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Telerehabilitation for chronic respiratory disease (Protocol)

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[Intervention Protocol]

Telerehabilitation for chronic respiratory disease

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ABSTRACT

This is a protocol for a Cochrane Review (Intervention). The objectives are as follows:

1. To determine whether telerehabilitation in people with chronic respiratory disease has beneficial effects on exercise capacity, breathlessness and health-related quality of life when compared to traditional, centre-based pulmonary rehabilitation or no rehabilitation control.

2. To assess the safety of telerehabilitation in people with chronic respiratory disease.

BACKGROUND

Description of the condition

Chronic respiratory diseases, including chronic obstructive pulmonary disease (COPD), interstitial lung diseases (ILD), bronchiectasis and chronic asthma, contribute 7% to the global burden of disease (Maio 2006). These conditions cause chronic inflammation and/or infection of the airways and other structures of the lungs (Bousquet 2007). As a group, chronic respiratory diseases are the third leading cause of death worldwide, and account for 10% of all disability adjusted life years (a metric that estimates the amount of active and productive life lost due to a condition) (Forum of International Respiratory Societies 2017). This level of disability is second only to that of cardiovascular disease, including stroke (Forum of International Respiratory Societies 2017). The estimated prevalence of preventable chronic respiratory diseases exceeds 800 million people globally (Bousquet 2007), with four

million premature deaths attributed to chronic respiratory disease each year (Ferkol 2014).

Chronic respiratory disease commonly develops as a consequence of repeated exposure to noxious environmental stimuli such as cigarette smoke, air pollution or occupational hazards. Other possible causes for the development of a chronic respiratory disease include immunological disorders, iatrogenic responses, genetic factors, repeated severe respiratory infections during childhood and low socioeconomic status (GOLD 2018). Collectively, people with a chronic respiratory disease experience breathlessness limiting functional capacity, reduced exercise tolerance, impaired health-related quality of life, repeated need for hospitalisation, and an increased prevalence of anxiety and depression (Celli 2004). The adverse social and economic effects of chronic respiratory disease experienced by individuals, families and societies are large and projected to increase substantially in the future (Bousquet 2007).

Description of the intervention

Pulmonary rehabilitation aims to improve the physiological and psychological condition of individuals with chronic respiratory disease through exercise training accompanied by education and behaviour change (Spruit 2013). Pulmonary rehabilitation is commonly delivered in an outpatient or community setting and comprises two or more sessions per week delivered over a period of at least four weeks (McCarthy 2015). Where healthcare system culture and resources allow, pulmonary rehabilitation may also be delivered in the inpatient setting (McCarthy 2015). The exercise training component of pulmonary rehabilitation includes both aerobic training and strength training. Typically, each session consists of up to 30 minutes of aerobic training (often a combination of walking and cycle training), with exercise prescription individualised on the basis of a pre-rehabilitation assessment of functional exercise capacity (Spruit 2013). Strength training for the upper and lower limbs is achieved through repetitive lifting of loads equivalent to 60% to 70% of the maximum load able to be moved through the full range of movement once (i.e. one repetition maximum) or that which produces fatigue after eight to 12 repetitions (Chodzko-Zajko 2009). To improve strength the American College of Sports Medicine recommends adults undertake strengthening exercises on two or three days in the week, comprising one to three sets of eight to 12 repetitions (Chodzko-Zajko 2009). Progression of training intensity, or overload, over the course of the rehabilitation period is paramount in order to achieve optimal gains in functional exercise tolerance (Spruit 2013). While individually tailored exercise training is the cornerstone of pulmonary rehabilitation, programmes may also include disease-specific education and self-management training (Spruit 2013). Self-management training aims to help people with COPD develop and implement the skills necessary to perform their health management tasks, guide behaviour change and provide support to achieve optimal function and disease control (Zwerink 2014). However, the most effective content for self-management training remains unclear (Zwerink 2014).

