–
Nield 2007[130] C	–	–	1	–	–	–	–	–
Ninot 2011[250]	–	–	–	1	1	1	–	1
Normandin 2002[131]	1	–	–	–	–	–	–	–
Norweg 2005[132] A	–	–	–	–	1	–	–	–
Norweg 2005[132] B	1	–	–	–	–	–	1	–
Norweg 2005[132] C	–	–	–	–	1	–	–	–
Oh 2003[283]	1	–	1	–	1	–	1	1
O'Neill 2007[150]	1	–	–	–	1	–	–	–
Ortega 2002[176] A	–	–	–	–	–	–	–	–
Ortega 2002[176] B	–	–	–	–	–	–	–	–
Ortega 2002[176] C	–	–	–	–	–	–	–	–
O'Shea 2007[167]	–	–	–	–	1	–	–	–
Ozdemir 2010[239]	–	–	–	–	–	–	–	–
Paz-Diaz 2007[269]	–	–	–	–	1	–	–	–
Petersen 2008[225]	1	–	–	–	1	–	1	–
Petty 2006[133] A	1	–	–	–	–	–	–	–
Petty 2006[133] B	1	–	–	–	–	–	–	–
Petty 2006[133] C	1	–	–	–	–	–	–	–
Pomidori 2012[243]	–	–	–	–	–	–	–	–
Prince 1989[151]	1	–	–	–	1	1	–	–
Probst 2011[234]	–	–	–	–	–	–	–	–
Puente-Maestu 2000[177]	–	–	–	–	–	–	1	–
Puhan 2006[257]	1	–	–	–	1	–	–	–
Rea 2004[230]	–	–	–	1	–	1	1	–
Regiane Resqueti 2007[178]	–	–	–	–	1	–	–	–
Ren 2011[201] A	–	–	–	–	1	–	–	–
Ren 2011[201] B	–	–	–	–	1	–	–	–
Ren 2011[201] C	1	–	1	–	1	–	–	1
Rice 2010[140]	1	–	–	1	1	1	1	–
Riera 2001[179]	–	–	1	–	–	–	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	1	–	–	–	–	–	–	–	**4**
–	1	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**1**
–	1	–	–	–	–	1	–	–	**4**
–	1	–	–	–	–	1	–	1	**5**
–	–	–	–	–	–	1	–	–	**4**
–	1	1	–	–	–	1	1	–	**6**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
1	–	–	1	–	–	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
1	1	1	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**2**
1	1	–	1	1	–	1	1	–	**11**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
1	1	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	1	**2**
1	1	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**1**
1	–	–	–	–	–	1	–	–	**3**
–	1	–	–	–	–	1	–	–	**4**
–	–	1	1	–	–	–	1	1	**7**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	1	–	**6**
–	–	1	1	–	–	1	1	–	**9**
–	1	–	–	–	–	–	–	–	**2**

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Ringbaek 2000[226]	1	–	–	–	1	–	–	–
Romagnoli 2006[244]	1	–	–	–	1	–	–	–
Rooyackers 2003[187]	–	–	–	–	–	–	–	–
Sassi-Dambron 1995[134]	1	–	–	–	1	–	–	–
Scherer 2000[258]	–	–	1	–	–	–	–	–
Sewell 2005[152]	1	–	–	–	1	–	1	1
Sewell 2006[153]	1	–	–	–	1	–	1	1
Seymour 2010[154]	1	–	–	–	1	–	–	–
Shao 2003[202]	–	–	–	–	1	1	–	–
Simpson 1992[135]	–	–	–	–	1	–	–	–
Singh 2003[241]	–	–	–	–	1	–	–	1
Sívori 1998[263]	–	–	–	–	–	–	–	–
Smith 1999[168]	1	–	–	1	–	1	1	–
Soler 2006[180]	1	–	–	–	1	1	–	–
Solomon 1998[136]	1	–	–	–	–	–	1	–
Spencer 2010[169]	–	–	–	–	1	–	–	–
Spruit 2002[247]	–	–	–	–	–	–	–	–
Sridhar 2008[155]	1	1	–	1	1	1	1	–
Stulbarg 2002[137] A	1	1	–	–	1	–	1	–
Stulbarg 2002[137] B	1	1	–	–	1	–	1	–
Stulbarg 2002[137] C	1	1	–	–	1	–	1	–
Subin 2010[242] A	–	–	–	–	1	–	–	–
Subin 2010[242] B	–	–	–	–	1	–	–	–
Subin 2010[242] C	–	–	–	–	1	–	–	–
Theander 2009[220]	1	1	–	–	1	1	1	–
Toshima 1990[138]	1	–	–	–	1	1	1	1
Trappenburg 2011[188]	–	–	–	1	1	1	1	–
Troosters 2000[248]	–	–	–	–	–	–	–	–
Van Gestel 2012[208]	–	–	–	–	1	–	–	–
Vogiatzis 2002[265]	1	–	–	–	1	–	1	1
Vonbank 2012[246] A	–	–	–	–	–	–	–	–
Vonbank 2012[246] B	–	–	–	–	–	–	–	–
Vonbank 2012[246] C	–	–	–	–	–	–	–	–
Wadell 2004[221] A	–	–	–	–	–	–	–	–
Wadell 2004[221] B	–	–	–	–	–	–	–	–
Wadell 2004[221] C	–	–	–	–	–	–	–	–
Wakabayashi 2011[262]	1	–	–	1	–	1	1	–
Wang 2004[203]	–	–	–	–	1	–	–	–
Warlies 2006[209]	–	–	–	–	–	–	–	–
Waterhouse 2010[277]	1	–	–	–	1	–	1	–
Watson 1997[231]	1	–	–	1	–	–	–	–
Wedzicha 1998[157]	1	–	–	1	1	1	1	1

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	1	–	–	–	–	1	–	–	**5**
1	1	–	–	–	–	1	–	–	**5**
–	–	–	–	–	–	1	–	–	**1**
–	1	–	–	1	–	–	–	–	**4**
–	–	–	–	–	–	–	–	–	**1**
1	1	–	–	1	–	1	–	–	**8**
1	1	–	–	1	–	1	–	–	**8**
–	–	–	–	–	–	1	–	–	**3**
1	1	–	–	–	–	1	–	–	**5**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	1	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	1	–	–	1	1	–	**7**
1	–	–	1	–	–	1	1	–	**7**
–	–	–	–	–	–	–	1	–	**3**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	1	–	**8**
–	1	–	–	–	–	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
1	–	–	–	1	–	1	–	–	**8**
1	1	1	–	1	–	1	–	1	**11**
1	–	1	1	–	–	1	1	–	**9**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
1	1	–	–	–	–	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	–	1	1	–	–	1	–	–	**8**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	1	–	–	1	–	1	–	–	**6**
–	–	–	–	–	–	–	–	–	**2**
1	1	–	1	–	–	1	–	–	**10**

Author, year	Intervention							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Weekes 2009[158]	–	–	–	–	1	–	–	–
White 2002[159]	1	–	–	1	1	–	1	1
Wijkstra 1994[189]	1	–	1	–	1	–	1	–
Wijkstra 1995[190] A	1	–	1	–	1	–	1	–
Wijkstra 1995[190] B	1	–	1	–	1	–	1	–
Wijkstra 1995[190] C	1	–	1	–	1	–	1	–
Wittmann 2007[210]	1	1	–	1	1	–	1	–
Wong 2005[74]	1	–	–	–	–	–	–	–
Wood-Baker 2006[170]	1	–	–	1	1	1	1	1
Wright 2003[211]	–	–	–	–	1	–	–	–
Xu 2010[204] A	–	–	–	–	1	–	–	–
Xu 2010[204] B	–	–	–	–	1	–	–	–
Xu 2010[204] C	–	–	–	–	–	–	–	–
Xu 2010[204] D	–	–	–	–	1	–	–	–
Xu 2010[204] E	–	–	–	–	1	–	–	–
Xu 2010[204] F	–	–	–	–	1	–	–	–
Yamaguti 2012[235]	–	–	–	–	1	–	–	–
Yeh 2010[139]	–	–	–	–	1	–	–	–
Zhang 2008[205] A	–	–	–	–	1	–	–	–
Zhang 2008[205] B	–	–	–	–	–	–	–	–
Zhang 2008[205] C	–	–	–	–	1	–	–	–
Total number	**108**	**24**	**32**	**43**	**140**	**44**	**77**	**30**

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	–	–	–	–	–	–	–	–	**2**
1	1	–	1	–	–	1	–	–	**9**
–	1	–	–	–	–	1	–	–	**6**
–	1	–	–	–	–	1	1	–	**7**
–	1	–	–	–	–	1	1	–	**7**
–	1	–	–	–	–	1	1	–	**7**
1	1	1	1	–	–	1	–	–	**10**
–	–	–	–	–	–	–	1	–	**2**
1	1	1	1	–	1	1	–	–	**12**
–	–	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	–	–	**3**
–	1	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**1**
–	1	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	–	–	1	**2**
–	–	–	–	–	–	–	–	1	**1**
–	–	–	–	–	–	–	–	1	**2**
51	**77**	**18**	**36**	**22**	**7**	**176**	**50**	**18**	**953**

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Aimonino Ricauda 2008[75]	–	–	–	–	–	–	–	–
Arnardottir 2006[216]	–	–	–	–	1	–	–	–
Arnardottir 2007[217]	–	–	–	–	1	–	–	–
Barakat 2008[249]	–	–	–	–	–	–	–	–
Bauldoff 2002[108]	–	–	–	–	–	–	–	–
Bauldoff 2005[109] A	–	–	–	–	–	–	–	–
Bauldoff 2005[109] B	–	–	–	–	–	–	–	–
Bauldoff 2005[109] C	–	–	–	–	–	–	–	–
Beckerman 2005[253]	–	–	1	–	–	–	–	–
Behnke 2000[64]	–	–	–	–	1	–	–	–
Bendstrup 1997[222]	–	–	–	–	–	–	–	–
Bernard 1999[191]	–	–	–	–	1	–	–	1
Berry 2010[110]	1	–	–	–	–	–	–	–
Bestall 2003[141]	1	–	–	1	1	1	1	1
Bjornshave 2005[223]	–	–	–	–	–	–	–	–
Blake Jr 1990[111]	–	–	–	–	–	–	–	–
Bonilha 2009[232]	–	–	–	–	–	–	–	–
Bourbeau 2003[192]	–	–	–	–	–	–	–	–
Boxall 2005[160]	–	–	–	–	–	–	–	–
Breyer 2010[245]	1	–	–	–	1	1	1	1
Brooks 2002[193]	1	–	–	–	1	–	–	–
Bucknall 2012[63]	–	–	–	–	–	–	–	–
Busch 1988[194]	–	–	–	–	–	–	–	–
Cai 2006[199]	–	–	–	–	–	–	–	–
Carr 2009[195]	1	–	–	–	1	–	1	–
Casas 2006[71]	–	–	–	–	–	–	–	–
Chan 2010[212] A	–	–	–	–	–	–	–	–
Chan 2010[212] B	–	–	–	–	–	–	–	–
Chan 2010[212] C	1	–	–	–	1	–	–	–
Cockcroft 1987[142]	–	–	–	–	–	–	–	–
Coultas 2005[112] A	1	–	–	–	–	–	–	–
Coultas 2005[112] B	1	–	–	–	–	–	–	–
Coultas 2005[112] C	1	1	–	1	–	1	1	–
Covey 2001[113]	–	–	–	–	1	1	1	–
de Blok 2006[181]	–	–	–	–	–	–	–	–
Dheda 2004[73]	–	–	–	–	–	–	–	–
Donesky-Cuenco 2009[114]	1	–	–	–	–	–	–	–
Dourado 2009[233] A	–	–	–	–	–	–	–	–
Dourado 2009[233] B	–	–	–	–	–	–	–	–
Dourado 2009[233] C	–	–	–	–	–	–	–	–
du Moulin 2009[206]	1	–	–	–	1	1	–	–
Eaton 2009[227]	–	–	–	–	–	–	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**2**
1	1	–	1	1	–	–	–	–	**10**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	1	–	–	–	–	–	–	1	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
1	–	–	–	–	–	–	–	–	**6**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	1	–	–	1	–	1	–	–	**6**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**5**
1	1	–	–	1	–	–	–	–	**6**
1	1	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	1	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**1**

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Effing 2009[161]	1	1	–	1	1	1	1	1
Efraimsson 2008[218]	–	–	–	–	–	–	–	–
Egan 2002[69]	–	–	–	–	–	–	–	–
Elci 2008[236]	–	–	–	–	–	–	–	–
Elliott 2004[162] A	1	–	–	–	–	–	1	–
Elliott 2004[162] B	1	–	–	–	–	–	1	–
Elliott 2004[162] C	1	–	–	–	–	–	1	–
Emery 1998[115] A	–	–	–	–	–	–	–	–
Emery 1998[115] B	–	–	–	–	–	–	–	–
Emery 1998[115] C	1	–	–	–	–	–	1	–
Engstrom 1999[219]	–	–	–	–	–	–	–	–
Fernandez 2009[171]	1	–	–	1	–	–	–	–
Finnerty 2001[143]	–	–	–	–	–	–	–	–
Foy 2001[116]	–	–	–	–	–	–	–	–
Gallefoss 1999[255]	–	–	–	–	–	–	–	–
Ghanem 2010[264]	–	–	–	–	–	–	–	–
Gilmore 2010[117] A	1	–	–	–	–	–	1	–
Gilmore 2010[117] B	1	–	–	–	–	–	1	–
Gilmore 2010[117] C	1	–	–	–	–	–	1	–
Gilmore 2010[117] D	1	–	–	1	1	1	1	–
Gilmore 2010[117] E	1	–	–	–	–	–	1	–
Gilmore 2010[117] F	1	–	–	–	–	–	1	–
Gohl 2006[207]	–	–	–	–	–	–	–	–
Goldstein 1994[196]	–	–	–	–	–	–	–	–
Green 2001[144]	1	–	–	–	–	–	–	–
Güell 2000[172]	–	–	–	–	–	–	–	–
Güell 2006[173]	–	–	–	–	–	–	–	–
Guyatt 1992[118]	–	–	1	–	1	–	–	–
Hermiz 2002[67]	–	–	–	–	–	–	–	–
Hernandez 2000[282]	–	–	–	–	–	–	–	–
Hernandez 2003[68]	–	–	–	–	–	–	–	–
Hill 2006[163]	–	–	1	–	–	–	–	–
Holland 2004[164]	–	–	–	–	–	–	–	–
Hoogendoorn 2009[182]	–	–	–	–	–	1	–	–
Hospes 2009[183]	–	–	–	–	–	–	–	–
Hsiao 2003[259] A	–	–	1	–	1	–	–	–
Hsiao 2003[259] B	–	–	–	–	1	–	–	–
Hsiao 2003[259] C	–	–	–	–	1	–	–	–
Hynninen 2010[256]	–	–	–	–	–	–	–	–
Janaudis-Ferreira 2011[197]	–	–	–	–	–	–	–	–
Jang 2006[267]	1	–	–	–	–	–	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	1	–	–	–	–	1	1	–	**11**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	1	–	–	–	–	–	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	1	–	–	–	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	1	–	–	–	–	–	**3**
–	–	–	1	–	–	–	–	–	**3**
–	–	–	1	–	–	–	–	–	**3**
–	–	–	1	–	–	1	–	–	**7**
–	–	–	1	–	–	–	1	–	**4**
–	–	–	1	–	–	–	1	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	–	–	–	–	–	–	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	1	–	–	–	–	–	–	**3**
–	–	1	–	–	–	–	–	–	**2**
–	–	1	–	–	–	–	–	–	**2**
–	–	–	–	–	–	–	1	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Jarab 2012[266]	–	–	–	–	–	–	–	–
Karapolat 2007[237]	–	–	–	–	–	–	–	–
Katiyar 2006[240]	–	–	–	–	–	–	–	–
Kayahan 2006[238]	–	–	–	–	–	–	–	–
Khdour 2009[251]	–	–	–	–	–	–	–	–
Kim 1993[119]	–	–	1	–	–	–	–	–
Ko 2011[213]	–	–	–	–	–	1	–	–
Koff 2009[120]	–	–	–	–	–	–	–	–
Koppers 2006[184]	–	–	–	–	1	–	–	–
Kunik 2008[121]	1	–	–	–	1	1	1	1
Kwok 2004[70]	–	–	–	–	–	–	–	–
Lamers 2010[185]	–	–	–	–	–	–	–	–
Larson 1988[122]	–	–	1	–	–	–	–	–
Larson 1999[123] A	1	–	–	–	–	–	–	–
Larson 1999[123] B	1	–	–	–	–	–	–	–
Larson 1999[123] C	1	–	–	–	–	–	–	–
Larson 1999[123] D	–	–	–	–	–	–	–	–
Larson 1999[123] E	–	–	1	–	–	–	–	–
Larson 1999[123] F	–	–	–	–	–	–	–	–
Lee 2002[66]	–	–	–	–	–	–	–	–
Leung 2010[165]	–	–	–	–	–	–	–	–
Li 2002[200]	–	–	–	–	–	–	–	–
Liddell 2010[145]	1	–	–	–	1	–	1	–
Lindsay 2005[214]	–	–	–	–	–	–	–	–
Linneberg 2012[224]	1	1	–	–	–	1	1	1
Littlejohns 1991[146]	–	–	–	–	–	–	–	–
Liu 2008[260]	1	–	–	–	–	–	–	–
Livermore 2010[166]	–	–	–	–	–	–	–	–
Lord 2010[147]	1	–	–	–	1	–	–	–
Madariaga 2007[174] A	–	–	–	–	–	–	–	–
Madariaga 2007[174] B	–	–	–	–	–	–	–	–
Madariaga 2007[174] C	–	–	1	–	–	–	–	–
Mador 2004[126]	1	–	–	–	–	–	–	–
Mador 2005[125]	1	–	–	–	–	–	–	–
Mador 2009[124]	1	–	–	–	–	–	–	–
Magadle 2007[254]	–	–	–	–	–	–	–	–
Maltais 2008[198]	1	–	–	–	–	–	–	–
Man 2004[148]	–	–	–	–	–	–	–	–
Martin 2004[228]	–	–	–	–	–	–	–	–
McGeoch 2006[229]	–	–	–	–	1	1	–	–
Monninkhof 2003[186]	–	–	–	–	–	–	–	–
Moore 2009[284]	1	–	–	–	1	1	1	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	1	–	1	–	–	1	–	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
1	–	1	–	–	–	1	–	–	**8**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	1	–	**2**
–	–	–	–	–	–	–	1	–	**2**
–	–	–	–	–	–	1	1	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	1	–	–	–	1	1	–	–	**7**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	1	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	1	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
1	–	1	1	–	–	1	–	–	**6**
–	–	–	–	–	–	–	1	–	**1**
–	1	1	–	–	–	1	–	1	**8**

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Mota 2007[175]	–	–	1	–	–	–	–	1
Mularski 2009[127]	1	–	–	–	1	–	–	–
Murphy 2005[252]	–	–	–	–	–	–	–	–
Nakamura 2008[261] A	–	–	–	–	–	–	–	–
Nakamura 2008[261] B	–	–	–	–	–	–	–	–
Nakamura 2008[261] C	–	–	–	–	–	–	–	–
Ng 2011[215]	1	–	–	–	1	–	–	–
Nguyen 2008[128]	–	1	–	1	1	–	–	–
Nguyen 2009[129]	–	–	–	–	1	–	1	–
Nield 2007[130] A	–	–	–	–	–	–	–	–
Nield 2007[130] B	–	–	–	–	–	–	–	–
Nield 2007[130] C	–	–	–	–	1	–	–	–
Ninot 2011[250]	–	–	–	–	–	–	–	–
Normandin 2002[131]	1	–	–	–	–	–	–	–
Norweg 2005[132] A	–	–	–	–	–	–	–	–
Norweg 2005[132] B	–	–	–	–	–	–	–	–
Norweg 2005[132] C	1	–	–	–	–	–	1	–
Oh 2003[283]	1	–	–	–	1	–	1	1
O'Neill 2007[150]	1	–	–	–	–	–	–	–
Ortega 2002[176] A	–	–	–	–	–	–	–	–
Ortega 2002[176] B	–	–	–	–	–	–	–	–
Ortega 2002[176] C	–	–	–	–	–	–	–	–
O'Shea 2007[167]	–	–	–	–	–	–	–	–
Ozdemir 2010[239]	–	–	–	–	–	–	–	–
Paz-Diaz 2007[269]	–	–	–	–	–	–	–	–
Petersen 2008[225]	1	–	–	–	–	–	1	–
Petty 2006[133] A	–	–	–	–	–	–	–	–
Petty 2006[133] B	–	–	–	–	–	–	–	–
Petty 2006[133] C	1	–	–	–	–	–	–	–
Pomidori 2012[243]	–	–	–	–	–	–	–	–
Prince 1989[151]	1	–	–	–	–	–	–	–
Probst 2011[234]	–	–	–	–	1	–	–	–
Puente-Maestu 2000[177]	–	–	–	–	–	–	1	–
Puhan 2006[257]	1	–	–	–	1	–	–	–
Rea 2004[230]	–	–	–	–	–	–	–	–
Regiane Resqueti 2007[178]	–	–	–	–	–	–	–	–
Ren 2011[201] A	–	–	–	–	–	–	–	–
Ren 2011[201] B	–	–	–	–	1	–	–	–
Ren 2011[201] C	1	–	–	–	1	–	–	1
Rice 2010[140]	1	–	–	–	–	–	–	–
Riera 2001[179]	–	–	1	–	–	–	–	–

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	1	–	–	–	–	–	–	–	**3**
–	–	–	–	–	1	–	–	–	**3**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	1	**4**
–	–	–	–	–	–	1	–	–	**4**
–	1	1	–	–	–	1	1	–	**6**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	1	–	**1**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
1	1	1	–	–	–	1	–	–	**6**
1	–	–	1	1	–	–	–	–	**7**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	1	–	**1**
1	1	–	–	–	–	–	–	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**2**
1	–	–	–	–	–	1	–	–	**3**
–	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	–	1	–	**2**
–	1	–	–	–	–	–	–	–	**2**

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Ringbaek 2000[226]	–	–	–	–	–	–	–	–
Romagnoli 2006[244]	1	–	–	–	–	–	–	–
Rooyackers 2003[187]	–	–	–	–	–	–	–	–
Sassi-Dambron 1995[134]	–	–	–	–	–	–	1	–
Scherer 2000[258]	–	–	–	–	1	–	–	–
Sewell 2005[152]	1	–	–	–	1	–	1	1
Sewell 2006[153]	1	–	–	–	1	–	1	1
Seymour 2010[154]	1	–	–	–	–	–	–	–
Shao 2003[202]	–	–	–	–	–	–	–	–
Simpson 1992[135]	–	–	–	–	–	–	–	–
Singh 2003[241]	–	–	–	–	–	–	–	–
Sívori 1998[263]	–	–	–	–	–	–	–	–
Smith 1999[168]	1	–	–	–	–	–	–	–
Soler 2006[180]	1	–	–	–	–	–	–	–
Solomon 1998[136]	–	–	–	–	–	–	–	–
Spencer 2010[169]	–	–	–	–	–	–	–	–
Spruit 2002[247]	–	–	–	–	–	–	–	–
Sridhar 2008[155]	1	–	–	1	–	–	1	–
Stulbarg 2002[137] A	1	1	–	–	1	–	1	–
Stulbarg 2002[137] B	1	1	–	–	1	–	1	–
Stulbarg 2002[137] C	1	1	–	–	1	–	1	–
Subin 2010[242] A	–	–	–	–	1	–	–	–
Subin 2010[242] B	–	–	–	–	1	–	–	–
Subin 2010[242] C	–	–	–	–	1	–	–	–
Theander 2009[220]	–	–	–	–	–	–	–	–
Toshima 1990[138]	1	–	–	–	1	–	1	1
Trappenburg 2011[188]	–	–	–	–	1	1	1	–
Troosters 2000[248]	–	–	–	–	–	–	–	–
Van Gestel 2012[208]	–	–	–	–	–	–	–	–
Vogiatzis 2002[265]	1	–	–	–	1	–	1	1
Vonbank 2012[246] A	–	–	–	–	–	–	–	–
Vonbank 2012[246] B	–	–	–	–	–	–	–	–
Vonbank 2012[246] C	–	–	–	–	–	–	–	–
Wadell 2004[221] A	–	–	–	–	–	–	–	–
Wadell 2004[221] B	–	–	–	–	–	–	–	–
Wadell 2004[221] C	–	–	–	–	–	–	–	–
Wakabayashi 2011[262]	1	–	–	–	–	1	1	–
Wang 2004[203]	–	–	–	–	1	–	–	–
Warlies 2006[209]	–	1	–	–	–	1	1	–
Waterhouse 2010[277]	1	–	–	–	–	–	1	–
Watson 1997[231]	–	–	–	–	–	–	–	–
Wedzicha 1998[157]	1	–	–	1	1	1	1	1

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
–	–	–	–	–	–	–	–	–	**0**
1	1	–	–	–	–	1	–	–	**4**
–	–	–	–	–	–	1	–	–	**1**
1	–	–	–	–	–	1	–	–	**3**
–	–	–	–	–	–	–	–	–	**1**
1	1	–	–	1	–	1	–	–	**8**
1	1	–	–	1	–	1	–	–	**8**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**1**
1	–	–	1	–	–	1	–	–	**4**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**4**
–	1	–	–	–	–	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**6**
–	1	–	–	–	–	1	–	–	**6**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
1	–	–	–	–	–	1	–	–	**6**
1	–	1	1	–	–	1	–	–	**7**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
1	1	–	–	–	–	1	–	–	**7**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
1	–	1	1	–	–	1	–	–	**7**
–	–	–	–	–	–	–	–	–	**1**
–	–	–	1	–	–	–	–	–	**4**
–	1	–	–	1	–	1	–	–	**5**
–	–	–	–	–	–	–	–	–	**0**
1	1	–	1	–	–	–	–	–	**9**

APPENDIX 24

Author, year	Comparator							
	Disease knowledge	Unspecified SM	RMT	Action planning	Breathing	Smoking	Medication	Bronchial hygiene
Weekes 2009[158]	–	–	–	–	–	–	–	–
White 2002[159]	1	–	–	1	1	–	1	1
Wijkstra 1994[189]	–	–	–	–	–	–	–	–
Wijkstra 1995[190] A	–	–	–	–	–	–	–	–
Wijkstra 1995[190] B	–	–	–	–	–	–	–	–
Wijkstra 1995[190] C	1	–	1	–	1	–	1	–
Wittmann 2007[210]	–	1	–	–	1	–	1	–
Wong 2005[74]	–	–	–	–	–	–	–	–
Wood-Baker 2006[170]	1	–	–	–	1	1	1	1
Wright 2003[211]	–	–	–	–	–	–	–	–
Xu 2010[204] A	–	–	–	–	–	–	–	–
Xu 2010[204] B	–	–	–	–	–	–	–	–
Xu 2010[204] C	–	–	–	–	–	–	–	–
Xu 2010[204] D	–	–	–	–	1	–	–	–
Xu 2010[204] E	–	–	–	–	–	–	–	–
Xu 2010[204] F	–	–	–	–	–	–	–	–
Yamaguti 2012[235]	–	–	–	–	–	–	–	–
Yeh 2010[139]	–	–	–	–	–	–	–	–
Zhang 2008[205] A	–	–	–	–	–	–	–	–
Zhang 2008[205] B	–	–	–	–	–	–	–	–
Zhang 2008[205] C	–	–	–	–	–	–	–	–
Total number	**68**	**9**	**11**	**9**	**52**	**18**	**43**	**16**

1, component present.

Nutrition	Psychological	Preventative	Inhaler	Energy conservation	Support groups	Exercise	Enhanced access	Other	Total number
1	–	–	–	–	–	–	–	–	**1**
1	1	–	1	–	–	1	–	–	**9**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	1	–	–	–	–	1	1	–	**7**
1	1	–	1	–	–	1	–	–	**7**
–	–	–	–	–	–	–	–	–	**0**
1	1	1	1	–	1	1	–	–	**11**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	–	–	**2**
–	1	–	–	–	–	1	–	–	**2**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	1	–	–	**1**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	–	**0**
–	–	–	–	–	–	–	–	1	**1**
28	**34**	**11**	**19**	**7**	**3**	**96**	**15**	**4**	**443**

Appendix 25 Direction of effects for hospital admissions, exacerbation and health-related quality-of-life outcomes at last follow-up: review 4

First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	SGRQ				CRQ		
							Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Aimonino Ricauda 2008[75]	1	1	0	26	↑								
Arnardottir 2006[216]	1	0	0	16								↔	
Arnardottir 2007[217]	1	0	0	52			↔	↔	↔	↔			
Barakat 2008[249]	1	0	0	14			↑	•	•	•			
Bauldoff 2002[108]	1	0	0	8			↔	↔	↔	↔			
Bauldoff 2005[109] A	1	0	0	4			↔	↔	↔	↔			
Bauldoff 2005[109] B	1	0	0	4			↔	↔	↔	↔			
Bauldoff 2005[109] C	1	0	0	4			↔	↔	↔	↔			
Beckerman 2005[253]	1	1	0	52	↔		↔						
Behnke 2000[64]	1	1	0	78	↑							↑	↑
Bendstrup 1997[222]	1	0	0	24							↑		
Bernard 1999[191]	1	0	0	12								↔	↔
Berry 2010[110]	1	0	0	52							↔		
Bestall 2003[141]	1	0	0	52			↔				↔		
Bjornshave 2005[223]	1	0	0	4									
Blake Jr 1990[111]	1	0	0	52									
Bonilha 2009[232]	1	0	0	25			↔						
Bourbeau 2003[192]	1	1	1	52	↑	↔	↔	↔	↔	↔			
Boxall 2005[160]	1	1	0	12	↔		↑	↔	↔	↑			
Breyer 2010[245]	1	0	0	39									
Brooks 2002[193]	1	0	0	52							↔	↔	↔
Bucknall 2012[63]	1	1	0	52	↔		↔	↔	↔	↑			
Busch 1988[194]	1	0	0	18								↔	
Cai 2006[199]	1	0	1	26		↑	•	•	•	•			
Carr 2009[195]	1	0	0	12								↑	↔
Casas 2006[71]	1	1	0	52	↑		↔	↔	↔	↔			
Chan 2010[212] A	1	1	1	13	↔	↔	↔	•	•	•			
Chan 2010[212] B	1	1	1	13	↔	↔	↔	•	•	•			
Chan 2010[212] C	1	1	1	13	↔	↔	↔	•	•	•			
Cockcroft 1987[142]	0	1	0		↔								
Coultas 2005[112] A	1	1	0	26	↔		↔	↔	↔	↔			
Coultas 2005[112] B	1	1	0	26	↔		↔	↔	↔	↔			
Coultas 2005[112] C	1	1	0	26	↔		↔	↔	↔	↔			
Covey 2001[113]	1	0	0	16							↔		
de Blok 2006[181]	1	0	0	9			↔	↔	↔	↔			
Dheda 2004[73]	1	1	1	26	↔	↔	↑	↑	↔	↑			
Donesky-Cuenco 2009[114]	1	0	0	12								↔	↔
Dourado 2009[233] A	1	0	0	12			↔	•	•	•			
Dourado 2009[233] B	1	0	0	12			↔	•	•	•			
Dourado 2009[233] C	1	0	0	12			↔	•	•	•			
du Moulin 2009[206]	1	0	0	26		↔					↑	↑	↑
Eaton 2009[227]	1	1	0	13	↔							↔	↑
Effing 2009[161]	1	1	1	52	↔	↔						↔	↔

		SF-36													
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
				↔	↔	↔	↔	↔	↔	↔	↔			NHP	↑
↑	↑														
														YQLQ	↔
↔	↔														
			↔	↔											
		•	•												
														SIP physical	↑
		↑	↔												
↔	↔			•	•			•							
													↔		
↔	↔														
													↔		
				↔	↔	↔	↔	↔	↔	↔	↔				
				↔	↔	↔	↔	↔	↔	↔	↔				
				↔	↔	↔	↔	↔	↔	↔	↔				
				↔		↔	↔	↔							
↔	↔	↔	↔												
														AQ20	
														AQ20	
														AQ20	
↔	↔														
↔	↔	↑	↔												
↔	↔														

First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	SGRQ				CRQ		
							Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Efraimsson 2008[218]	1	0	0					↑					
Egan 2002[69]	1	1	0		↔								
Elci 2008[236]	1	0	0	13			↑						
Elliott 2004[162] A	1	0	0	13							↑		
Elliott 2004[162] B	1	0	0	13							•		
Elliott 2004[162] C	1	0	0	13							•		
Emery 1998[115] A	1	0	0	10									
Emery 1998[115] B	1	0	0	10									
Emery 1998[115] C	1	0	0	10									
Engstrom 1999[219]	1	0	0	52			↔	↔	↔	↔			
Fernandez 2009[171]	1	0	0	52			↑	•	•	•			
Finnerty 2001[143]	1	0	0	26			↑	•	•	•			
Foy 2001[116]	1	0	0	78								↑	↑
Gallefoss 1999[255]	1	1	0	52	↔		↔	↔	↔	↔			
Ghanem 2010[264]	1	0	0	9								↑	↑
Gilmore 2010[117] A	1	0	0	?			•	•	•	•			
Gilmore 2010[117] B	1	0	0	?			•	•	•	•			
Gilmore 2010[117] C	1	0	0	?			•	•	•	•			
Gilmore 2010[117] D	1	0	0	?			•	•	•	•			
Gilmore 2010[117] E	1	0	0	?			•	•	•	•			
Gilmore 2010[117] F	1	0	0	?			•	•	•	•			
Gohl 2006[207]	1	0	0	52			↔	•	•	•			
Goldstein 1994[196]	1	0	0	24								↑	↑
Green 2001[144]	1	0	0	7							↑	↑	↔
Güell 2000[172]	1	0	0	17								↑	↔
Güell 2006[173]	1	1	1	104	↔	↑						↑	↔
Guyatt 1992[118]	1	0	0	26									↔
Hermiz 2002[67]	1	1	0	13	↔		↔	↔	↔	↔			
Hernandez 2000[282]	1	1	0	8	↑		↑	↔	↔	↑			
Hernandez 2003[68]	1	0	0	12	↔						↑	↑	↑
Hill 2006[163]	1	0	0	8							↔	↑	↑
Holland 2004[164]	1	0	0	6								↔	↔
Hoogendoorn 2009[182]	1	1	1	104	•	↔	↑						
Hospes 2009[183]	1	0	0	12			↑	↔	↔	↔			
Hsiao 2003[259] A	1	0	0										
Hsiao 2003[259] B	1	0	0										
Hsiao 2003[259] C	1	0	0										
Hynninen 2010[256]	1	0	0	35			↔						
Janaudis-Ferreira 2011[197]	1	0	0	6							↔	↔	
Jang 2006[267]	1	0	0	8									
Jarab 2012[266]	1	1	1	26	↑	↔	↔	↔	↔	↔			
Karapolat 2007[237]	1	0	0	12			↑	↑	↑	↑			
Katiyar 2006[240]	1	0	0	13			↑	•	•	•			

		SF-36														
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
														SF-36 total	↑
														SIP total	↔
														SIP total	↑
														SIP total	↔
														SIP total	↔
↑	↑														
↑	↑	↑	↑	•	•	•	•	•	•	•	•	•			
			•	•	•	•	•	•	•	•	•	•			
↑	↑													QWB & SIP	↔
↑	↑														
↔	↑														
↑	↑														
↔															
														SF-12	
↑	↑														
•	•														
↔	↔														
				↔	↔	↔	↔	↔	↔	↔	↔			CCQ	↔
														SF-36	ns
														SF-36	ns
														SF-36	•
														QoL	↑

First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	SGRQ				CRQ		
							Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Kayahan 2006[238]	1	0	0	9			↑						
Khdour 2009[251]	1	1	1	52	↑	•	↔	↑	↔	↑			
Kim 1993[119]	1	0	0	26									
Ko 2011[213]	1	1	1	52	↔	↔	↔	↔	↔	↔			
Koff 2009[120]	1	1	1	13	•	↔	↑	↔	↔	↔			
Koppers 2006[184]	1	0	0	5							↔		
Kunik 2008[121]	1	0	0	52	↔							↔	↔
Kwok 2004[70]	0	1	0		↔								
Lamers 2010[185]	1	0	0	39			↑	↔	↔	↑			
Larson 1988[122]	1	0	0										
Larson 1999[123] A	1	0	0	17								•	•
Larson 1999[123] B	1	0	0	17								•	•
Larson 1999[123] C	1	0	0	17								•	•
Larson 1999[123] D	1	0	0	17								•	•
Larson 1999[123] E	1	0	0	17								•	•
Larson 1999[123] F	1	0	0	17								•	•
Lee 2002[66]	0	1	0	26	↔								
Leung 2010[165]	1	0	0	8							↔	↔	↔
Li 2002[200]	1	0	0	13									
Liddell 2010[145]	1	0	0	8			•						
Lindsay 2005[214]	1	0	0	13								↔	↔
Linneberg 2012[224]	1	0	0	52			↔						
Littlejohns 1991[146]	1	0	0	52	↔								
Liu 2008[260]	1	1	1	52	↑	•							
Livermore 2010[166]	1	1	0		↔		↔						
Lord 2010[147]	1	0	0	7			↔						
Madariaga 2007[174] A	1	0	0	8								↔	↔
Madariaga 2007[174] B	1	0	0	8								↔	↔
Madariaga 2007[174] C	1	0	0	8								↔	↔
Mador 2004[126]	1	0	0	8							↑	↑	↑
Mador 2005[125]	1	0	0	8							↔	↔	↔
Mador 2009[124]	1	0	0	8								↔	↔
Magadle 2007[254]	1	0	0	39			↑						
Maltais 2008[198]	1	1	1	52	•	•	•					↔	↔
Man 2004[148]	1	1	0	13	↔		↑	↔	↔	↑		↑	↑
Martin 2004[228]	1	1	0	52	↔								
McGeoch 2006[229]	1	1	0	52	↔		↔	↔	↔	↔			
Monninkhof 2003[186]	1	0	0	52			↔	↔	↔	↔			
Moore 2009[284]	1	0	0	6		↔							
Mota 2007[175]	1	0	0	5			•	•	•	•			
Mularski 2009[127]	1	0	0	8			↔	↔	↔	↔			
Murphy 2005[252]	1	0	1	6		↔	↔	•	•	•			
Nakamura 2008[261] A	1	0	0	12									

		SF-36														
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
														SIP total	•
↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔				
														SIP	↔
↔	↔														
														ADL, social activities	↑
↔	↔														
														SIP physical functioning	↑
		↑													
		↑	↔												
↔	↔														
↔	↔														
↔	↔														
↑	↑														
↔	↔														
↔	↔														
↔	↔														
↑	↑	↑	↑												
													↔		
														QoL	
		↑	↔												
													•		
				↑	↔	↔	↔	↔	↔	↔	↔				

							SGRQ				CRQ		
First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Nakamura 2008[261] B	1	0	0	12									
Nakamura 2008[261] C	1	0	0	12									
Ng 2011[215]	1	0	0	26								↔	↔
Nguyen 2008[128]	1	0	0	26			↔						
Nguyen 2009[129]	1	0	1	26		•						↔	↔
Nield 2007[130] A	1	0	0	12									
Nield 2007[130] B	1	0	0	12									
Nield 2007[130] C	1	0	0	12									
Ninot 2011[250]	1	1	0	52	↔		↔						
Normandin 2002[131]	1	0	0	8								↔	↔
Norweg 2005[132] A	1	0	0	24							↔	↔	↔
Norweg 2005[132] B	1	0	0	24							↔	↔	↔
Norweg 2005[132] C	1	0	0	24							↑	↔	↔
Oh 2003[283]	1	0	0	8							↑	↔	↑
O'Neill 2007[150]	1	0	0	26							↔	↔	↔
Ortega 2002[176] A	1	0	0	24								↔	↔
Ortega 2002[176] B	1	0	0	24								↔	↔
Ortega 2002[176] C	1	0	0	24								↔	↔
O'Shea 2007[167]	1	0	0	24								↔	↔
Ozdemir 2010[239]	1	0	0	4							•	•	•
Paz-Diaz 2007[269]	1	0	0	9			↑	•	•	•			
Petersen 2008[225]	1	0	0	7			↑	↔	↔	↔			
Petty 2006[133] A	1	0	0	16									
Petty 2006[133] B	1	0	0	16									
Petty 2006[133] C	1	0	0	16									
Pomidori 2012[243]	1	0	0	52			•						
Prince 1989[151]	1	0	0	6									
Probst 2011[234]	1	0	0	12									
Puente-Maestu 2000[177]	1	0	0	52								•	•
Puhan 2006[257]	1	0	0	5							↔	↔	↔
Rea 2004[230]	1	1	0	52	↔							↔	↑
Regiane Resqueti 2007[178]	0	0	1			•							
Ren 2011[201] A	0	0	1			•							
Ren 2011[201] B	0	0	1			•							
Ren 2011[201] C	1	0	0	26	•							↑	↑
Rice 2010[140]	1	1	0	52	↑	↑	↑						
Riera 2001[179]	1	0	0	26								↑	↔
Ringbaek 2000[226]	1	0	0	8			↔						
Romagnoli 2006[244]	1	1	0	56	↔		↔	↑	↔	•			
Rooyackers 2003[187]	1	0	0	10							↓		
Sassi-Dambron 1995[134]	1	0	0	26									
Scherer 2000[258]	1	0	0	8									