Telehealth interventions are those that provide healthcare at a distance through the use of telecommunications or virtual technology (WHO 2016). Telerehabilitation is a domain of telehealth, distinct from telemonitoring (the monitoring of patients at a distance using information technology), which makes use of information and communication technologies to provide clinical rehabilitation services from a distance (Kairy 2009). Remote communication between the patient and healthcare professional may utilise telephone (including text messaging), internet or videoconferencing technologies (Hwang 2015), in order to enable pulmonary rehabilitation services to be delivered to a satellite healthcare centre or directly to the patient's home (Lee 2015). Telerehabilitation may provide greater healthcare access and service delivery options for individuals who are geographically or socially isolated, for patients in full-time work or study, or for individuals who find travel difficult due to their disease severity or comorbidities. There is some evidence that a proportion of people with COPD attending pulmonary rehabilitation are interested in utilising telerehabilitation services (Seidman 2017). In addition to exercise training, telerehabilitation models may also include other components of centre-based pulmonary rehabilitation such as self-management education and education regarding disease management. Telerehabilitation models for pulmonary rehabilitation have the potential to positively influence uptake and accessibility of pulmonary rehabilitation services for all patients with a chronic respiratory disease.

How the intervention might work

Pulmonary rehabilitation is a proven, effective intervention which enables individuals with a variety of chronic respiratory diseases - including COPD (McCarthy 2015), bronchiectasis (Lee 2017), ILD (Dowman 2014), and asthma (Trevor 2014) - to achieve clinically important gains in exercise and functional capacity, as well as symptoms and health-related quality of life (Spruit 2013). Participation in pulmonary rehabilitation results in fewer symptoms, reduced hospitalisations due to an acute exacerbation of respiratory disease (Guell 2000), and reduced healthcare utilisation (Puhan 2005). The exercise training component of pulmonary rehabilitation helps to achieve these outcomes through improved capacity and efficiency of skeletal muscle function, which serves to reduce fatigue and perception of dyspnoea, allowing for increased exercise tolerance and physical functioning (Spruit 2013). Pulmonary rehabilitation also helps to improve disease self-management and control through education and training (McCarthy 2015).

Pulmonary rehabilitation delivered via telerehabilitation may utilise any of a number of technological modalities including, but not limited to, telephone (audio calls or text messaging), the internet (e.g. mobile application or web platform), or videoconferencing to deliver the requisite components of pulmonary rehabilitation to people with chronic respiratory disease. These techno-

logical modalities have the capacity to deliver the essential components of pulmonary rehabilitation, including the monitoring of physiological signs and symptoms during exercise remotely in real-time or in a 'store and forward' capacity. In addition, they can provide supervision and feedback for exercise training, and discussion of self-management education. Supervision of exercise training during telerehabilitation may involve direct (e.g. auditory or audio-visual communication in real-time) or indirect (e.g. via text message) feedback from a clinician. Telerehabilitation models may also offer unsupervised exercise training, whereby standard or automated prompts and feedback are provided via technological modalities to individuals. Telerehabilitation may be delivered directly to a patient's home or to a nearby healthcare facility. It is unclear whether telerehabilitation in general, or a particular mode of telerehabilitation delivery, can achieve improvements in physical function and health-related quality of life equivalent to those achievable using traditional models of pulmonary rehabilitation delivery. Telerehabilitation has the ability to overcome barriers to pulmonary rehabilitation participation, including issues of patient travel and transport, and staffing and resource limitations (Keating 2011). Telerehabilitation could be a relevant treatment alternative across all chronic respiratory diseases where rehabilitation is a proven therapeutic intervention. However it is also possible that the lack of in-person supervision and peer support could adversely affect rehabilitation outcomes.

Why it is important to do this review

Despite the proven benefits of pulmonary rehabilitation for people with chronic respiratory disease, only a very small percentage of people who are eligible to attend pulmonary rehabilitation ever do so (Brooks 2007). Significant patient-centred barriers to attendance and completion of pulmonary rehabilitation relate to travel and transport to the rehabilitation centre (Keating 2011). In addition, access to pulmonary rehabilitation in non-metropolitan areas is limited due to lack of services and suitably trained healthcare professionals (Johnston 2012). Improving patient access to pulmonary rehabilitation, through alternative models of service delivery, has the potential to improve health outcomes and reduce total hospitalisations and healthcare utilisation for people with chronic respiratory disease. Economic modelling from Australia suggests that increasing the number of patients who complete pulmonary rehabilitation from 5% to 20% at a single institution might reduce that hospital's admission rates related to COPD by 75% per year, with associated cost savings (NSW Agency for Clinical Innovation 2010).