		SF-36												
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
				↔	↔	↔	↔	↔	↔	↔	↑				
				↔	↔	↔	↔	↔	↔	↔	•				
↔	↔	↔	↔				↔				↔				
		↔	↔												
↔	↔	↔	↔												
		•													
		•													
		•													
↔	↔														
↔	↔														
↔	↔														
↔	↔														
↑	↑														
↔	↔														
↔	↔														
↔	↔														
↔	↔														
↔	↔														
•	•														
														SOLDQ	•
														SOLDQ	•
														SOLDQ	•
														VAS	•
														GHQ	•
•	•														
↔	↔														
↔	↑			↔	↔	↔	↔	↔	↔	↔	↔				
↔	↔														
↔	↔													PGWB index	↔
														QWB total	↔
		↑	↔												

							SGRQ				CRQ		
First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Sewell 2005[152]	1	0	0	7								↔	↔
Sewell 2006[153]	1	0	0	7							↔	↔	↔
Seymour 2010[154]	1	1	1	13	↑	↑	↑	↔	↑	↔		↑	↔
Shao 2003[202]	1	0	0	52									
Simpson 1992[135]	1	0	0	8							↑	↔	↔
Singh 2003[241]	1	0	0	4								↑	↑
Sívori 1998[263]	1	1	0	8	•	•	•				•		
Smith 1999[168]	1	1	0	52	↔								
Soler 2006[180]	1	1	1	52	↑	•	↔	↔	↔	↔			
Solomon 1998[136]	1	1	0	26	↔								
Spencer 2010[169]	1	1	1	52	↔	↔	↔	↑	↔	↔			
Spruit 2002[247]	1	0	0	12	↔						↔		
Sridhar 2008[155]	1	1	0	104	↔						↑	•	•
Stulbarg 2002[137] A	1	0	0	9								↑	↔
Stulbarg 2002[137] B	1	0	0	9								↔	↔
Stulbarg 2002[137] C	1	0	0	9								↔	↔
Subin Rao 2010[242] A	1	0	0	4								•	•
Subin Rao 2010[242] B	1	0	0	4								•	•
Subin Rao 2010[242] C	1	0	0	4								•	•
Theander 2009[220]	1	0	0	12			↔	↔	↔	↔			
Toshima 1990[138]	1	1	0	26	↔								
Trappenburg 2011[188]	1	1	1	26	↔	↔	↔	↔	↔	↔			
Troosters 2000[248]	1	0	0	78							↔	↔	↔
Van Gestel 2012[208]	1	0	0	4							↔		
Vogiatzis 2002[265]	1	0	0	13							↔	↔	↔
Vonbank 2012[246] A	1	0	0	12			↔	•	•	•			
Vonbank 2012[246] B	1	0	0	12			↔	•	•	•			
Vonbank 2012[246] C	1	0	0	12			↔	•	•	•			
Wadell 2004[221] A	1	0	0	12			↔	↔	↑	↔			
Wadell 2004[221] B	1	0	0	12			↔	↔	↔	↔			
Wadell 2004[221] C	1	0	0	12			↔	↔	↑	↔			
Wakabayashi 2011[262]	1	0	0	52	↔		↔						
Wang 2004[203]	1	0	0	15									
Warlies 2006[209]	1	0	0	26			↔	•	•	•			
Waterhouse 2010[277]	1	0	0	78							↔	↔	↔
Watson 1997[231]	1	0	0	26			↔	?	?	?			
Wedzicha 1998[157]	1	0	0	8			↔				↔		
Weekes 2009[158]	1	0	0	52			↑	↔	↔	↑			
White 2002[159]	1	0	0	13							↔	↔	↔
Wijkstra 1994[189]	1	0	0	12								↑	↔
Wijkstra 1995[190] A	1	0	0	78							↔		↔
Wijkstra 1995[190] B	1	0	0	78							↑		↔
Wijkstra 1995[190] C	1	0	0	78							↓		↔
Wittmann 2007[210]	1	1	0	52	•		↔	•	•	•			

		SF-36														
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
↔	↔														
↔	↔														
↑	↔												↔		
														ADL, social activities	
↔	↔														
↑	↑														
														CO-OP	•
				↔	↔	↔	↔	↔	↔	↔	↔				
•	•														
↔	↑	↔	↔	↔	↔	↔	↔	↑	↔	↔	↔	↑			
↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔			
↔	↑	↔	↔	↔	↔	↔	↔	↑	↔	↔	↔	↔			
•	•														
•	•														
•	•														
				↔	↔	↔	↔	↔	↔	↔	↔				
														QWB total	•
↔	↔														
↔	↔														
		↑	↔												
		↔	↔												
		↑	↔												
														QoL	•
↔	↔	↔	↔										↔		
												↑			
↔	↔			↔					↔						
↑	↑														
↔	↔														
↔	↑														
↔	↔														

APPENDIX 25

First author	QoL	Hospital (re) admissions	Exacerbations	Follow-up (weeks)	Hospital admissions	Exacerbations	SGRQ				CRQ		
							Total	Symptoms	Activity	Impact	Total	Dyspnoea	Fatigue
Wong 2005[74]	0	1	0	13	↔								
Wood-Baker 2006[170]	1	1	0	52	↔		↔	↔	↔	↔			
Wright 2003[211]	1	0	0	12			•						
Xu 2010[204] A	1	0	0	52							↑		
Xu 2010[204] B	1	0	0	52							↑		
Xu 2010[204] C	1	0	0	52							↑		
Xu 2010[204] D	1	0	0	52							↑		
Xu 2010[204] E	1	0	0	52							↑		
Xu 2010[204] F	1	0	0	52							↔		
Yamaguti 2012[235]	1	0	0	4			↑	↑	↔	↑			
Yeh 2010[139]	1	0	0								↑	↔	↑
Zhang 2008[205] A	1	0	0	8									
Zhang 2008[205] B	1	0	0	8									
Zhang 2008[205] C	1	0	0	8									

ADL, activities of daily living; AQ20, airways questionnaire 20; CCQ, Clinical COPD Questionnaire; CO-OP, Dartmouth Primary Care Co-operative Quality of Life Questionnaire; MCS, mental component summary; NHP, Nottingham Health Profile; PCS, physical component summary; PGWB, Psychological General Wellbeing Index; QWB, quality of wellbeing; SF-12, Short Form questionnaire-12 items; SIP, Sickness Impact Profile; SOLDQ, Seattle Obstructive Lung Disease questionnaire; VAS, visual analogue scale; YQLQ, York Quality of Life Questionnaire.

Notes

↑ Intervention group had significantly better outcome than comparator.
↓ Intervention group had significantly worse outcome than comparator.
↔ No significant difference between study groups.
• Outcome reported, but difference between study arms not reported.

		SF-36														
Emotional function	Mastery	PCS	MCS	Physical functioning	Role physical	Bodily pain	General health	Vitality	Social functioning	Role emotional	Mental health	Change in health	EQ-5D	Other	Other effect
↔	↔													Mood, dyspnoea, social activity, household activity, headache, appetite, anxiety	•

Appendix 26 Risk of bias assessment for all included studies with primary outcomes: review 4

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Aimonino Ricauda 2008[75]	LOW Computer-generated random numbers	LOW Sealed numbered envelopes	HRQoL: HIGH Hospital admission: UNCLEAR Method not stated	LOW ITT analysis 23% dropout – balanced in number and similar reasons between groups No comment on the baseline characteristics of dropouts vs. completers but only 3% lost to follow-up – remainder were deaths	UNCLEAR No protocol	HIGH Baseline data provided for all participants Gender and percentage on home oxygen imbalanced was between groups – the home oxygen use was greater in the intervention group
Arnardottir 2006[216]	UNCLEAR 'Blindly randomised in block of 4'	LOW 'Blindly randomised'	HIGH 'Self-administered questionnaires'	UNCLEAR Withdrawals reported, but no ITT	LOW All outcomes reported	UNCLEAR Very small sample Baseline line differences for rate of perceived exertion and 12-MWD
Arnardottir 2007[217]	UNCLEAR 'Stratified according to disease severity . . . randomised into blocks of 4'	UNCLEAR 'Closed envelope method'	HRQoL: HIGH	HIGH 40% loss to follow-up – higher functional/residual capacity and lung capacity = more severe disease; no other differences in dropouts; reasons given for dropouts but no numbers per arm	LOW	HIGH No description of baseline characteristics of those lost to follow-up

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Barakat 2008[249]	LOW Randomisation was in blocks of 10, using random numbers	UNCLEAR Not mentioned	HRQoL: HIGH	LOW SGRQ 9/80 missing; provided reasons for dropouts, equal numbers per arm	UNCLEAR	HIGH 'Excluded' participants from analysis after randomisation, including 2/40 who did not adhere to rehabilitation programme Some imbalance in FVC at baseline: 86.1 (17.8) vs. 78.7 (5.5)
Bauldoff 2002[108]	UNCLEAR	UNCLEAR	HRQoL: HIGH	UNCLEAR Mean data given only for outcomes therefore no details on '*n*'; it could be assumed that there was complete follow-up	UNCLEAR HRQoL mentioned in methods and reported in results	UNCLEAR Baseline characteristics seem balanced, (age imbalance, $p < 0.05$ but values not stated); gender not mentioned
Bauldoff 2005[109]	UNCLEAR	UNCLEAR Not clear when allocated to intervention	UNCLEAR No mention	LOW All subjects accounted for	LOW No study protocol but report includes all outcomes	LOW
Beckerman 2005[253]	LOW 'The patients were randomised using a random numbers table into two groups'	UNCLEAR NR	HRQoL: LOW Sham training intervention is control; mode of data collection not reported but blinded assessor Hospital admission/ length of stay: LOW Self-reported but reported on daily by blinded assessor telephone call	HIGH Dropouts – more from control group dropped out and more deaths in control group (2 vs. 4) Characteristics of dropouts not described	UNCLEAR No protocol	LOW Well-matched baseline with all participants reported No discussion of limitations in discussion

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Behnke 2000[64]	UNCLEAR	UNCLEAR	HRQoL: HIGH Questionnaires unblinded	HIGH 16/46 dropped out – 8 from each group; reasons given for each and fairly similar but small numbers; possible that exacerbation may be more of a reason for dropout in the control group; no comparison of those who drop out with those who complete	UNCLEAR HRQoL reported in methods and results	HIGH Baseline data/demographics only given only for completers; seems balanced
Behnke 2003[65]	UNCLEAR Stated randomised, no method given	UNCLEAR	HRQoL: LOW Self-reported intervention vs. UC control Hospital admissions: LOW Exacerbations: LOW	UNCLEAR Only 26 of the 30 previously recruited patients took part in this follow-up study – no reasons given for the dropouts Is an ITT analysis of the 26 patients	UNCLEAR No protocol	HIGH Baseline reported for all 26 patients (but not the 30 previous trial completers) Intervention group average age 5 years younger
Bendstrup 1997[222]	UNCLEAR	UNCLEAR	HRQoL: HIGH Comments indicate that patients were not blind as control group told would get intervention at end of study if it proved effective	HIGH Only 32/47 randomised patients completed Reasons for dropouts stated but not clear for 5/15 dropouts to which group they belonged; four dropped out of intervention and five from control; small number but similar reason	UNCLEAR Method = results section	HIGH Demographics supplied for only those who completed the intervention in each arm Appear balanced but small numbers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Bernard 1999[191]	UNCLEAR	UNCLEAR	HRQoL: HIGH	UNCLEAR 4/19 and 5/26 failed to complete, reasons given but not by group; no comparison with completers	UNCLEAR HRQoL mentioned in the methods and results	HIGH Baseline data only for completers Fairly well balanced Baseline HRQoL not reported; only comparisons of change in each group
Berry 2010[110]	LOW 'Randomisation was performed using a web-based randomisation application'; 'stratified by gender and study period'. Block sizes varied randomly between 4 and 6	LOW 'Only the statisticians were unblinded to the randomisation scheme'	HRQoL: HIGH	Lifestyle activity programme: 24/87 dropped out; traditional exercise therapy: 20/89 Details of reasons for dropout were provided by study group; higher dropouts were due to medical condition in traditional exercise therapy than lifestyle activity programme (6 vs. 2) 'The dropouts were significantly younger and there were a relatively low percentage with comorbid illness'	UNCLEAR	LOW
Bestall 2003[141]	LOW 'Randomisation sequence was computer generated'	UNCLEAR Blocks of eight in sealed envelopes	HRQoL: HIGH	LOW All patients accounted for	LOW All outcomes reported	LOW Baseline balanced

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Bjornshave 2005[223]	UNCLEAR 'After inclusion, the patients were randomised' (p. 103)	UNCLEAR Timing of randomisation is unclear	No information on who performed tests and whether blinded HRQoL: HIGH	HIGH Withdrawals reported – slightly higher in intervention group However, dropouts were excluded in analysis; no imputation or baseline observation carried forward	LOW All prespecified outcomes reported	UNCLEAR None – no adjustments for sex or baseline FEV_1, which differed at baseline – but small numbers and baseline differences not statistically significant
Blake Jr 1990[111]	UNCLEAR Stated randomised but no method detailed	UNCLEAR NR	HRQoL: HIGH Self-reported intervention vs. UC control Admissions: LOW Self-reported at monthly intervals	UNCLEAR ITT analysis < 10% dropout/incomplete data No comparison of those with incomplete data/ attendance with those with complete data/attendance	UNCLEAR No protocol	HIGH Baseline characteristics reported for all participants; unbalanced HRQoL 11.3 vs. 14.4, intervention vs. control Intervention group more educated (40% beyond high school vs. 22%)
Bonilha 2009[232]	UNCLEAR 'The volunteers were then randomised to a Singing Group or to a Control Group' No information on method of randomisation	UNCLEAR	HRQoL: LOW Self-completed comparison of interventions (singing vs. handcrafts) No mention of single blinding of outcome assessors	HIGH ITT analysis – NR Characteristics of patients who dropped out not discussed 30% overall dropout rate (25% from control group, 34% from intervention) Similar reasons and proportions of dropout from each group Characteristics of patients who dropped out not discussed	UNCLEAR No protocol	HIGH Baseline only reported for trial completers Difference in HRQoL at baseline between groups – 10 points on the SGRQ Current smokers excluded

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Bourbeau 2003[192]	LOW 'Patients underwent randomisation with the use of a central computer-generated list of random numbers'	LOW Central allocation in blocks	Independent evaluator HRQoL: HIGH Admissions: LOW Exacerbations: LOW	LOW All patients accounted for; dropout slightly higher in control	LOW All outcomes reported	LOW Baseline balanced
Gadoury 2005[271]	UNCLEAR 'Randomly assigned'	UNCLEAR	LOW Patients unblinded, but outcome data from hospital and insurance database	LOW Withdrawals reported, and ITT performed	LOW All outcomes reported	UNCLEAR Protocol only adhered to strictly for year 1; case manager available for some subjects
Boxall 2005[160]	LOW Computer-generated random numbers	UNCLEAR Coded into opaque envelopes by person blinded	'Neither assessors or patients were blinded' HRQoL: HIGH Admissions: LOW	UNCLEAR Withdrawals reported, but no ITT	LOW All outcomes reported	LOW
Breyer 2010[245]	LOW 'Randomisation . . . was done by a computer-generated algorithm . . .'	UNCLEAR	HRQoL: HIGH	HIGH No ITT analysis Very low dropout rate – 7.6% but no reports of characteristics of dropouts Similar dropout rate for both intervention and control groups But dropout from intervention due to exacerbation; dropout from control as a result of loss to follow-up	LOW Protocol available	HIGH Retired patients or on sick leave? Highly motivated patients – note low dropout Baseline well matched but only reported for trial completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Brooks 2002[193]	LOW Random numbers table	UNCLEAR	HRQoL: HIGH Intervention vs. UC	UNCLEAR Appears to be ITT analysis Similar proportions of dropouts – reasons not detailed Stated no differences in baseline characteristics between groups and details reported	UNCLEAR No protocol	LOW Baseline characteristics reported for all patients
Bucknall 2012[63]	LOW 'We used a minimisation technique to stratify randomisation of participants by demographic factors . . . We constructed a computer-generated sequence by using the method of randomised permuted blocks of length four, with two allocations being made at random and two by minimisation'	LOW 'The researcher did not know whether a participant was being allocated at random or by minimisation and could therefore not determine the next treatment allocation before enrolling each participant'	HRQoL: HIGH Hospital admissions: LOW 'The study team were blind to information on hospital admissions when these classifications were made' 'Participants received monthly telephone calls from an independent researcher, blinded to the patients' randomisation status, to collect information on health service usage and exacerbations'	HRQoL: HIGH Self-completed questionnaires with only 61% returned – failure to complete associated with sicker, more depressed and lower self-efficacy Time to admission or death: LOW 11% dropout rate (low) – but more withdrawals from the control group, – 21 vs. 32 Similar and small (three and four, respectively) numbers lost to follow-up in each treatment group ITT analysis of primary outcome (readmission or death)	UNCLEAR Protocol available Additional subgroup analyses were added during the trial 'Within the first few months, we realised that some participants accepted self-management more readily than others. Therefore, as participants in the intervention group completed their 12-month period of follow-up, we classified them as either a "successful self-manager" or not after case based review by the study team'	UNCLEAR Well matched at baseline across all characteristics Low recruitment rate (47%), but similar recruitment rate to other trials in this field; intervention required high level of commitment so non-participants may not have benefited from the intervention Those who declined more deprived residence area

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Busch 1988[194]	UNCLEAR 'Assigned patients by stratified random sampling to either the control group or exercise group'	UNCLEAR	HRQoL: HIGH	HIGH 20 random 10 : 10; 14 follow-up 7 : 7 Reasons for dropouts documented	UNCLEAR All outcomes in methods reported in results	HIGH Patients excluded from follow-up in exercise group if they did not adhere to exercise regime ($n = 3$); control group if they exercise $n = 2$ Baseline data given for only 14 patients followed up
Cai 2006[199]	Randomly	NR	HIGH			
Carr 2009[195]	UNCLEAR States randomised but randomisation methods not reported	UNCLEAR	Investigator responsible for collection outcome measure data not aware of group allocation HRQoL: HIGH Interviewer delivered CRQ but intervention vs. UC	HIGH Five dropouts due to acute exacerbation 85% completion Report on the characteristics of withdrawn patients – less dyspnoea otherwise similar to completers – no quantification of degree of difference ITT analysis – NR	UNCLEAR No protocol	HIGH 'Comorbidities that might adversely affect outcome measures' excluded – not clear what these are Acute exacerbation removed from follow-up Baseline differences 12% and 24%, respectively, on oxygen in intervention vs. control group – 53% vs. 35% male in intervention vs. control Baseline reported for all completers but only for all participants who did not have an intervening AECOPD between recruitment/baseline and randomisation

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Casas 2006[71]	LOW Computer-generated randomisation	UNCLEAR NR	HRQoL: HIGH Self-reported comparison of intervention vs. UC control Hospital admissions: LOW from records	LOW ITT analysis Similar drop-out rate and reasons between arms 20–26% drop-out rate with death responsible for 17%	UNCLEAR No protocol	UNCLEAR Baseline reported for all patients Gender imbalance (12% vs. 23% female) Difference between type of intervention at the two study sites – GP home visits in Germany; nurse, social worker and physician in Spain
Garcia-Aymerich 2007[72]	LOW 'Assigned using computer-generated random numbers'	LOW 'Blindly assigned'	HRQoL: HIGH Health-care resource use: LOW	HIGH Follow-up intervention 53% Loss to follow-up 3% Follow-up control 60% Loss to follow-up 13% Imbalance in loss to follow-up, high loss	LOW	LOW
Chan 2010[212]	LOW Computer-generated randomisation	UNCLEAR NR	HRQoL: UNCLEAR	LOW ITT analysis; 23% dropout Reasons for dropout similar between groups except loss of interest higher in breathing/exercise group	UNCLEAR No protocol	UNCLEAR Baseline reported for a wide range of characteristics for all participants and gender differences controlled for in analysis