While people with COPD previously formed the majority of candidates for pulmonary rehabilitation, recent evidence of the efficacy of pulmonary rehabilitation in other lung diseases has broadened the application of this intervention (Spruit 2013), and treatment recommendations in pulmonary rehabilitation guidelines now encompass the spectrum of chronic respiratory disease (e.g. Alison 2017). As such, individuals referred to pulmonary rehabilitation now have a variety of chronic respiratory diseases. These include, but are not limited to COPD, chronic airflow limitation in the absence of smoking history, bronchiectasis, ILD and chronic asthma. Consistent with the changing demographic of pulmonary rehabilitation participants, research studies in pulmonary rehabilitation are increasingly including people with a broad cross section of lung disease to ensure the included study populations are reflective of those individuals who are referred to and attend pulmonary rehabilitation (Greening 2014). Results from such studies may have a greater capacity for translation into clinical practice because they represent the real-world clinical situation (Grimshaw 2012).

Telerehabilitation has the potential to overcome known barriers to pulmonary rehabilitation participation, and could be a relevant treatment alternative across all chronic respiratory diseases where rehabilitation is an accepted therapeutic intervention. To date, there has not been a comprehensive assessment of the capacity of telerehabilitation to achieve improvements in exercise capacity, breathlessness and health-related quality of life in people with chronic respiratory disease, or its ability to improve uptake and access to rehabilitation services. This Cochrane Review aims to evaluate the efficacy of telerehabilitation on clinical and patient-related outcomes in people with chronic respiratory disease, and to highlight directions for future work.

OBJECTIVES

1. To determine whether telerehabilitation in people with chronic respiratory disease has beneficial effects on exercise capacity, breathlessness and health-related quality of life when compared to traditional, centre-based pulmonary rehabilitation or no rehabilitation control.

2. To assess the safety of telerehabilitation in people with chronic respiratory disease.

METHODS

Criteria for considering studies for this review

Types of studies

We will include randomised controlled trials (RCTs) and controlled clinical trials of telerehabilitation in people with chronic respiratory disease. We will include controlled clinical trials in order to encompass studies where randomisation may not be possible, e.g. where regional cohorts are compared to metropolitan

patients. We will include studies reported in full text, those published as an abstract only, and unpublished data.
For the purposes of this review, the following definitions will apply.

1. Telerehabilitation is the delivery of pulmonary rehabilitation services at a distance, using telecommunications technology as a delivery medium (Lee 2015).
2. Traditional (centre-based) pulmonary rehabilitation is that which is conducted in an outpatient or inpatient setting, and comprises supervised exercise training (with or without education and psychological support) for at least four weeks (McCarthy 2015)

Types of participants

We will include adults (aged 18 and older) with a diagnosis of a chronic respiratory disease (according to relevant established criteria), of any disease severity, in stable state (i.e. not during an inpatient admission for an acute exacerbation). We will include studies that incorporate a mix of chronic diseases but only where data relating to review outcomes can be obtained separately for participants with chronic respiratory diseases.
We will exclude participants with the following comorbidities/characteristics.

1. A diagnosis of cystic fibrosis. Standard pulmonary rehabilitation models have not been tested or applied to individuals with cystic fibrosis due to infection control.
2. A primary diagnosis of a neuromuscular disease.

Types of interventions

We will include studies that compare telerehabilitation with traditional pulmonary rehabilitation or a no rehabilitation control. We will also include telerehabilitation interventions for the delivery of maintenance programmes following the pulmonary rehabilitation period (i.e. interventions designed to maintain health benefits gained from a primary pulmonary rehabilitation programme (Yorke 2010)).
To be included in the review, the telerehabilitation intervention must include exercise training, with at least 50% of the rehabilitation intervention being delivered by telerehabilitation (Hwang 2015).
Telerehabilitation may be delivered to any of a variety of locations, including directly into the patient's home or to a healthcare centre, or to a mobile device. Telerehabilitation may be performed in a group (physical or virtual) or individually. It can include visual interaction (e.g. videoconferencing) or audible interaction, or both, between participants and healthcare providers.
Telehealth interventions for the purposes of monitoring symptoms or physiological parameters alone (i.e. telemonitoring), without delivery of pulmonary rehabilitation, will be excluded.