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Chan 2011[272]	LOW Random allocation was done using a randomiser software[21] Both the total number of subjects and number of groups were entered into the computer randomiser, which then generated the random assignment of subjects; this step helped avoid yielding a highly disparate sample size in the study groups; instead, it preserved many positive attributes of simple randomisation	UNCLEAR	Exacerbations: LOW 'The number of COPD exacerbations and hospital admissions during the preceding 6 weeks period was recorded' This study utilised a single-blind, RCT. The research assistants for data collection were blinded to minimise researcher bias	HIGH Overall dropout rate > 10% Total dropout rate = 23% With differences in dropout rates between groups: • 28% control • 14% t'ai chi group • 28% plain exercise	UNCLEAR No protocol	UNCLEAR Very few female patients overall Age: t'ai chi group older average age 69 years vs. 58 years for control and 61 for exercise – also fewer current smokers in t'ai chi group: 17.1% vs. 23.2% vs. 22.4%
Cockcroft 1987[142]	UNCLEAR States randomised but no method described	UNCLEAR NR	HRQoL: HIGH Self-reported intervention vs. UC control Admissions: LOW from records	LOW Low dropout ($n = 2$) from ($n = 75$) sample Not stated as ITT analysis and no comparison of dropouts vs. trial completers, but very low dropout	UNCLEAR No protocol	UNCLEAR Baseline data reported for all participants; limited range of variables reported; well-balanced baseline
Coultas 2005[112]	LOW 'Selected from electronic claims database' 'Computer-generated random list'	UNCLEAR	HRQoL: HIGH 'Self-report health care utilisation' 'Assessors of health care outcomes were blinded'	UNCLEAR Withdrawals reported, but no ITT	LOW All outcomes reported	UNCLEAR Underpowered Baseline line differences for gender

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Covey 2001[113]	UNCLEAR Stated randomised But no details	UNCLEAR NR	HRQoL: LOW Control group is educational intervention Patients blinded to previous responses Stated single blinded	HIGH ITT analysis not reported – appears not to be according to results Larger dropout from IMT group (7 vs. 3) 'Sample characteristics for patients who completed the study and those who did not complete the study were not significantly different' but no detail of this	UNCLEAR NR	HIGH Baseline reported for only the completers BMI higher in educational intervention group Smoking status – NR
de Blok 2006[181]	UNCLEAR 'Randomly assigned'	UNCLEAR	HIGH 'Clinical staff blinded for group assessment'	UNCLEAR Withdrawals reported but no ITT	LOW All outcomes reported	UNCLEAR Very small sample
Dheda 2004[73]	HIGH Stated randomised, no methods described	UNCLEAR NR	HRQoL: HIGH Self-reported UC vs. intervention	UNCLEAR ITT analysis not reported; no comparison of characteristics of dropouts vs. trial completers	UNCLEAR No protocol	UNCLEAR Not clear if baseline reported for all participants or just trial completers; limited range of variables reported at baseline $n = 25$ at completion

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Donesky-Cuenco 2009[114]	UNCLEAR 'Forty-one (41) patients were randomly assigned to the Yoga group or to the UC group' No details of method for assigning	UNCLEAR	HRQoL: HIGH Self-reported Blinding not referred to except – 'Patients were asked about their satisfaction and experiences with the programme during individual exit interviews, which were conducted by the PI, who was not involved with the study operations'	UNCLEAR ITT analysis – stated ITT analysis in flow diagram but numbers stated do not indicate ITT Dropout rate identical, similar reasons – 71% follow-up, all dropouts reported and characteristics compared	No protocol	HIGH Baseline data only reported for trial completers Baseline differences between treatment group and controls – oxygen use higher in treatment group (29% vs. 6%) also mean age higher (4 years older)
Dourado 2009[233]	UNCLEAR 'In groups of 3, patients were randomly assigned to one of the training modalities . . .' No comment on mode of randomisation	UNCLEAR	HRQoL: LOW Self-completed questionnaires and comparison of intervention	HIGH ITT analysis – NR Approximately 25% dropout rate – variable between groups Detail of reasons for dropout provided for only the whole study cohort, not by group 'However, comparisons of these patients (dropouts) with those completing the programs did not show significant differences at baseline' No other details	UNCLEAR No protocol	HIGH $n = 35$ but three groups, so each only small Baseline differences Baseline only reported for completing participants

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
du Moulin 2009[206]	LOW For randomisation purposes, we prepared 20 envelopes, 10 with a plus, indicating intervention group, and 10 with a minus, indicating control group; patients drew these envelopes themselves; if this was not possible, a third person not involved in the study randomised the patient	UNCLEAR Opaque envelopes	HRQoL: HIGH Self-completion with assistance if required Intervention vs. normal care	HIGH ITT analysis Large dropout rate – but balance between two groups and different reasons for dropout No comparison of the characteristics of dropout vs. completers	UNCLEAR No protocol	HIGH Very small study size $n = 20$ with 40% dropout Baseline reported for all patients Average age 5 years younger and 20% more smokers in intervention group
Eaton 2009[227]	LOW 'Randomised . . . using computer-generated randomisation'	UNCLEAR 'Computer-generated randomisation with the allocation being concealed until the intervention was assigned' No details about how	HRQoL: HIGH Intervention vs. UC 'The nature of the intervention precluded blinding of participants and health-care providers' Hospital readmission: LOW 'Data were obtained from hospital and primary health-care records and were reconciled with patient home diary records by assessors blinded to the intervention allocation'	HIGH 'Both intention-to-treat and per-protocol analyses are reported' 82 vs. 90% follow-up intervention vs. control 'There were no significant differences in baseline characteristics between attendees and non-attendees' But not detailed	LOW The study was registered prospectively with the Australian Clinical Trials Registry (ACTRNO12605000372684)	HIGH Baseline: 9% fewer current smokers in intervention group and lower total pack-years (by 5 years) – also more European patients in intervention group (83 vs. 68%)

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Effing 2009[161]	LOW Minimisation programme	UNCLEAR	HRQoL: LOW Self-reported, comparison of two interventions Hospital admission Not entirely clear how these data were collected? From records or from diaries? Exacerbations: LOW Data collected from patient diaries but very clearly defined criteria	UNCLEAR ITT analysis done but only after baseline measurement and substantial number of dropouts between randomisation and baseline measurement Imbalance between numbers and reasons for dropout – more dropouts for lack of motivation in self-treatment group Limited comparison between baseline characteristics of dropouts vs. completers – dropouts less dyspnoeic	UNCLEAR No protocol	UNCLEAR Baseline data reported for all patients but note only limited range of variables reported and substantial number of dropouts after randomisation and before baseline measurements Exacerbations clearly defined as negative change in two major symptoms with duration also clearly defined
Effing 2011[278]	LOW 'Patients were randomised into two study groups, using a minimisation programme, nine minimising differences between groups in gender, current smoking, FEV_1 predicted (or > 50%), use of inhaled corticosteroid, and current participation in a regular physiotherapy programme'	UNCLEAR	HRQoL: HIGH Self-completed questionnaire	HIGH ITT analysis done but no reporting on baseline characteristics of dropouts Low dropout rate of 8 (10.5%) Withdrawals from the control group and only three (4%) from treatment group – lost to follow-up/failure to return only in the control group, but total lost to follow-up only 7% Identical and low numbers of deaths	UNCLEAR No protocol	HIGH Baseline variation between groups in ISWT and endurance walking test – intervention group longer distance

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Efraimsson 2008[218]	LOW Matched pairs, independent person drew lots for allocation of either intervention or control	UNCLEAR	HRQoL: HIGH By questionnaire in undisturbed area of clinic, nurse available to answer questions and check patients had responded to all items	UNCLEAR 100% follow-up in tables, yet says 'the dropout rate' was 10 patients, may refer to eligible patients not recruited	UNCLEAR	LOW
Egan 2002[69]	LOW Random number tables	UNCLEAR NR	HRQoL: HIGH Intervention vs. UC control – not entirely clear if control is UC; however, significantly different level of clinical input between intervention and control group	HIGH Dropout rate not balanced between groups (24% from control; 15% from intervention). Reasons not listed for withdrawal and no comparison of characteristics No ITT analysis	UNCLEAR No protocol	HIGH Baseline data listed for all participants Marked gender imbalance between groups – 60% vs. 30% male, intervention vs. control Also variation in income levels Inclusion criteria includes chronic asthma – diagnosis not listed in baseline data
Elci 2008[236]	LOW Randomly allocated using number tables	UNCLEAR	HRQoL: HIGH	LOW Loss to follow-up 15.4%, equal in each arm No description of *n* by outcome	LOW	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Elliott 2004[162]	UNCLEAR Randomly assigned	UNCLEAR No mention of when measures undertaken in relation to randomisation	HIGH No mention of blinding – unsure who undertook measures	LOW Outcome data reported only on completed; no baseline measure carried forward or imputation; but no systematic difference in withdrawals by group (73% complete in intervention vs. 69% in control) Reason for withdrawal described (table 4)	LOW All outcomes reported	LOW
Emery 1998[115]	LOW 'Patients were randomised to one of three groups … Group assignments were taken from a random number schedule, printed on a piece of paper, and placed in a sealed envelope'	LOW 'Participants were not given the envelope containing their group assignment until after completing the baseline assessment, and technical staff conducting the assessments were not aware of group assignments'	HRQoL: HIGH Using self-reported, validated questionnaire	LOW 79 randomised with 6/79 (7.6%) dropouts, which were all reasoned Group A: 4/29 (illness) Group B: 2/25 (transport issues) Group C: no dropouts Differences between completers vs. dropouts assessed	UNCLEAR Outcomes measures in methods section reported in results section	LOW Baseline data reported for all patients randomised; any baseline imbalances made explicit in text
Engstrom 1999[219]	UNCLEAR	UNCLEAR	HIGH	UNCLEAR 2/28 control plus 3/27 dropped out; reasons were given; no comparisons between dropouts and completers undertaken	UNCLEAR HRQoL (SGRQ and generic) mentioned in methods and results	HIGH Baseline data given for only those followed up; fairly balanced

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Fernandez 2009[171]	UNCLEAR Randomised by block allocation but no indication of how	UNCLEAR	No direct comment on blinding for any of the outcomes HRQoL: UNCLEAR Self-completed questionnaire of intervention vs. normal care	HIGH ITT analysis – NR 84% follow-up Similar dropout numbers Three refused from intervention, one refused in control No comment on characteristics of dropouts	UNCLEAR No protocol	HIGH No female patients but baseline well matched; however, only reported for those who completed the study Control group approximately half of the size of the intervention group
Finnerty 2001[143]	LOW 'In blocks of 10 using random numbers'	UNCLEAR	HRQoL: HIGH Patient completed but supervised by a blinded observer	HIGH Many patients failed to attend assessment at baseline after randomisation. HRQoL – quality of outcome data plus whether balance between groups depends on time point for assessment	UNCLEAR HRQoL mentioned in method and results	HIGH Demographics not given for all randomised patients at baseline
Foy 2001[116]	UNCLEAR	UNCLEAR	HRQoL: HIGH	14/70 did not complete 18 months of study in short-term intervention arm; 8/70 in the long-term intervention arm; reason not reported No mention of difference between dropouts and completers	UNCLEAR CRQ mentioned in methods and results	LOW Baseline characteristics given for all randomised parts and seem fairly balanced

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Gallefoss 1999[255]	UNCLEAR	UNCLEAR	HRQoL: HIGH	UNCLEAR 4/31 and 5/31 in control and intervention lost to follow-up; two of those in the hospital group were due to hospitalisation; no other details given	UNCLEAR HRQoL (HRQoL, SGRQ) mentioned in methods and results	UNCLEAR Baseline characteristics are fairly balanced except more never smoked in the intervention group [13% ($n = 4$) vs. 0%]
Gallefoss 2000[280]	LOW 'Using random number tables'	UNCLEAR	HRQoL: HIGH Self-reported hospitalisations: LOW	UNCLEAR Dropouts of patients with COPD were similar between groups: 4/31 and 5/31. Two of the control patients dropped out due to exacerbations but none in the intervention group	UNCLEAR Hospitalisation appears presented as expected. Was HRQoL measured at baseline? (Appears not.) HRQoL data appear to be presented only as a relationship with hospitalisations/GP visits	LOW Baseline data for patients with COPD only appears balanced for the variables tabulated Demographics are presented for all patients at baseline
Gallefoss 2002[391]	LOW Random number table	UNCLEAR	Hospital admission: LOW Self-reported and checked against hospital records Exacerbations: LOW Measured by use and prescribing of rescue medications from pharmacy records	No ITT analysis Low dropout 13% Balanced number and reasons between groups	UNCLEAR No protocol	LOW Baseline reported for all patients – well balanced and good range of characteristic reported, not BMI
Gallefoss 2004[281]	UNCLEAR Randomly assigned	UNCLEAR No mention	UNCLEAR No mention; unlikely to affect results	LOW Withdrawals discussed; no different in withdrawal by group; no imputation	LOW All outcomes reported	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Ghanem 2010[264]	UNCLEAR 'Randomly allocated' – no details given	UNCLEAR No details given	HRQoL: HIGH 'It was not possible to blind patients or assessors'	LOW No loss to follow-up at 2 months follow-up	UNCLEAR	HIGH Large baseline difference in urban/rural residence; high proportion of those not allocated to rehabilitation were 'rural' 86% vs. 56% Considerable baseline difference in 'respiratory failure', more control group had respiratory failure: 72 vs. 43%
Gilmore 2010[117]	LOW Randomly drawn cards in blocks of four	UNCLEAR Allocation concealment – NR	States non-blinded HRQoL: HIGH Not self-completed (read aloud to participants) Four intervention groups – three intervention variants and one UC control	HIGH 27% dropout Reasons for dropouts not reported by group in text Home visit group appears to have higher dropouts Comparison of characteristics of completers with recruits given	UNCLEAR No protocol	UNCLEAR Baseline reported for all and for all completers But baseline comparison between groups reported for only the completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Gohl 2006[207]	Patients were randomised ('lottery'); no further details	UNCLEAR No details	No details	7/17 dropouts in intervention group [two, peripheral arterial disease; one shoulder fracture; one prostate cancer, exacerbation due to infection during main training period (1) or during final assessment period (2)] 8/17 dropouts in control group (two, bereavement; two peripheral arterial disease; two exacerbation due to infection during final assessment period; two non-compliance) No details on differences between patients dropping out or remaining in study	No obvious selective reporting; all outcomes mentioned in methods also reported in results section	Reasons for dropouts described as atypical for this patient population
Goldstein 1994[196]	UNCLEAR Randomised, stratified by 6-MWD	UNCLEAR No details	HRQoL: HIGH	HIGH Follow-up: 78/89 Intervention dropouts 7/45; control 4/44 Details not provided by study arm	UNCLEAR	HIGH Baseline imbalances in sex, number living alone, years since cessation of smoking and number receiving supplementary oxygen
Gourley 1998[286]	UNCLEAR Stated randomised but not methods described	UNCLEAR NR	HRQoL: HIGH Intervention vs. control, which differs markedly in degree of contact	HIGH Total recruitment, follow-up not reported, reported only elsewhere Not ITT analysis	UNCLEAR No protocol	HIGH No baseline data given in this paper; however, reported elsewhere and only for trial completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Guyatt 1999[393]	UNCLEAR Stated randomised, but no detail of method Full method described in Goldstein 1994[196]	UNCLEAR NR	HRQoL: HIGH Self-reported intervention vs. UC control	HIGH 16% vs. 10% dropout in intervention vs. control; reasons for dropout not reported by group ITT – NR No comparison of baseline characteristics of dropouts vs. trial completers	UNCLEAR No protocol	UNCLEAR Baseline reported in Goldstein, 1994;[196] baseline reported for all participants Gender imbalance 57% vs. 43% male in intervention vs. control Baseline HRQoL well balanced
Green 2001[144]	UNCLEAR NR	UNCLEAR Concealed envelopes; envelopes not numbered	HRQoL: LOW Comparison of interventions	Not ITT analysis	UNCLEAR No protocol	HIGH Baseline reported for all participants Mismatched baseline for pack-years (38 vs. 47 in 4-week rehabilitation vs. 7-week rehabilitation); also significant (> 0.5) differences in baseline HRQoL scores
Güell 2000[172]	LOW	HIGH Unconcealed but consecutive patients enrolled	Technical staff blinded No mention of other groups HRQoL: HIGH Questionnaires Admissions: LOW	LOW 7/30 and 6/30 dropped out. Demographic data for completers and dropouts given for both groups for major variables (but not gender)	UNCLEAR HRQoL/exacerbations/ hospitalisations mentioned in methods and given in results	LOW Baseline data given for all patients, not just completers Groups were fairly balanced

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Güell 2006[173]	UNCLEAR 'Unconcealed randomisation' 'Recruitment of consecutive patients'	UNCLEAR 'Not concealed'	HIGH 'Neither patients or clinicians were blinded' 'Technicians who collected data were blinded to allocation'	UNCLEAR Withdrawals reported, but no detail on management of data	LOW All outcomes reported	HIGH Baseline differences for Millon Behavior Health Inventory (MBHI) (*behaviour*) and Revised Symptom Checklist (SCL-90-R) (*symptoms*)
Guyatt 1992[118]	UNCLEAR Randomisation reported but method not described 'Randomisation in sequence'	UNCLEAR Concealment Reported but method not described	HRQoL: LOW Comparison of interventions and blind assessors 'Other study personnel were blind to allocation. Patients were repeatedly instructed not to mention their impressions of the training procedure to their physician or to anyone concerned with the study'	HIGH No ITT analysis 15% dropout (11/74); however, dropout in run-in period due to illness 'too great a commitment' was 30%); different reasons for dropout given between groups and no comparison of characteristics	UNCLEAR No protocol	HIGH Baseline reported for only those who completed the run-in period Smoking status – NR
Hermiz 2002[67]	UNCLEAR *Site 1*: randomised permuted blocks with a block size of four *Site 2*: 'simple randomisation'	UNCLEAR	HRQoL: HIGH All data collected by project officer, including administration of HRQoL measure No mention of blinding	HIGH Loss to follow-up: intervention 8/84, control 3/93 – more withdrew from intervention group	UNCLEAR	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Hernandez 2000[282]	UNCLEAR Stated randomised but no details	UNCLEAR	HRQoL: UNCLEAR Self-reported: was intervention vs. control; however, both groups attended for check up and treatment supervision greater than normal care	HIGH Not clear if ITT analysis as not stated and *n* not given Dropout rate 39% but balanced between groups	UNCLEAR No protocol	UNCLEAR Only a limited range of baseline characteristics reported – unclear if for all patients or only completers Participants were ex-smokers only; no exacerbations during course of study and no comorbidities
Hernandez 2003[68]	LOW 'Blindly assigned using a set of computer-generated random numbers'	UNCLEAR	HRQoL: HIGH Self-reported intervention vs. UC trial Hospital admission: LOW Self-reported with some verified from records Exacerbations: LOW	UNCLEAR Dropout rate not reported except deaths Unclear if ITT analysis as *n* not reported in data	UNCLEAR No protocol	Baseline given for all patients and a good range of characteristics reported 10% more current smokers in intervention group
Hill 2006[163]	LOW Computer-generated random number sequence	UNCLEAR NR	HRQoL: LOW Double-blind, interviewer-administered comparison of intervention and sham intervention	UNCLEAR Low (6%) dropout after randomisation, but dropouts ($n = 2$) from intervention group	UNCLEAR No protocol	HIGH Baseline reported for only trial completers but, as noted, only 6% dropout Baseline well matched except 6-MWT: > 10% further in intervention group

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Holland 2004[164]	UNCLEAR Not described	UNCLEAR Not clear whether baseline measures were taken prior to randomisation	LOW Data collector was blinded to group allocation	LOW All withdrawals accounted for ITT analysis undertaken	LOW All expected outcomes reported	LOW
Hospes 2009[183]	UNCLEAR 'Patients were randomly assigned to an exercise counselling or a UC group' No mention of methods of randomisation	UNCLEAR	HRQoL: HIGH Self-reported but intervention vs. control	HIGH Only 10% dropout and similar between groups Analysis was not ITT analysis	UNCLEAR No protocol	HIGH $N = 40$ but baseline reported for only the completing participants Baseline difference between groups in GOLD stage of COPD (22% stage 1 in intervention group vs. only 6% in control group) Smoking not reported in baseline characteristics
Hsiao 2003[259]	UNCLEAR Method of randomisation not described	UNCLEAR NR	HRQoL: UNCLEAR Interventions and one UC control; no details of blinding/administration	Dropout 12/42 No reported differences in baseline characteristics but no detail given No ITT analysis	UNCLEAR No protocol	HIGH Baseline given for only study completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Hynninen 2010[256]	UNCLEAR Stated randomly assigned in matched pairs but no details on method	LOW Numbered sealed containers, identical in appearance	HRQoL: HIGH	HIGH ITT analysis Overall dropout over 18 months (20%); however; imbalanced dropouts – 30% from control group, 10% from intervention No comparison of characteristics of dropouts vs. trial completers	UNCLEAR No protocol	UNCLEAR Baseline reported for all participants Only a limited range of characteristics reported, but well-matched baseline with exception of mental health diagnosis (40 vs. 50%, intervention vs. control)
Janaudis-Ferreira 2011[197]	UNCLEAR 'Patients were randomly (in blocks of four) assigned to an intervention or control group. Randomisation was stratified according to the presence or absence of the use of supplemental oxygen at rest' No further details	LOW 'The sequence was kept in opaque envelopes by an investigator who was not involved in the recruitment process These envelopes were drawn by the trainer after the subjects had completed their preassessment session, allowing for concealed allocation'	HRQoL: LOW Control group underwent sham exercises The outcome assessor and the patients remained unaware of the group allocation Each patient exercised individually at different times and locations	HIGH No data on characteristics of dropouts 16% lost to follow-up – 2× as many in treatment arm than control arm, but loss to follow-up unrelated to intervention ITT analysis used	UNCLEAR No protocol available	UNCLEAR Baseline characteristics reported for all patients recruited but smoking status not reported
Jang 2006[267]	Tossed coins	UNCLEAR	HIGH			
Jarab 2012[266]	LOW 'Participants were randomly assigned to intervention and control groups via a minimisation technique using MINIM software'	UNCLEAR No details given	HRQoL: HIGH Health-care utilisation: LOW	3/66 intervention and 3/67 control group patients withdrew by 6 months; no details given about reasons	UNCLEAR	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Karapolat 2007[237]	UNCLEAR No detail	UNCLEAR 'Sealed envelopes'	HRQoL: UNCLEAR	LOW Loss to follow-up 1/27 intervention, 3/22 control; no reasons given	UNCLEAR	HIGH Five participants excluded from control group post randomisation 'because they did not satisfy inclusion criteria'
Katiyar 2006[240]	LOW Computer-generated randomisation	UNCLEAR NR	HRQoL: HIGH Supervised self-administered. Intervention vs. UC	HIGH Low dropout 3/24 but not ITT analysis	UNCLEAR No protocol	HIGH Baseline reported for only the completers
Kayahan 2006[238]	UNCLEAR 'Randomised', no details	UNCLEAR	HIGH	UNCLEAR Reported but no reasons given or information on management of data	LOW All outcomes reported	UNCLEAR Small sample
Khdour 2009[251]	LOW Computer-generated minimisation	UNCLEAR	HRQoL: HIGH Self-reported UC vs. intervention Admissions: LOW Patient questionnaires confirmed by hospital records	HIGH No ITT analysis – as per-protocol analysis reported Dropouts, lost to follow-up and death balanced across groups No comparison of characteristics of dropouts vs. completers	UNCLEAR No protocol	LOW Baseline data reported for all participants Good range of variables reported and well balanced across all variables

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Khdour 2011[279]	LOW Minimisation	UNCLEAR	HRQoL: HIGH Self-completed questionnaires (intervention vs. UC) Admissions: LOW Patient records verified from hospital record	HIGH No ITT analysis 27% dropout Balanced numbers and similar reasons for dropout between groups	UNCLEAR No protocol	HIGH No comparison of baseline characteristics of dropouts vs. completers Baseline balanced with the exception of 10% more 'never smokers' in control group
Kim 1993[119]	UNCLEAR	UNCLEAR	'Double-blind' control group received sham intervention HRQoL: LOW	HIGH 129 patients enrolled, 67 'provided 6 months of usable data'; detail provided on loss to follow-up but not by study arm; 17 patients dropped out before randomisation, in 4-week control period before randomisation Follow-up: 41/66 intervention; 26/46 control	UNCLEAR All data on measures in methods were reported in results	HIGH No detail on baseline characteristics of those lost to follow-up

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Ko 2011[213]	LOW 'Subjects were randomised, by random number generator, to receive either PR or UC (UC). A computer programme (allocation by minimisation) was used to assist the randomisation of subjects equally into each group taking into account five factors'	UNCLEAR Not discussed	HRQoL: HIGH Readmission/ exacerbation: LOW From records 'Owing to the nature of the intervention, this was an open study for patients and therapists but the technicians . . . were not involved in the delivery of the PRP and were not aware of the randomisation status'	HIGH ITT analysis At 6 months – loss to follow-up in both arms > 10% 20% and 17% in control and intervention arms, respectively Reasons for non-completion similar across groups No reporting of baseline characteristics of dropouts	LOW Protocol available at www.clinicaltrials.gov NCT00287625 Verified with published protocol all reported	HIGH Includes patients with comorbidities and there are significant differences between the control and the intervention arms (cardiac-related comorbidity 17% in intervention vs. 30% in control group), likely significant given low numbers of participants and only 10% reported improvement in HRQoL at 6 months and nil at 12 months
Koff 2009[120]	Envelopes – not stated shuffled but presumably	UNCLEAR Envelopes – not stated sealed or numbered	HRQoL: HIGH Self-reported but intervention vs. UC control and unblinded	UNCLEAR No ITT analysis Very low drop outs (5% 1 participant from each branch with $n = 40$)	UNCLEAR No protocol	UNCLEAR Baseline reported for all patients and well balanced with the exception of % flu vaccinated (100% vs. 85%) and living alone 15% vs. 30%, both of which may impact on HRQoL
Koppers 2006[184]	UNCLEAR Stated randomised but no details	UNCLEAR NR	HRQoL: LOW Self-completed – blinded assessor control is sham training	HIGH Very low dropout rate – 8%; three participants, same reason (severe exacerbation) Characteristics – NR ITT analysis – NR	UNCLEAR No protocol One of the three study arms was dropped owing to financial reasons	UNCLEAR Baseline – reported for all participants but smoking status not reported

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Kunik 2008[121]	LOW Used 'Statistical Analysis Systems plan procedure to create randomisation list, with blocks of size 2 to provide approximate equal number per class. The statistician provided randomised numbers and treatment codes to the study co-ordinator . . .'	LOW	HRQoL: HIGH	HIGH High loss to follow-up 8 weeks: 63/120 and 60/118 1 year: 56/120 and 52/118 Reasons for dropout not given by arm	UNCLEAR	LOW
Kwok 2004[70]	LOW Random number table	LOW Remote telephone allocation	Readmissions: LOW Verified from electronic hospital records	UNCLEAR Not ITT analysis 11% dropout rate, half due to death No comparison of characteristics of dropouts vs. trial completers	UNCLEAR No protocol	HIGH Baseline reported for all participants Appears well balanced except PEFR (misprint) However, patients with asthma and bronchiectasis included, but their distribution between groups not documented

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Lamers 2010[185]	LOW Randomisation was performed by an external agency using a computerised random number generator In order to avoid an imbalance of chronic illness and general practice (care level) over the two groups, stratification for general practice and chronic illness (diabetes mellitus or COPD) was performed. Furthermore, to obtain equal numbers in both arms, a blocked design with a block size of two was applied	LOW Randomisation was performed by an external agency using a computerised random number generator The researchers entered patients into a computer connected to an external agency, which performed the randomisation using a computerised random number generator	HIGH	HIGH ITT analysis Very high dropout rate from both the intervention and control groups Intervention group only 74% received the intervention Only 67% and 75% reached even the first follow-up in intervention and control group	LOW Protocol available This paper seems to report only a subset of the outcome measure	UNCLEAR Education level mismatched between baseline groups – up to 9% variation between percentage of highly educated in intervention and control groups
Larson 1988[122]	UNCLEAR Randomisation stated but not described	UNCLEAR NR	HRQoL: LOW Comparison of interventions Double-blind trial	HIGH *n* = NR Only *n* is number who completed study	UNCLEAR No protocol	HIGH Baseline characteristics table is for only the completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Larson 1999[123]	UNCLEAR Randomisation stated but method not reported	UNCLEAR Concealment – NR	HRQoL: UNCLEAR Study was comparison of interventions; however, blinding of assessors not reported; participants blinded to baseline and previous responses	HIGH ITT analysis – NR Poor completion rate – 41% 'There were no significant differences between those who completed the study and those who dropped out of the study in terms of demographics, pulmonary function tests, and arterial blood gases' but no detail of this	UNCLEAR No protocol	HIGH Baseline data reported for only the completers of study
Lee 2002[66]	UNCLEAR Nursing home was randomised, not patient; no method given but homes were randomised based on number of admissions	UNCLEAR	HRQoL: HIGH UC vs. intervention Hospital admission: LOW	HIGH No reporting of the distribution of dropouts between groups No ITT analysis	UNCLEAR No protocol	HIGH Limited range of baseline characteristics reported: reported for only the study completers
Leung 2010[165]	LOW Computerised telephone dial-up system – stratified randomisation	LOW Remote allocation by telephone dial-up	HRQoL: LOW Questionnaires were interviewer administered – and is comparison of interventions States blinded outcome assessment 'An assessor blinded to allocation performed outcome assessment'	LOW ITT analysis Only 12% dropout rate Similar dropout rate between branches and has comparison of characteristics of those lost to follow-up/ dropouts, different by age and FEV_1/FVC ratio	UNCLEAR No protocol	LOW Baseline well matched data for all participants included Training intensity well standardised

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Li 2002[200]	Randomly	NR	HRQoL: UNCLEAR	NR		
Liddell 2010[145]	UNCLEAR 'Separate but identical randomisation processes were carried out at each outpatient department' No comments on method of randomisation	LOW 'Equal numbers of once-weekly and twice-weekly allocations were created, and then stored in sealed envelopes. These envelopes were only opened after the initial assessment and patient consent' Not sequentially numbered	HRQoL: UNCLEAR Self-completed SGRQ but is an equivalence trial on intervention 'Follow-up assessments were completed within 2 weeks of the end of the programme. At follow-up, blinding was not possible as staff and patients were aware which programme the patients had attended'	HIGH 33% dropout rate – all accounted for and similar rates/reasons in each group ITT analysis Baseline variables used for missing data from dropouts No comparison of completers to follow-up	No protocol	HIGH Three participants did not have COPD on spirometry (no comment on which group they were randomised to) = 10% of participants Baseline reported for all participants Some variation in baseline characteristics > 10% in mean FEV_1 Smoking not reported as a variable
Lindsay 2005[214]	UNCLEAR 'Randomly allocated'	UNCLEAR	HIGH	LOW Withdrawals reported, and ITT performed	LOW All outcomes reported	UNCLEAR Underpowered
Linneberg 2012[224]	UNCLEAR 'Patients were randomised (in blocks of 20) for the intervention group or control group'	UNCLEAR No information given	HRQoL: HIGH	Reasons for dropouts were reported, but not by arm Follow-up at 1 year: 49/59 for intervention, 47/59 for control	UNCLEAR	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Littlejohns 1991[146]	LOW Random number table	LOW Sealed numbered envelopes kept centrally	HRQoL: HIGH Self-reported intervention vs. UC control Admissions: LOW	HIGH No ITT analysis 88% trial completion rate Balanced loss to follow-up Characteristics of dropouts and trial completers compared; however, characteristics reported of only those who died	UNCLEAR No protocol	HIGH Baseline characteristics of all patients reported for a wide range of characteristics Average HRQoL appears significantly different (9.4 vs. 7.2 – intervention vs. control) in both physical and psychosocial domains
Liu 2008[260]	LOW '. . . assigned to the cell phone group according to a table of random numbers'	UNCLEAR	Blinding not reported in whole study HRQoL: UNCLEAR Admissions: LOW Exacerbations: HIGH Appear to be self-defined	HIGH No ITT analysis Dropouts evenly matched between groups but no comparison of characteristics Unclear at what point data removed from analysis for dropouts	UNCLEAR No protocol	UNCLEAR Baseline appears very well matched but smoking history not reported and only reported for study completers

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Livermore 2010[166]	LOW 'We used the Excel Bernoulli function to generate a random sequence of numbers, with a 50% chance of each of the two groups occurring. Randomisation was linked to subject numbers'	UNCLEAR 'Randomisation . . . was concealed until after the baseline assessment was completed' No details about how this was achieved	HRQoL: HIGH Self-completed but intervention vs. control Admissions: LOW Record review	UNCLEAR Graded unclear as low drop out at 6 months but higher later Dropout rate at first assessment (post intervention) = 0% Dropout rate at 6 months = 2.5% Dropout rate at 12 months = 17% Dropout rate at 18 months = 22% Similar dropout rates for each branch but no reasons given Low at 6 months, high at 12 and 18 months ITT analysis done	UNCLEAR No protocol	HIGH No significant baseline differences – but no report on characteristics of dropouts Blind outcome assessor for a 20% sample good correlation between assessments of non-blinded and blinded assessors

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Lord 2010[147]	UNCLEAR 'Using block randomisation through consecutive sealed envelopes' Not enough details to decide	UNCLEAR Sealed but not numbered envelopes	HRQoL: LOW Self-completed questionnaires but comparison of interventions 'At seven weeks follow-up, study participants were again assessed by the same respiratory physiotherapists, who were blinded to treatment allocation. All subjects were instructed not to tell the physiotherapist which group they had been allocated to'	HIGH ITT analysis 22% drop out rate Similar dropout rate and reasons in each group Block allocation resulted in control group 20% smaller than intervention group No comparison of characteristics of dropouts	UNCLEAR No protocol	HIGH Baseline characteristics reported only for those completing study Although they did not reached significance (because of small numbers of participants) there were clinically significant baseline differences in recovery after ISWT and in the ISWT distance itself
Madariaga 2007[174]	UNCLEAR No details	UNCLEAR No details	UNCLEAR No details	LOW No loss to follow-up	UNCLEAR	HIGH States 34 randomised in methods, 33 in abstract and baseline imbalances in dyspnoea score High for HRQoL
Mador 2004[126]	UNCLEAR No description of how randomised	LOW Used 'opaque sealed envelope' (p. 2037)	LOW	LOW Dropout accounted for, and similar in two groups; no imputation for dropouts	LOW All outcomes reported	LOW Multiple measures and tests; no adjustment for multiple testing
Mador 2005[125]	UNCLEAR 'Randomly assigned'	UNCLEAR	HIGH	UNCLEAR Withdrawals briefly reported, but no ITT	LOW All outcomes reported	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Mador 2009[124]	UNCLEAR Stated randomised but no detail	UNCLEAR Stated concealed but no detail	HRQoL: LOW Self-reported comparison of interventions	HIGH 12.5% dropouts balanced between groups No comparison of characteristics between dropouts and completers No ITT analysis	UNCLEAR No protocol	HIGH Baseline reported for only the completers
Magadle 2007[254]	LOW 'Using a random number table'	UNCLEAR Not stated	Patients blinded by 'sham IMT' control; outcome assessment HRQoL: LOW	LOW Loss to follow-up: intervention 2/10, control 2/15	LOW	LOW
Maltais 2008[198]	LOW 'We used a centrally administered, computer-generated permuted block randomisation scheme using blocks of two, stratified according to sex and participating site'	LOW 'We communicated assignments by e-mail to research staff who were not otherwise involved in the trial. The case manager subsequently informed patients of their group allocation. Study personnel were unaware of the permuted block size'	HRQoL: LOW Comparison of interventions Home vs. hospital-based rehabilitation	LOW 'The primary analysis took a modified intention-to-treat approach using all patients who provided data at the specified follow-up time regardless of adherence' 'The withdrawal rate was similar in both treatment groups' Although reasons for withdrawal reported, they were not reported by group 'The baseline characteristics of the patients who withdrew were similar to those of patients who completed the trial'	LOW Protocol available ClinicalTrials.gov registration number: NCT00169897	UNCLEAR Baseline reported for all patients Baseline: home rehabilitation group 8% GOLD stage IV vs. 18% in hospital Although groups matched to dyspnoea Pack-years reported but not current smoking status

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Man 2004[148]	LOW A random number generator to assign an intervention to the first patient entering the study Minimisation method taking into account age, sex, length of hospital admission, ISWT distance and FEV_1	LOW	It was not possible to blind patients or the assessors HRQoL: HIGH Admissions: LOW	LOW Follow-up: 16/21 control, 18/21 intervention Details of dropouts by study arm	UNCLEAR	LOW
Martin 2004[228]	UNCLEAR Stated randomised but no detail given	UNCLEAR	HRQoL: HIGH Intervention vs. control Hospital admission: LOW Method of data collection – NR	HIGH Deaths between intervention and control were not balanced (9 vs. 4); low dropout rate (13.5%) Unclear if ITT analysis – based on missing data from baseline seems likely that it is not	UNCLEAR No protocol	UNCLEAR Baseline reported for all participants for some variables but not others – limited number of variables reported and gender imbalance between groups
McGeoch 2006[229]	UNCLEAR 'Randomly selected' and use of 'random numbers table' 'Cluster randomisation of surgeries'	UNCLEAR	HIGH 'No blinding'	UNCLEAR Withdrawals reported, but no detail on management of data	LOW All outcomes reported	UNCLEAR Baseline differences for primary outcome SGRQ, 'not clinically significant'
Monninkhof 2003[186]	UNCLEAR	UNCLEAR Using sealed envelopes	HIGH No blinding	LOW Withdrawals and dropouts reported No difference between groups	LOW All outcomes reported	LOW

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Moore 2009[285]	LOW Minimisation method	UNCLEAR States concealed but no details on method	HRQoL: UNCLEAR Intervention vs. control – control group did receive some educational material/ consultation	HIGH No ITT analysis $N = 27$, dropouts and lost to follow-up balanced between groups Dropout = 27%	UNCLEAR No protocol	HIGH Baseline reported for only the participants completing study Small sample size ($n = 20$) Baseline well balanced
Mota 2007[175]	UNCLEAR No details	UNCLEAR No details	Participants in control given sham training Outcome assessments blinded – 'blind regarding the assigned training or sham groups' HRQoL: LOW	LOW HRQoL: LOW Loss to follow-up 2/8 in control due to exacerbation Intervention 10/10 completed	UNCLEAR	HIGH Baseline characteristics for completers only SGRQ values for baseline not given – only % change at follow-up
Mularski 2009[127]	LOW Computer-generated random number table	UNCLEAR Sealed, un-numbered envelopes	HRQoL: LOW Comparison of interventions	HIGH ITT analysis Imbalanced dropouts 52% vs. 30% (intervention vs. control)	UNCLEAR No protocol	HIGH Baseline reported for all participants Significant differences in average age (71 years vs. 64 years), BMI (26 kg/m^2 vs. 31 kg/m^2) and current smoking 17% vs. 34%) in intervention vs. control
Murphy 2005[252]	UNCLEAR 'Randomly assigned 1 : 1 ratio'	UNCLEAR 'Blinded sealed envelopes'	HRQoL: HIGH Exacerbations: LOW	UNCLEAR Withdrawals reported, but no ITT	LOW All outcomes reported	UNCLEAR Baseline differences for smoking history, hospitalisations

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Nakamura 2008[261]	UNCLEAR Stated as randomised but method not described	UNCLEAR Allocation concealment – NR	HRQoL: UNCLEAR Two interventions and one UC control However, tool was administered by a trained interviewer – blinding not reported	HIGH Follow-up was reasonable – 22% dropout – but not balanced between groups; reasons for dropout were not reported and there was no comparison of characteristics	UNCLEAR No protocol	HIGH Baseline reported for only the completers No reporting of smoking status or baseline HRQoL
Ng 2011[215]	LOW Computer-generated random number list with 'permutated blocks'	LOW 'It was then sealed in a database file with a security password'. . .' The occupational therapist who was blind to the list opened the file and assigned the subject to treatment or control group . . .'	HRQoL: LOW Control group did dummy breathing exercises	HIGH 24% lost to follow-up and discontinuation Unbalanced loss, greater in control group	UNCLEAR No protocol available	HIGH Baseline characteristics: more female in control (93 vs. 85%) and general health subscale (intervention vs. control 42.5% vs. 49.5%)
Nguyen 2008[128]	LOW An investigator who was not involved in the day-to-day study operations generated the randomised sequence using random sequence generator feature [SPSS version 14 (SPSS Inc., Chicago, IL, USA)] Stratified by two clinical sites in blocks of six	UNCLEAR 'separated sealed opaque envelopes'	'Study staff not involved in the intervention' HRQoL: UNCLEAR Exacerbations – LOW	HIGH $n = 11$ (36%) dropped out – similar in characteristics to those who remained, except more likely to be female, current smokers, reported no musculoskeletal problems, rated themselves as having advanced computer skills and less likely to have participated in face-to-face support groups or PR	LOW NCT00102401	HIGH Not clear whether some baseline measures may have been completed once nurse (not patient) knew their allocation Study stopped only because of technical problems

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Nguyen 2009[129]	UNCLEAR Stated randomised but no methods detailed	UNCLEAR	HRQoL: UNCLEAR Self-completed questionnaires, comparison of interventions, but one intervention arm had more contact with the research teams	LOW ITT analysis Low dropout	LOW Trial registration: ClinicalTrials.gov (NCT00373932)	HIGH Data reported for all participants but significant differences in characteristics between groups (age and disease severity) $n = 17$
Nield 2007[130]	UNCLEAR Stated as randomised but not described	UNCLEAR	HRQoL: UNCLEAR Administration of questionnaire is not reported; however, a comparison on two interventions against a UC/minimum intervention control	HIGH Dropouts and reasons not reported by group 'Loss of subjects did not impair group equivalency at either week 4 or week 12' but no details	UNCLEAR Not protocol	HIGH Baseline mismatched – one intervention group had higher-than-average BMI Smoking not reported except 'Most subjects were white men, with an average age of 65 years, with a FEV_1% pred = 39; they were former smokers Were all former smokers? Also mismatch in baseline HRQoL between PLB intervention group and control (21 vs. 29)

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Ninot 2011[250]	LOW Computer-generated sequence, block randomisation	UNCLEAR Remote allocation by fax machine	HRQoL: HIGH Neither participants or researchers were blinded Hospital admissions: LOW From records Exacerbations: HIGH From patient interview	HIGH No ITT analysis 16% dropout balanced in number between groups and reasons given differ between groups	UNCLEAR No protocol	UNCLEAR Demographics of dropouts similar to those who completed study Baseline imbalances in 6-MWD and mean age
Normandin 2002[131]	UNCLEAR	UNCLEAR	HRQoL: HIGH Reported as an unblinded study	HIGH 7/27 proportion lost from both groups. Reason similar between groups, except more withdrew consent in the high-intensity arm (dropout due to exacerbations, equal between groups)	UNCLEAR HRQoL in methods and results	HIGH Baseline data for only the completers Data available, balanced for gender and age Some potential imbalance in some biological/physical measures but not consistent in favour of one group or another
Norweg 2005[132]	LOW Randomised using biased coin design plus probability table	UNCLEAR No mention of allocation concealment Unclear whether baseline measures taken prior to randomisation	HRQoL: HIGH Administered by first author who delivered intervention	UNCLEAR Withdrawals accounted for but higher withdrawal/dropout in the exercise training-plus-activity training group at 6/52 Also, a priori, not including those who did not follow through with treatment recommendation	LOW Outcomes stated a priori and reported; however, stated that results would be assessed according to age and depression; no results by depression are presented but probably insufficient power to do this; did adjust for depression	HIGH No other adjustment needed Exclusion of non-compliant patients from analysis

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Oh 2003[284]	UNCLEAR 'Patients were randomly assigned to the experimental group in order of referral . . .'	UNCLEAR No mention	UNCLEAR It is not clear, but likely, that measures are not done by same person as whom delivering intervention	LOW 11 withdrawals – accounted for High dropout – 11/34 but greater in control	LOW All outcomes assessed	LOW Also no difference at baseline between dropouts and those who continued
O'Neill 2007[150]	LOW Patients were randomised in sets of 12; in each set, half were randomised to group 1 and half to group 2; random numbers were generated by an independent researcher	LOW 'Stored in sealed envelopes . . . opened after recruitment and assessment, before which none of the coordinator, research team and patient was aware of group allocation	HRQoL: HIGH	HIGH	LOW	HIGH Baseline characteristics were in only the completers of the PR programmes ($n = 34$ and 32)
Ortega 2002[176]	UNCLEAR	UNCLEAR	HRQoL: HIGH	HIGH Only mentioned with relation to dropouts 7/54 randomised patients dropped out and were not included in demographics or study data Numbers given by group: 1/18, 2/18, 4/18, reasons given	UNCLEAR HRQoL mentioned in methods and results	UNCLEAR Small numbers but some small imbalances in patient characteristics HRQoL appears somewhat imbalanced at baseline across domains but appears to be within chance variability

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
O'Shea 2007[167]	LOW 'Group allocation was generated by a member of the research team not involved in participant recruitment' 'Block randomisation'	UNCLEAR 'Created in envelopes until after completion of baseline measurement'	'All measurement sessions were conducted by an independent trained assessor, blinded to group allocation' Exacerbations: LOW	LOW Follow-up at 24 weeks: control 22/27, intervention 19/27; reasons given for withdrawal Those who withdrew more likely to have reduced 6-MWT distance and to have never completed PR HRQoL: LOW	UNCLEAR	LOW
Ozdemir 2010[239]	LOW 'Randomised . . . according to tables of random numbers'	UNCLEAR No details given	HRQoL: HIGH	LOW No loss to follow-up – last follow-up at 1 month	UNCLEAR	LOW
Paz-Diaz 2007[269]	UNCLEAR No detail	UNCLEAR No detail	No detail	HRQoL: LOW	LOW	UNCLEAR
Petersen 2008[225]	UNCLEAR Reported as randomised but no details	UNCLEAR Allocation concealment not considered	HRQoL: HIGH Self-completed but intervention vs. UC	LOW ITT analysis with 100% follow-up of all 19 participants	UNCLEAR No protocol	HIGH $n = 19$ for intervention vs. control study 'There were no difference in any of the baseline characteristics between the "COPD training" and "COPD control" groups', but no detail given

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Petty 2006[133]	UNCLEAR 'Block randomisation'	UNCLEAR	HIGH Self-administered, 'no blinding'	HIGH '82% retention rate' No other information provided Disproportionate dropout in one group	UNCLEAR '9-month follow-up data not provided because of poor response'	LOW
Pomidori 2012[243]	UNCLEAR 'Random assignment' to one of two exercise regimes; no other details	UNCLEAR No details given	HRQoL: LOW Comparison of two exercise regimes	36/47 (77%) follow-up at 1 year; A1 5/23 and A2 6/24 Reasons not given for dropouts, nor characteristics of dropouts	UNCLEAR	HIGH Baseline characteristics presented for only those followed up at 1 year No data provided on SGRQ – only that from baseline to 12 months: 'values significantly improved'
Prince 1989[151]	UNCLEAR Stated as randomised but method not described	UNCLEAR NR	HRQoL: LOW	HIGH Dropouts 2 vs. 4 on control vs. intervention No ITT analysis; no comparison of characteristics	UNCLEAR No protocol	HIGH Reported baseline characteristics for completers only. 6-MWD 371 vs. 412
Probst 2011[234]	UNCLEAR Reported randomised but no methods given	UNCLEAR	HRQoL: LOW Comparison of interventions	HIGH No ITT analysis 37% dropout, balanced in numbers between groups, reasons not broken down by intervention Comparison of baseline characteristics of participants who dropped out vs. trial completers	UNCLEAR No protocol	HIGH Baseline data reported for only the participants completing trial Good range of variables reported and groups well matched

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Puente-Maestu 2000[177]	UNCLEAR 'Blocks of four patients established before the first patient was included	LOW 'The physicians who sent the patients for rehabilitation were unaware of the randomisation sequence'	HRQoL: UNCLEAR Not mentioned 'HRQoL – unclear . . . measured . . . by . . . nurse' Study almost certainly unblinded for patients and most staff	HIGH 8/49: five patients withdrew from one group and three from another Reasons were non-medical (scheduling/no adherence/ personal affairs); no mention of how these compared with completers or if reasons balanced across groups	UNCLEAR HRQoL in results and methods	HIGH Baseline data given for only the completers does not include gender Mostly respiratory markers Seem fairly balanced including HRQoL
Puente-Maestu 2003[275]	UNCLEAR Patients randomly assigned but no description	UNCLEAR No mention of allocation concealment	No mention of blinding; outcome unlikely to be influenced on lack of blinding	LOW 10 patients dropped out, five from each group; all accounted for	LOW All outcomes reported	LOW
Puhan 2006[257]	LOW 'Online central randomisation'	LOW 'Central randomisation using a computerised minimisation procedure'	Not reported for participants. Self-report questionnaires. Health-care staff supervising ex and those doing post intervention testing were blinded	LOW ITT performed and attrition/withdrawals reported	LOW Protocol available but not checked All specified outcomes evident in results	UNCLEAR Baseline differences for antibiotic use, 6-MWT
Rea 2004[230]	LOW Practices randomised – computer-generated random number table	UNCLEAR	HRQoL: HIGH Self-reported intervention vs. UC control Hospital admission: LOW Data collected from records	Balanced per cent dropout (14 vs. 12%) Similar reasons for dropout between groups ITT analysis of hospital admissions LOW Not ITT analysis – for HRQoL HIGH	UNCLEAR No protocol	HIGH Baseline characteristics only reported for completers Intervention vs. control groups very unbalanced numbers (83 vs. 52) Randomisation based on GP practices but no data present on practice demographics/location

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Regiane Resqueti 2007[178]	UNCLEAR No details	UNCLEAR 'Sealed opaque envelopes'	HRQoL: UNCLEAR	LOW 29/38 follow-up at 6 months Intervention 14/19, control 15/19 Not reported by outcome	UNCLEAR	LOW
Ren 2011[201]	Randomly	NR	Questionnaires used to know the frequency of acute exacerbations	HIGH Four losses to follow-up, no details given	LOW Exacerbations, lung function, 6-MWD, Modified Medical Research Council Scale (MMRC)	
Rice 2010[140]	UNCLEAR Stated as randomised but randomisation method not reported	UNCLEAR	HRQoL: HIGH Patient completed self-reported questionnaires Admissions: LOW Records obtained	Admissions: LOW No dropouts – 98% of records obtained HRQoL: HIGH 55% and 60% returned questionnaire in control and treatment groups, respectively	UNCLEAR No protocol	LOW Well matched baseline – reported for all patients
Riera 2001[179]	UNCLEAR Stated randomised But no details	UNCLEAR	HRQoL: LOW Questionnaires administered by blinded assessor Sham intervention as control	LOW No dropouts 100% follow up	UNCLEAR NR	HIGH $N = 20$ Baseline; only very limited number of characteristics reported

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Ringbaek 2000[226]	UNCLEAR	UNCLEAR	HRQoL: HIGH	HIGH Dropouts all occurred in the Action arm, 7/24 (3× exacerbations, 2× myalgia, 1× lack of time, 1× no reason) 'These patients did not differ from patients who completed the rehabilitation' with regard to baseline characteristics	UNCLEAR HRQoL in methods and results	HIGH Between groups males/females unbalanced, plus 'smoking' unbalanced, plus '6-minute walk' unbalanced; 3/15?, unbalanced, more than expected by chance Demographics given for all randomised patients
Romagnoli 2006[244]	UNCLEAR 'Group allocation decided according to a predetermined list'	UNCLEAR Allocation 'blinded to the scientists specifically involved in the study'	HRQoL: HIGH 'Self-administered SGRQ' Hospital admissions: LOW Taken from 'the hospitals and from the general practitioners' registry'	LOW Follow-up: 14/17, group 1; 15/18 group 2 Reasons given for loss to follow-up and exclusions	LOW	HIGH Baseline data provided only for the study completers
Rooyackers 2003[187]	UNCLEAR Randomly allocated – no mention of how	UNCLEAR No mention	UNCLEAR No mention	LOW Inpatient programme – all patients completed	LOW All outcomes reported	LOW Baseline balanced

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Sassi-Dambron 1995[134]	UNCLEAR 'Randomised' – no further details given	UNCLEAR	HRQoL: HIGH	HIGH Dropout before treatment: intervention 1/47, control 8/51 Reasons for dropouts given by study arm – more controls lost to 'time pressures and lack of interest!'	UNCLEAR	HIGH Significant difference at baseline for VAS 6-MWD between study groups
Scherer 2000[258]	LOW Computer-generated random number table	UNCLEAR Randomisation after consent	HRQoL: LOW comparison of interventions	HIGH No ITT analysis No data comparing baseline characteristics of completers and dropouts	UNCLEAR No protocol	HIGH Baselines only presented for trial completers Imbalanced baseline – age Smoking status – NR
Sewell 2005[152]	UNCLEAR	LOW 'Sequentially numbered, sealed envelopes' 'Lead investigator blinded to subject randomisation'	HIGH 'Patients not blinded' 'Lead investigator blinded' 'Self-reported CRQ'	UNCLEAR Withdrawals briefly reported, but no ITT	LOW All outcomes reported	LOW
Sewell 2006[153]	UNCLEAR 'Randomised', no details	UNCLEAR 'Sealed envelopes'	LOW 'Blinded assessor' included ISWT and self-report questionnaires	UNCLEAR Withdrawals reported, but no detail on management of data; similar across both groups	LOW All outcomes reported	LOW Underpowered at 6-month time point

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Seymour 2010[154]	UNCLEAR 'Patients were randomised to receive either UC or peak expiratory flow rate initiated within a week of hospital discharge' No details on how randomisation achieved	UNCLEAR	HRQoL: HIGH Self-completed by patients but UC vs. intervention Admissions: LOW Patient diary and medical note review 'Due to personnel required for these assessments and inevitable patient interaction, it was not possible to fully blind assessors to participant allocation'	HIGH ITT analysis 19% dropout rate Similar dropout between branches – only detail is 'failed to attend' Comparison of baseline data of dropouts – NR	LOW Protocol available: Clinical Trials Registration Number NCT00557115	LOW No significant baseline differences and reported for all participants
Shao 2003[202]	Random drawing	NR	HIGH Self-report QoL questionnaires	HIGH Two losses to follow-up in each group; no reason/ details given		
Simpson 1992[135]	UNCLEAR Randomisation reported but no detail 'Stratification and random assignment yielded two groups of 17 subjects'	UNCLEAR NR	HRQoL: HIGH Intervention vs. control UC 'When the questionnaire was administered again at the end of the study subjects were informed of their previous answers . . .'	HIGH 3/17 dropout rate No ITT analysis	UNCLEAR No protocol	HIGH $n = 17$ Baseline reported for all participants Smoking status – NR

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Singh 2003[241]	UNCLEAR Patients divided randomly no descriptions	UNCLEAR No mention	UNCLEAR No mention	LOW All patients completed	LOW All outcomes reported	LOW Groups balanced at baseline
Sívori 1998[263]	LOW Randomised using random number tables	NR	Not reported for any outcomes Patient notes were used to determine days of hospitalisation (days/patients/year calculation)	28 patients completed Details of attrition provided. No details to suggest ITT performed	LOW	Intervention differed with respect to training, although upper and lower limb training group had double the intervention with respect to time from what it appears to suggest from the papers; group similar at baseline; high attrition
Smith 1999[168]	LOW Random computer-generated numbers	UNCLEAR	HRQoL: HIGH Unblinded study, self-completed questionnaires, intervention vs. control Hospital admissions: LOW Case note review	LOW ITT analysis Similar numbers of dropouts and deaths) 10% overall dropout Reported similar characteristics between dropouts/deaths and trial completers (not presented)	UNCLEAR No protocol	LOW Baseline reported for all patients – well balanced
Soler 2006[180]	UNCLEAR	UNCLEAR	HRQoL: HIGH Self-report questionnaires Hospital admissions: LOW	UNCLEAR Withdrawals reported but no detail on management of data	LOW All outcomes reported	UNCLEAR Baseline differences for ISWT, endurance shuttle walk test. Planned intervention of rehabilitation not done Small sample

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Solomon 1998[136]	LOW Random number table	UNCLEAR NR	Admissions: LOW	HIGH Total recruitment/follow-up – NR No ITT analysis	UNCLEAR No protocol	HIGH Baseline reported for only participants who completed the trial Gender imbalance 43% vs. 55% male in intervention vs. control)
Spencer 2010[169]	LOW 'Randomisation (performed using computerised number generation)'	UNCLEAR 'Randomisation (performed using computerised number generation) was concealed in opaque envelopes and prepared by an investigator not directly involved in the study' Numbering and sealing of envelopes not reported	HRQoL: HIGH Self-completed questionnaire – intervention vs. control trial Hospital admission: LOW Exacerbations: HIGH Self-reported and defined as worsening symptoms 'The assessor and subjects were not blind to group allocation'	ITT analysis used 18% lost to follow up Reasons listed Identical numbers dropped out due to death/illness Approximately 2× as many dropouts from intervention arm Reported characteristics of those who withdrew appear to have a lower FEV_1 and be more likely to be smokers	LOW Protocol available at Australia and New Zealand Clinical Trials registry	LOW Baseline characteristics similar – presented for all participants

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Spruit 2002[247]	UNCLEAR	UNCLEAR Limited reporting 'concealed envelopes'	HRQoL: HIGH	UNCLEAR 18/48 dropped out of the study: three in each group dropped out owing to lack of motivation (6/48), and seven in resistance training group, plus five in endurance training group (12/48) owing to hospitalisation/exacerbation (two and one of these died, respectively) Comparison in some baseline characteristics between dropouts and completers is given; no details given by outcome	UNCLEAR HRQoL mentioned in methods and results	HIGH Baseline data given appears balanced (only 1/8 factor statistically significant difference (diffusion capacity for CO_2) but baseline data given for only the completers
Sridhar 2008[155]	LOW 'By the use of random numbers'	UNCLEAR	HRQoL: high Readmissions: LOW 'Corroboration of self-report with hospital admissions was undertaken by respiratory research nurses against local hospital records'	LOW Follow-up: 55/61 Intervention: 49/61 control. All loss to follow-up due to death HRQoL: only data at 2 years follow-up reported	UNCLEAR	HIGH Imbalance in SM activities at baseline; more control participants had reserve antibiotics or steroids

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Stulbarg 2002[137]	UNCLEAR	UNCLEAR	HRQoL: HIGH	UNCLEAR	UNCLEAR	HIGH
	Stratified randomisation using four strata related to oxygen saturation and anaerobic threshold		Self-reported via SF-36 and CRQ, with feedback given about previous scoring by the patient	103/115 completed the study; four dropouts from each of three groups ($n = 40/37/38$); reasons are given but not numbers for each reason, nor by group; those who dropped out 'were not significantly different in baseline characteristics from those who remained in the study except for high $PaCO_2$ and lower age'	HRQoL tools mentioned in methods, also given in results	Baseline characteristics given in detail for only the completers. Fairly well balanced – some small differences between the three groups but not extensive
Davis 2006[395]	UNCLEAR	UNCLEAR	HRQoL: HIGH	UNCLEAR	LOW	UNCLEAR
	'Randomised' no details			Overall dropout reported, but no reasons given or information on management of data	All outcomes reported	High dropout rate
Carrieri-Kohlman 2005[394]	UNCLEAR	UNCLEAR	HIGH	UNCLEAR	LOW	LOW
	'Methods and 2-month outcomes reported elsewhere'		'Blinded assessor'	Withdrawals reported, but no ITT	All outcomes reported	
Subin 2010[242]	UNCLEAR	UNCLEAR	HRQoL: LOW	No loss to follow-up	UNCLEAR	LOW
	'Randomly assigned to one of three groups through block randomisation'	No detail given	Three active interventions compared			

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Theander 2009[220]	LOW The randomisation procedures were performed by an independent person from the research group, who took a random envelope from the prepared box with sealed envelopes	UNCLEAR Opaque envelopes but not sequentially numbered	HRQoL: HIGH Self-completed, intervention vs. UC control	HIGH ITT analysis: NR Reasonable completion rate but three dropouts due to ill health and death in intervention group; only one dropout from control group (burden of assessment)	UNCLEAR No protocol	HIGH $n = 26$ Recruitment was terminated at 30 patients – power calculation suggested that 40 patients more appropriate – reasons for stopping recruitment not detailed Baseline reported for only the completers Gender and employment status imbalance between groups
Toshima 1990[138]	LOW 'Computer-generated list of the words "rehabilitation" and "education" in random order'	LOW 'The recruiter reported the name to an independent person who made assignments according to the random order lists'	HRQoL: LOW (both groups had an intervention)	LOW Balanced losses between arms 89% follow-up at 6 months Reasons for loss to follow-up given by arm	HIGH 'In this article, some preliminary results are presented'	HIGH 10 participants dropped out between recruitment and starting the intervention. No baseline data are provided for these participants, nor allocation group
Ries 1995[276]	LOW 'The randomisation scheme was fixed before the trial with a block size of 8; assignment was determined by a table of random numbers . . .'	LOW Clinical personnel were unaware of the randomisation scheme	HRQoL: HIGH Hospital and ED visits: HIGH Self-reported	Nine people (six intervention; three control) dropped out prior to treatment 'Patients who dropped out and those who remained in the study did not differ'	UNCLEAR	HIGH Baseline criteria for only the 119/128 randomised

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Trappenburg 2011[188]	LOW 'To conceal the assignment sequence, a central web-based service was used. Randomisation was carried out using the minimisation technique to balance the control and intervention groups for centre and gender'	LOW	HRQoL: HIGH Patient-completed questionnaire Exacerbations: HIGH Self-reported, but well defined and adjudicated by three assessors Length of exacerbation time: HIGH Self-reported Health-care utilisation: LOW Telephone call verified by record	UNCLEAR No ITT analysis Reasonably balanced reasons for loss to follow-up with 16% and 19% from control and intervention group respectively, but more comorbidity in control group (5 vs. 2) Subjects lost to follow-up had more severe airflow limitation and were more frequently recruited from an outpatient clinic ($p < 0.05$)	UNCLEAR No protocol	UNCLEAR Baseline data for all patients given Baseline: control group had a lower percentage educated to college standard (12% vs. 7%) and more with secondary education (62% vs. 68%) – potentially relevant as intervention was action plan and recording was diaries and self-reporting No details on timing of recruitment/follow-up period. i.e. more exacerbations/more severe exacerbations/longer recovery over winter months
Troosters 2000[248]	UNCLEAR Prepared before study	UNCLEAR Sealed envelopes	HRQoL: HIGH	UNCLEAR 13/50 intervention 17/50 control dropped out; these appeared fairly balanced; the patients who dropped out were not dissimilar to those who were followed up (except age $p < 0.004$)	UNCLEAR HRQoL mentioned in methods and results	HIGH Baseline data given for only the completers (see above also) Groups seem balanced
Van Gestel 2012[208]	UNCLEAR 'RCT' – no further details	UNCLEAR No details given	HRQoL: HIGH	2/22 withdrew from intervention group; 1/21 from control group owing to exacerbation	UNCLEAR	HIGH Baseline data for only the 40 participants with follow-up data

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Van Wetering 2010[273]	LOW 'Patients were randomised to the INTERCOM programme or to UC using a computerised procedure with concealed patient allocation'	UNCLEAR 'Patients were randomised to the INTERCOM programme or to UC using a computerised procedure with concealed patient allocation' No comment on method of concealed allocation	HRQoL: HIGH Self-completed and comparison of intervention vs. control Exacerbations: UNCLEAR Patient defined reason for attendance at GP/ED Hospital admissions: UNCLEAR Linked paper[182] reports hospital record review during economic analysis of a subset of patients – this paper on whole cohort does not	LOW ITT analysis At 4 months, 94% completion At 12 months, 90% completion At 2 years, 85% completion Low risk of bias at 4 and 12 months Reported differences in dropouts – age in both groups (older vs. younger)	LOW Protocol available NCT00840892	HIGH Baseline characteristics similar and reported on whole cohort, but 9% more current smokers in intervention group
Vogiatzis 2002[265]	UNCLEAR NR Described as stratified randomisation; no specific details of strata mentioned	UNCLEAR	HRQoL: HIGH	UNCLEAR HRQoL: no specific mention other than for the whole study; for the whole study, 9/45 patients did not complete the programme – four in one group, five in the other Reasons were not given by group but overall; the reasons were pulmonary infection and non-compliance 'Characteristics were not significantly different from those of the completing patients'	UNCLEAR HRQoL mentioned in methods and results	HIGH Details given for only the completers (36/45) Baseline data seem balanced Baseline HRQoL data not shown, only change

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Vonbank 2012[246]	UNCLEAR 'Randomly assigned'	UNCLEAR No details given	HRQoL: LOW All participants received active intervention	HIGH 7/43 lost to follow-up; no details provided on dropouts	UNCLEAR	HIGH Data provided at baseline for only the participants who completed the trial
Wadell 2004[221]	UNCLEAR Semi-randomised Stratified by sex, FEV_1 and work capacity	UNCLEAR No mention of allocation concealment	UNCLEAR Not mentioned	LOW Two dropouts – discussed and from different groups	LOW All outcomes reported	LOW
Wakabayashi 2011[262]	LOW 'A case manager independent of the study randomly assigned patients to either group I or group U using a computer-generated list'	LOW 'Patient allocations were sealed in numbered envelopes by an independent evaluator, not involved in the interventions . . .'	Hospital admissions: LOW	HIGH Does not report, as ITT analysis not done for the reported outcome of emergency attendance and admission	UNCLEAR No mention in methods that ER attendance and admissions would be reported – only secondary outcome measures were mentioned; however, all outcome measures mentioned in methods were reported No protocol available	HIGH Under-recruited (100 needed, 102 recruited but 17 dropped out) Baseline difference in emergency visits and hospital admissions
Wang 2004[203]	Randomly	NR	UNCLEAR		LOW Lung function, QoL, 12-MWD reported	

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Warlies 2006[209]	External randomisation Method not completely clear: patients were allocated a code number, chosen by randomly opening shuffled, securely closed envelopes	Allocation number in securely closed envelopes	HRQoL: HIGH Study described as open label Patients were not given assistance with completing the SGRQ to avoid results being biased	4/28 in intervention group and 4/32 in control group discontinued Six found participation too onerous/were not motivated, including all four in the control group; one in the intervention group withdrew without giving a reason and one developed lung cancer; including these eight, there was a total of 12 patients with missing data Variable number of patients included for different outcomes depending on completeness of assessments	No obvious selective reporting All outcomes mentioned in methods also reported in results section	No further comments
Waterhouse 2010[277]	LOW 'Random allocation sequence using the RALLOC procedure in Stata 8 . . .'	UNCLEAR	'All were blinded to the telephone intervention arm until 1 month post rehabilitation, when only the assessment team and research participants were unblinded' HRQoL: HIGH Interviewer-led completion – unblinded participants and assessors	HIGH No ITT analysis Only 50% and 57% follow-up for community and hospital rehabilitation, respectively, for acute outcome and 57% long-term outcomes Reported comparison of dropouts vs. completers – well matched on reported features	LOW Trial registration: Current Controlled Trials ISRCTN86821773	HIGH Does not show baseline for all recruited participants, only for those who started the trial Smoking not reported as a variable

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Watson 1997[231]	UNCLEAR 'With random assignment of subjects to either UC or enhanced care'	UNCLEAR No details given	HRQoL: HIGH No details about blinding of assignments	13/69 lost to follow-up, details not given by study group	UNCLEAR	HIGH Some large baseline imbalances, for example influenza immunisation, access to a nebuliser and marital status
Wedzicha 1998[157]	UNCLEAR Stratified randomisation based on MRC dyspnoea score; blocks of eight No details on generation of sequence	UNCLEAR 'Codes held in sealed envelopes'	HRQoL: HIGH	UNCLEAR Eight dropouts out of 63 in exercise group; eight dropouts out of 63 in control group; reasons given More withdrawal as reason in exercise group (7 vs. 3) and more details in the control group (0 vs. 2)	UNCLEAR SGRQ, CRQ, Extended Activities of Daily Living assessment (EADL) mentioned in methods and results given; HADS mentioned in methods and baseline data but following data appear not to be presented	UNCLEAR Baseline data given for only the followed up patients; groups are fairly well balanced at baseline for demographics; no details of how dropouts differed from completers Possible baseline difference for shuttle walk test
Weekes 2009[158]	UNCLEAR 'Randomisation occurred in a standard way using sealed opaque envelopes containing randomised codes' Not clear how the randomised codes were generated	UNCLEAR 'Using sealed opaque envelopes' Not sequentially numbered	HRQoL: HIGH Not clear if self-reported or with unblinded outcome assessor; controls given leaflet – is this different from UC? 'A randomised controlled unblinded trial was performed'	LOW 'All patients who completed at least two assessments (baseline and one other) were included in an ITT analysis to provide an unbiased assessment of the treatment effect' Dropout reasons available online Dropout rates broadly similar between intervention and control groups	UNCLEAR No protocol	LOW Baseline characteristics included for all randomised patients who reached baseline assessment Difference of 8% and 10% in ex/current smokers between intervention and control groups – fewer smokers in intervention group High death rate/comorbidity diagnosis rate, but similar between groups

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
				6-month 33% dropout 12-month 37% dropout and baseline characteristics of dropouts compared		Deaths 7/59 but this probably reflects this patient group and rates that are broadly similar between groups
White 2002[159]	UNCLEAR	UNCLEAR	LOW	LOW	LOW	LOW
	No description of sequence generation but groups unequal, suggesting computerised	Opaque sealed envelopes		Nine dropouts in intervention arm, six in brief advice; all accounted for	All outcomes reported	Groups balanced at baseline
Wijkstra 1994[189]	UNCLEAR	UNCLEAR	HRQoL: HIGH	LOW	UNCLEAR	HIGH
	After stratification by FEV_1% pred, their limiting factor in exercise capacity and maximal workload, the patients were randomly allocated	No details given		Dropouts: intervention 2/30; control 0/15 Reasons for dropouts provided		Baseline imbalance in inspiratory vital capacity
Wijkstra 1995[190]	UNCLEAR	UNCLEAR	HRQoL: HIGH	LOW		LOW
	Stratified by FEV_1, maximum workload and limiting factor to exercise Randomly allocated to one of three groups	No details given		Clear details given by study arm for reasons loss to follow-up • group A: 5/15 • group B: 4/15 • group C: 3/15		

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Wittmann 2007[210]	UNCLEAR External randomisation: no further details	UNCLEAR No detail: the fact that randomisation occurred externally may contribute to concealment of allocation	LOW	13/107 dropouts in intervention group and 15/105 dropouts in control group during rehabilitation; reasons for both given Follow-up 1 year later was 98% (180/184) No details on differences between patients dropping out or remaining in study	UNCLEAR No obvious selective reporting All outcomes mentioned in methods also reported in results section	91/303 eligible patients refused to participate; 32 of these specifically requested, and received, the intervention (not as part of the study); the authors state that this means that the most motivated patients were excluded
Wong 2005[74]	LOW Computer-generated randomisation (p. 2123)	UNCLEAR	LOW Outcomes measured by nurse blind to group assignment	LOW Two dropouts but analysed with imputed values	LOW All outcomes reported	LOW
Wood-Baker 2006[170]	LOW 'Cluster randomisation' 'Computer-generated randomisation package'	UNCLEAR	HIGH Self-administered, 'no blinding'	UNCLEAR Withdrawals reported, but no detail on management of data	LOW All outcomes reported	HIGH Imbalance at baseline for gender, smokers, activity levels 'Underpowered'
Wright 2003[211]	UNCLEAR Reported randomised but no details given	UNCLEAR NR	HRQoL: HIGH Intervention vs. UC control	HIGH Large imbalance in dropouts between control and intervention groups – total recruitment not reported but completers $n = 21$ in intervention group and $n = 5$ in control	UNCLEAR No protocol	HIGH Not clear if baseline reported for all participants and small number of variables reported (weight not BMI) No smoking status Very heterogeneous age and symptomology within treatment group

Author year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome reporting	Selective outcome reporting	Other
Xu 2010[204]	Random number	NR	UNCLEAR Use of QoL questionnaire		6-MWD, Borg score	
Yamaguti 2012[235]	UNCLEAR Randomisation was stratified according to gender, using random block sizes of 2 and 4	UNCLEAR No information given	HRQoL: HIGH	HIGH Follow-up: intervention 15/15, control 12/15 Information given on reasons for loss to follow-up ITT analysis done using baseline observation carried forward for missing data	UNCLEAR Outcomes in methods all reported in results	LOW
Yeh 2010[139]	UNCLEAR Stated randomised but no detail	UNCLEAR NR	HRQoL: HIGH	LOW ITT analysis	UNCLEAR No protocol	HIGH Very small trial $n = 10$ Feasibility study Baseline reported for all participants Smoking status – NR
Zhang 2008[205]	UNCLEAR Randomly	UNCLEAR	HRQoL: HIGH Self-administered questionnaire	HIGH Three losses to follow-up in group A; no reasons given	LOW	

6-MWD, 6-Minute Walk Distance; 6-MWT, 6-Minute Walk Test; 12-MWD, 12-Minute Walk Distance; AECOPD, acute exacerbation of chronic obstructive pulmonary disease; BMI, body mass index; ER, emergency room; ISWT, incremental shuttle walk test; ITT, intention to treat; NR, not reported; PEFR, peak expiratory flow rate; PI, principal investigator; PLB, pursed lip breathing; SCL-90-R, Symptom Checklist-90-Revised; VAS, visual analogue scale.

Appendix 27 Trials included in each analysis

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Aimonino Ricauda 2008[75]	0	0	0	1	0	0	0	0
Arnardottir 2006[216]	0	0	0	0	0	0	0	0
Arnardottir 2007[217]	0	0	0	0	0	0	0	0
Barakat 2008[249]	1	0	0	0	1	0	0	0
Bauldoff 2002[108]	0	1	0	0	0	0	0	0
Bauldoff 2005[109] A	0	0	0	0	0	0	0	0
Bauldoff 2005[109] B	0	0	0	0	0	0	0	0
Bauldoff 2005[109] C	0	0	0	0	0	0	0	0
Beckerman 2005[253]	0	0	0	0	0	0	0	0
Behnke 2000[64]	1	0	1	1	1	0	0	0
Bendstrup 1997[222]	1	0	0	0	1	0	0	0
Bernard 1999[191]	0	0	0	0	0	0	0	0
Berry 2010[110]	1	0	0	1	1	0	0	0
Bestall 2003[141]	1	1	0	0	1	0	0	0
Bjornshave 2005[223]	0	0	0	0	0	0	0	0
Blake Jr 1990[111]	0	0	0	1	0	0	0	0
Bonilha 2009[232]	0	0	0	0	0	0	0	0
Bourbeau 2003[192]	1	0	0	1	0	1	0	0
Boxall 2005[160]	1	0	0	0	1	0	0	0
Breyer 2010[245]	0	1	0	0	0	0	0	0
Brooks 2002[193]	1	1	0	1	1	0	0	0
Bucknall 2012[63]	1	0	0	1	0	0	1	0
Busch 1988[194]	0	0	1	0	0	0	0	0
Cai 2006[199]	0	0	0	0	0	0	0	0
Carr 2009[195]	0	0	0	0	0	0	0	0
Casas 2006[71]	1	0	0	1	0	0	0	1
Chan 2010[212] A	0	0	1	0	0	0	0	0
Chan 2010[212] B	1	0	1	0	1	0	0	0
Chan 2010[212] C	0	0	0	0	0	0	0	0
Cockcroft 1987[142]	1	0	0	1	0	0	1	0
Coultas 2005[112] A	1	0	0	0	0	0	1	0
Coultas 2005[112] B	1	0	0	0	0	0	1	0
Coultas 2005[112] C	0	0	0	0	0	0	0	0
Covey 2001[113]	0	0	0	0	0	0	0	0
de Blok 2006[181]	0	0	0	0	0	0	0	0
Dheda 2004[73]	1	0	0	0	0	0	0	1

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	1	0	0
1	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Donesky-Cuenco 2009[114]	1	0	0	0	1	0	0	0
Dourado 2009[233] A	0	0	0	0	0	0	0	0
Dourado 2009[233] B	0	0	0	0	0	0	0	0
Dourado 2009[233] C	0	0	0	0	0	0	0	0
du Moulin 2009[206]	0	0	0	1	1	0	0	0
Eaton 2009[227]	1	0	0	0	1	0	0	0
Effing 2009[161]	0	1	0	0	0	0	0	0
Efraimsson 2008[218]	1	0	0	1	0	0	0	1
Egan 2002[69]	0	0	0	1	0	0	0	0
Elci 2008[236]	1	0	0	0	1	0	0	0
Elliott 2004[162]	0	0	0	0	0	0	0	0
Elliott 2004[162]	0	0	0	0	0	0	0	0
Elliott 2004[162]	0	0	0	0	0	0	0	0
Emery 1998[115] A	1	0	0	0	1	0	0	0
Emery 1998[115] B	1	0	0	0	0	0	1	0
Emery 1998[115] C	0	0	0	0	0	0	0	0
Engstrom 1999[219]	1	0	0	0	1	0	0	0
Fernandez 2009[171]	0	0	0	0	0	0	0	0
Finnerty 2001[143]	1	0	0	0	1	0	0	0
Foy 2001[116]	0	0	0	0	0	0	0	0
Gallefoss 1999[325]	1	0	0	0	0	1	0	0
Ghanem 2010[264]	1	0	0	0	0	1	0	0
Gilmore 2010[117] A	0	0	0	0	0	0	0	0
Gilmore 2010[117] B	0	0	0	0	0	0	0	0
Gilmore 2010[117] C	0	0	0	0	0	0	0	0
Gilmore 2010[117] D	0	0	0	0	0	0	0	0
Gilmore 2010[117] E	0	0	0	0	0	0	0	0
Gilmore 2010[117] F	0	0	0	0	0	0	0	0
Gohl 2006[207]	0	0	1	0	0	0	0	0
Goldstein 1994[196]	1	0	0	1	1	0	0	0
Green 2001[144]	0	0	0	0	0	0	0	0
Güell 2000[172]	1	0	0	0	1	0	0	0
Güell 2006[173]	1	0	0	0	1	0	0	0
Guyatt 1992[118]	0	0	0	0	0	0	0	0
Hermiz 2002[67]	1	0	0	1	0	0	0	1

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Hernandez 2000[282]	0	1	1	0	0	0	0	0
Hernandez 2003[68]	1	0	0	1	0	0	0	0
Hill 2006[163]	0	0	0	0	0	0	0	0
Holland 2004[164]	0	0	0	0	0	0	0	0
Hoogendoorn 2009[182]	1	0	0	0	1	0	0	0
Hospes 2009[183]	0	0	1	0	0	0	0	0
Hsiao 2003[259] A	0	0	0	0	0	0	0	0
Hsiao 2003[259] B	0	0	0	0	0	0	0	0
Hsiao 2003[259] C	0	0	0	0	0	0	0	0
Hynninen 2010[256]	1	0	0	0	0	0	1	0
Janaudis-Ferreira 2011[197]	1	0	0	0	1	0	0	0
Jang 2006[267]	1	0	0	0	1	0	0	0
Jarab 2012[266]	1	0	0	0	0	0	0	1
Karapolat 2007[237]	1	0	0	0	1	0	0	0
Katiyar 2006[240]	0	1	1	0	0	0	0	0
Kayahan 2006[238]	1	0	0	0	1	0	0	0
Khdour 2009[251]	1	0	0	1	0	1	0	0
Kim 1993[119]	0	0	0	0	0	0	0	0
Ko 2011[213]	1	0	0	0	1	0	0	0
Koff 2009[120]	1	0	0	1	0	0	1	0
Koppers 2006[184]	0	0	0	0	0	0	0	0
Kunik 2008[121]	0	1	0	0	0	0	0	0
Kwok 2004[70]	1	0	0	1	0	0	0	1
Lamers 2010[185]	1	0	0	0	0	0	1	0
Larson 1988[122]	0	0	0	0	0	0	0	0
Larson 1999[123] A	0	0	0	0	0	0	0	0
Larson 1999[123] B	0	0	0	0	0	0	0	0
Larson 1999[123] C	0	0	0	0	0	0	0	0
Larson 1999[123] D	0	0	0	0	0	0	0	0
Larson 1999[123] E	0	1	0	0	0	0	0	0
Larson 1999[123] F	0	1	0	0	0	0	0	0
Lee 2002[66]	0	0	0	0	0	0	0	0
Leung 2010[165]	0	0	0	0	0	0	0	0
Li 2002[200]	0	1	0	0	0	0	0	0
Liddell 2010[145]	0	0	0	0	0	0	0	0
Lindsay 2005[214]	1	0	0	0	1	0	0	0
Linneberg 2012[224]	0	0	0	0	0	0	0	0
Littlejohns 1991[146]	0	0	0	1	0	0	0	0
Liu 2008[82]	0	0	0	0	0	0	0	0

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	1	0	1	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Livermore 2010[166]	1	0	0	0	0	0	0	0
Lord 2010[147]	1	0	0	0	1	0	0	0
Madariaga 2007[174] A	0	0	0	0	0	0	0	0
Madariaga 2007[174] B	0	0	0	0	0	0	0	0
Madariaga 2007[174] C	0	0	0	0	0	0	0	0
Mador 2004[126]	0	0	0	0	0	0	0	0
Mador 2005[125]	0	0	0	0	0	0	0	0
Mador 2009[124]	0	0	0	0	0	0	0	0
Magadle 2007[254]	0	0	0	0	0	0	0	0
Maltais 2008[198]	0	0	0	0	0	0	0	0
Man 2004[148]	1	0	0	0	1	0	0	0
Martin 2004[228]	0	1	0	0	0	0	0	0
McGeoch 2006[229]	0	1	0	0	0	0	0	0
Monninkhof 2003[186]	1	0	0	0	0	1	0	0
Moore 2009[285]	1	1	0	0	0	1	0	0
Mota 2007[175]	0	0	0	0	0	0	0	0
Mularski 2009[127]	0	0	0	0	0	0	0	0
Murphy 2005[252]	0	0	1	0	0	0	0	0
Nakamura 2008[261] A	1	0	0	0	1	0	0	0
Nakamura 2008[261] B	0	0	1	0	0	0	0	0
Nakamura 2008[261] C	1	0	0	0	1	0	0	0
Ng 2011[215]	0	1	0	0	1	0	0	0
Nguyen 2008[128]	0	0	0	0	0	0	0	0
Nguyen 2009[129]	0	0	0	0	0	0	0	0
Nield 2007[130] A	0	1	0	0	0	0	0	0
Nield 2007[130] B	0	1	0	0	0	0	0	0
Nield 2007[130] C	0	1	0	0	0	0	0	0
Ninot 2011[250]	1	0	0	0	1	0	0	0
Normandin 2002[131]	0	0	0	0	0	0	0	0
Norweg 2005[132] A	0	0	0	0	0	0	0	0
Norweg 2005[132] B	1	0	0	0	1	0	0	0
Norweg 2005[132] C	0	0	0	0	0	0	0	0
Oh 2003[283]	1	0	0	1	0	1	0	0
O'Neill 2007[150]	0	0	0	0	0	0	0	0
Ortega 2002[176] A	0	0	0	0	0	0	0	0
Ortega 2002[176] B	0	0	0	0	0	0	0	0

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	1	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	1	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Ortega 2002[176] C	0	0	0	0	0	0	0	0
O'Shea 2007[167]	0	0	1	0	0	0	0	0
Ozdemir 2010[239]	0	1	1	0	0	0	0	0
Paz-Diaz 2007[269]	0	0	0	0	0	0	0	0
Petersen 2008[225]	1	1	0	0	1	0	0	0
Petty 2006[133] A	0	0	1	0	0	0	0	0
Petty 2006[133] B	0	0	0	0	0	0	0	0
Petty 2006[133] C	0	0	0	0	0	0	0	0
Pomidori 2012[243]	0	0	0	0	0	0	0	0
Prince 1989[151]	1	0	0	0	0	0	0	1
Probst 2011[234]	0	0	0	0	0	0	0	0
Puente-Maestu 2000[357]	0	0	0	0	0	0	0	0
Puhan 2006[76]	0	0	0	0	0	0	0	0
Rea 2004[230]	0	0	0	1	0	0	0	0
Regiane Resqueti 2007[178]	0	0	0	1	1	0	0	0
Ren 2011[201] A	0	1	0	0	0	0	0	0
Ren 2011[201] B	0	0	0	0	0	0	0	0
Ren 2011[201] C	0	1	0	0	0	0	0	0
Rice 2010[140]	1	0	0	1	0	0	0	1
Riera 2001[179]	0	0	0	0	0	0	0	0
Ringbaek 2000[226]	1	0	0	0	1	0	0	0
Romagnoli 2006[244]	0	0	0	0	0	0	0	0
Rooyackers 2003[187]	0	0	0	0	0	0	0	0
Sassi-Dambron 1995[134]	1	0	0	0	0	0	1	0
Scherer 2000[258]	0	0	0	0	0	0	0	0
Sewell 2005[152]	0	0	0	0	0	0	0	0
Sewell 2006[153]	0	0	0	0	0	0	0	0
Seymour 2010[154]	0	0	0	0	0	0	0	0
Shao 2003[202]	1	0	0	0	1	0	0	0
Simpson 1992[135]	0	0	1	0	0	0	0	0
Singh 2003[241]	1	0	0	0	1	0	0	0
Sívori 1998[263]	0	0	0	0	0	0	0	0
Smith 1999[168]	1	0	0	1	0	0	0	1
Soler 2006[180]	1	0	0	1	0	0	0	1
Solomon 1998[136]	1	0	0	1	0	0	1	0
Spencer 2010[169]	0	0	0	0	0	0	0	0
Spruit 2002[247]	0	0	0	0	0	0	0	0
Sridhar 2008[155]	0	0	0	1	0	0	0	0
Stulbarg 2002[137] A	1	1	0	0	1	0	0	0

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0
0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	1
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Stulbarg 2002[137] B	1	1	0	0	1	0	0	0
Stulbarg 2002[137] C	1	1	0	0	1	0	0	0
Subin 2010[242] A	0	0	0	0	0	0	0	0
Subin 2010[242] B	0	0	0	0	0	0	0	0
Subin 2010[242] C	0	0	0	0	0	0	0	0
Theander 2009[220]	1	0	0	0	1	0	0	0
Toshima 1990[138]	1	0	0	0	1	0	0	0
Trappenburg 2011[188]	0	1	0	1	0	0	0	0
Troosters 2000[248]	0	0	1	0	0	0	0	0
Van Gestel 2012[208]	0	1	0	0	0	0	0	0
Vogiatzis 2002[265]	0	0	0	0	0	0	0	0
Vonbank 2012[246] A	0	0	0	0	0	0	0	0
Vonbank 2012[246] B	0	0	0	0	0	0	0	0
Vonbank 2012[246] C	0	0	0	0	0	0	0	0
Wadell 2004[221] A	0	0	1	0	0	0	0	0
Wadell 2004[221] B	0	0	1	0	0	0	0	0
Wadell 2004[221] C	0	0	0	0	0	0	0	0
Wakabayashi 2011[262]	1	0	0	0	0	1	0	0
Wang 2004[203]	0	0	0	0	0	0	0	0
Warlies 2006[209]	0	0	1	0	0	0	0	0
Waterhouse 2010[277]	0	0	0	0	0	0	0	0
Watson 1997[231]	0	1	0	0	0	0	0	0
Wedzicha 1998[157]	0	1	0	0	0	0	0	0
Weekes 2009[158]	0	1	0	0	0	0	0	0
White 2002[159]	0	0	0	0	0	0	0	0
Wijkstra 1994[189]	1	0	0	0	1	0	0	0
Wijkstra 1995[190] A	1	0	0	1	1	0	0	0
Wijkstra 1995[190] B	1	0	0	1	1	0	0	0
Wijkstra 1995[190] C	0	0	0	0	0	0	0	0
Wittmann 2007[210]	0	0	0	0	0	0	0	0
Wong 2005[74]	0	0	0	1	0	0	0	0
Wood-Baker 2006[170]	1	1	0	0	0	0	0	1
Wright 2003[211]	0	0	1	0	0	0	0	0
Xu 2010[204] A	1	0	0	0	1	0	0	0

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
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1	0	0	0	0	0	0	0	0	0
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1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Study	Multicomponent SM interventions vs. control/UC	Single component vs. UC or multicomponent + 1 vs. multicomponent	Exercise-only interventions vs. control/UC/sham training	Enhanced care (with/without SM package) vs. UC/SM package	Multicomponent SM including supervised exercise vs. control/UC	Multicomponent SM including non-supervised exercise vs. control/UC	Multicomponent SM without exercise or exercise counselling vs. control/UC	Multicomponent SM with exercise education only vs. control/UC
Xu 2010[204] B	0	0	0	0	0	0	0	0
Xu 2010[204] C	0	0	0	0	0	0	0	0
Xu 2010[204] D	0	1	0	0	0	0	0	0
Xu 2010[204] E	0	0	0	0	0	0	0	0
Xu 2010[204] F	0	0	0	0	0	0	0	0
Yamaguti 2012[235]	0	1	0	0	0	0	0	0
Yeh 2010[139]	1	0	1	0	1	0	0	0
Zhang 2008[205] A	0	1	0	0	0	0	0	0
Zhang 2008[205] B	0	1	0	0	0	0	0	0
Zhang 2008[205] C	0	1	0	0	0	0	0	0

Combined strength plus aerobic plus other SM vs. UC	Strength plus aerobic exercise training vs. aerobic ex only	Endurance vs. strength/resistance exercise training	Addition of upper limb training to lower limb training	Comparisons of interval and continuous exercise	Inspiratory and expiratory muscle training vs. control/sham training/UC	Exercise of a specific intensity/duration vs. exercise of different intensity/duration	Intervention in one setting vs. intervention in a different setting	Pharmacist led	Maintenance post PR
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

Appendix 28 Funnel plot of studies for multicomponent self-management interventions vs. usual care: St George's Respiratory Questionnaire outcomes at 13 weeks' follow-up – review 4

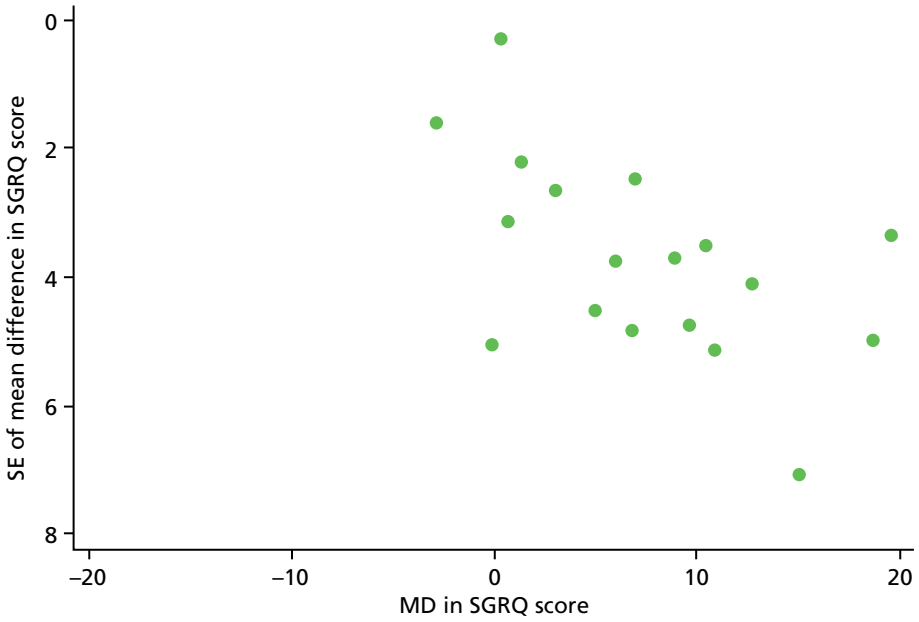

FIGURE 80 Egger's test: coefficient of bias 1.98, *p*-value 0.001.

Appendix 29 Funnel plot of studies for multicomponent self-management interventions vs. usual care: St George's Respiratory Questionnaire outcomes at between 3 and 6 months' follow-up – review 4

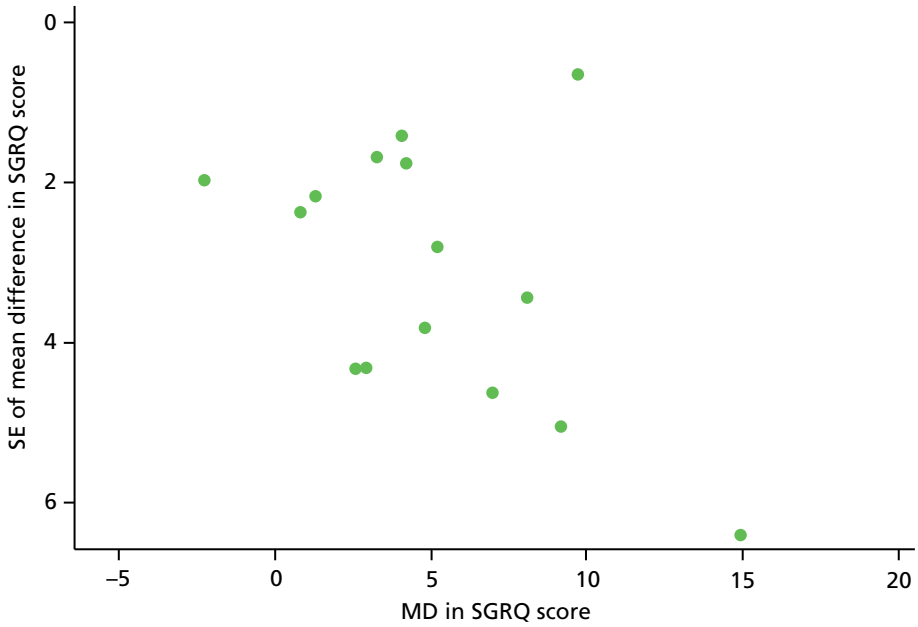

FIGURE 81 Egger's test: coefficient of bias –1.80, *p*-value 0.054.

Appendix 30 Funnel plot of studies for multicomponent self-management interventions vs. usual care: St George's Respiratory Questionnaire outcomes at ≥ 6 months' follow-up – review 4

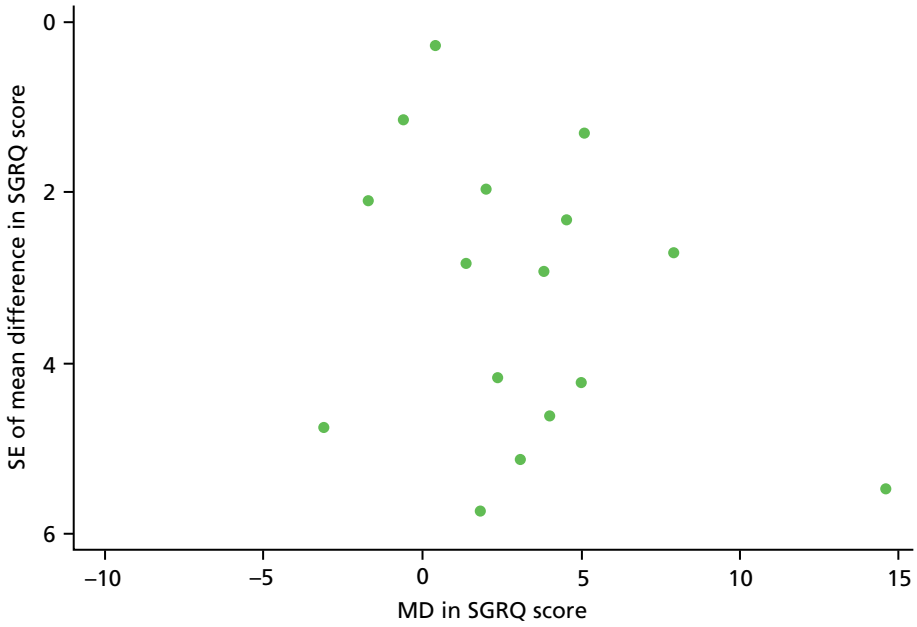

FIGURE 82 Egger's test: coefficient of bias 0.99, *p*-value 0.031.

Appendix 31 Funnel plot of studies for multicomponent self-management interventions including supervised exercise: St George's Respiratory Questionnaire outcomes at ≤ 13 weeks' follow-up – review 4

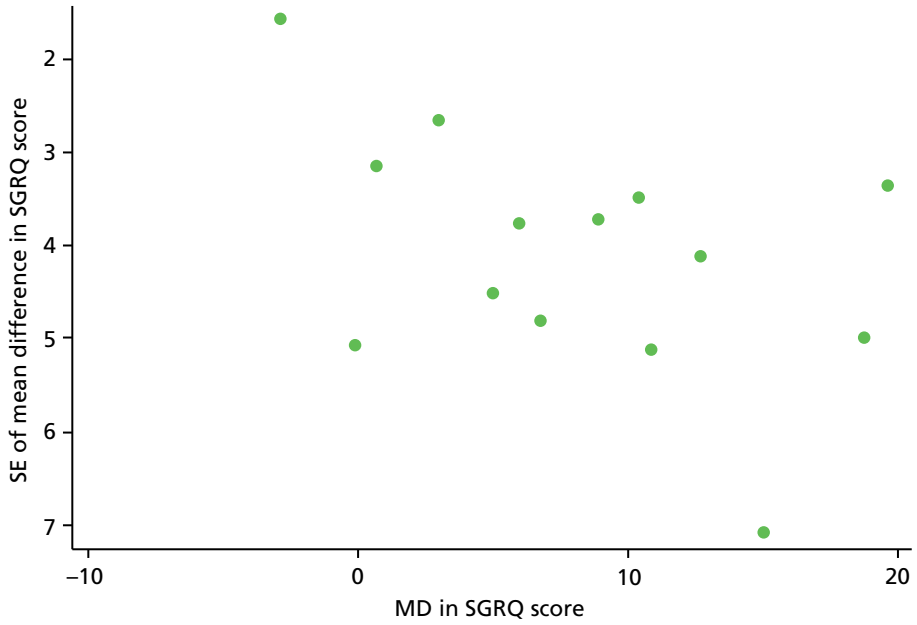

FIGURE 83 Egger's test: coefficient of bias 3.91, *p*-value 0.006.

Appendix 32 Funnel plot of studies for enhanced care interventions: hospital admissions at ≥ 6 months' follow-up – review 4

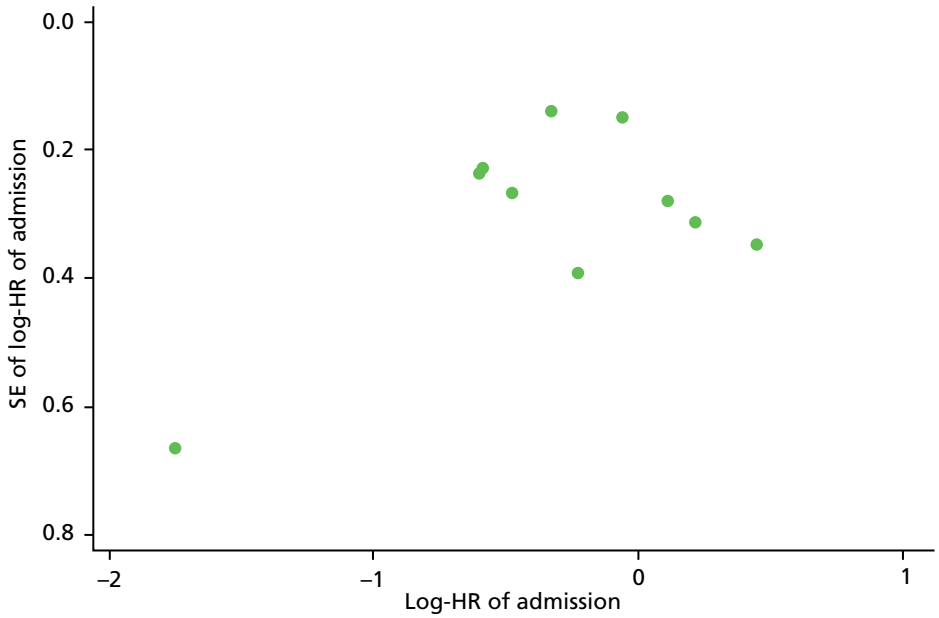

FIGURE 84 Egger's test: coefficient of bias –0.43, *p*-value 0.749.

Appendix 33 Funnel plot of studies for combined strength and aerobic interventions: St George's Respiratory Questionnaire outcomes at ≤ 13 weeks' follow-up – review 4

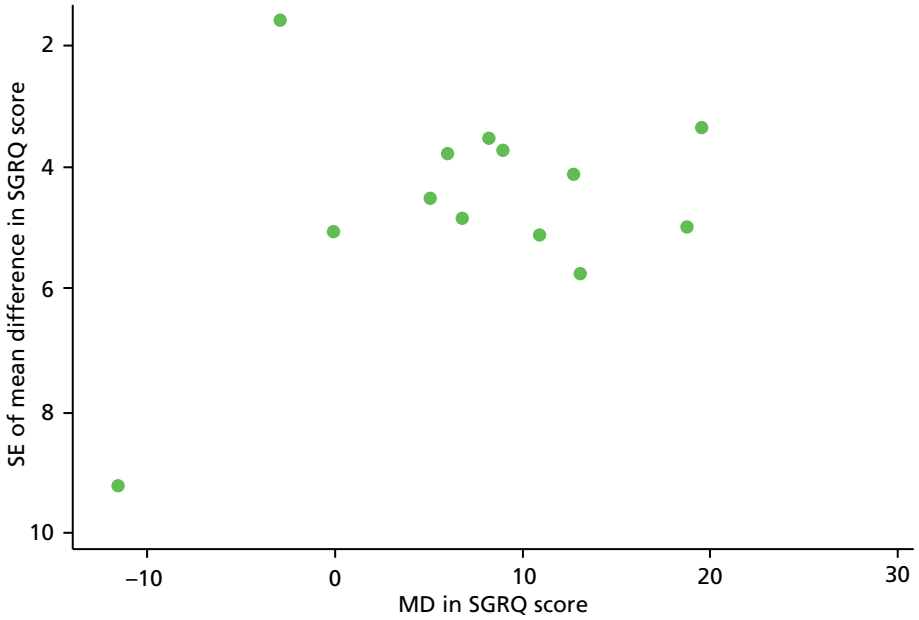

FIGURE 85 Egger's test: coefficient of bias 2.79, *p*-value 0.061.

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HS&DR
HTA
PGfAR
PHR

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