Comparisons

1. Telerehabilitation compared to centre-based (outpatient) pulmonary rehabilitation.
2. Telerehabilitation compared to inpatient pulmonary rehabilitation.
3. Telerehabilitation compared to a no rehabilitation control.

We will analyse studies of telerehabilitation for maintenance rehabilitation separately from trials of telerehabilitation for primary pulmonary rehabilitation.

Types of outcome measures

Primary outcomes

1. Exercise capacity, measured by a laboratory test or standardised field test.
2. Adverse events (e.g. musculoskeletal injuries, falls, medical emergencies).
3. Dyspnoea (any validated measure, including isotime measures from exercise tests).
4. Quality of life (generic or disease specific).

The primary time point for analysis will be change from baseline to end of intervention. We will report any follow-up measurements reported after completion of the intervention as medium-term (up to and including six months after completion of the intervention) or long-term (longer than six months after completion of the intervention).

Secondary outcomes

1. Adherence to the intervention or completion of pulmonary rehabilitation/telerehabilitation (as defined by specific criteria of individual included studies or more than 70% of prescribed classes (Williams 2014)).
2. Anxiety or depression, or both (any validated measure).
3. Physical activity participation (any objective measure of physical activity such as pedometer, accelerometer, physical activity monitor providing a measure of step count, activity counts, energy expenditure or physical activity time (different intensities, range of thresholds used)).
4. Healthcare utilisation (including hospitalisation).

Where documented, issues of a technological nature and the incidence of such issues (e.g. loss of internet connection, failure of technological devices) will be reported narratively.
Reporting one or more of the outcomes listed here in the study is not an inclusion criterion for the review.

Search methods for identification of studies

Electronic searches

We will identify studies from the Cochrane Airways Trials Register, which is maintained by the Information Specialist for the group. The Cochrane Airways Trials Register contains studies identified from several sources:

1. monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL), through the Cochrane Register of Studies Online (crso.cochrane.org);
2. weekly searches of MEDLINE Ovid SP, 1946 to date;
3. weekly searches of Embase Ovid SP, 1974 to date;
4. monthly searches of PsycINFO Ovid SP;
5. monthly searches of CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature);
6. monthly searches of AMED EBSCO (Allied and Complementary Medicine);
7. handsearches of the proceedings of major respiratory conferences.

Studies contained in the Trials Register are identified through search strategies based on the scope of Cochrane Airways. Details of these strategies, as well as a list of handsearched conference proceedings are in Appendix 1. See Appendix 2 for search terms used to identify studies for this review. We will conduct additional searches of CENTRAL, MEDLINE & Embase. The search strategy for MEDLINE is in Appendix 3. This strategy will be appropriately adapted for use in the other databases.

We will also search the following trials registries:

1. US National Institutes of Health Ongoing Trials Register, ClinicalTrials.gov (www.clinicaltrials.gov);
2. World Health Organization International Clinical Trials Registry Platform (apps.who.int/trialsearch);
3. Australia New Zealand Clinical Trials Registry (www.anzctr.org.au).

We will search the Cochrane Airways Trials Register and additional sources from inception to present, with no restriction on language of publication.

Searching other resources

We will check the reference lists of all primary studies for additional references.

We will search for errata or retractions from included studies published in full text on PubMed and report the date this was done within the review.

Data collection and analysis

Selection of studies

Three review authors (NSC, HM, POH) will screen the titles and abstracts of the search results independently and code them as 'retrieve' (eligible or potentially eligible/unclear) or 'do not retrieve'. We will retrieve the full-text study reports of all potentially eligible studies and three review authors (NSC, HM, POH) will independently screen them for inclusion, recording the reasons for exclusion of ineligible studies. We will resolve any disagreement through discussion or, if required, we will consult a third person/review author (AEH or JAA). We will identify and exclude duplicates and collate multiple reports of the same study so that each study, rather than each report, is the unit of interest in the review. We will record the selection process in sufficient detail to complete a PRISMA flow diagram and 'Characteristics of excluded studies' table (Moher 2009).

Data extraction and management

We will use a data collection form for study characteristics and outcome data, which has been piloted on at least one study in the review. Three review authors (NSC, CJH, PZ) will independently extract the following study characteristics from included studies.

1. Methods: study design, duration of the intervention, length of any follow-up period, study location, study setting, withdrawals, date of study.
2. Participant characteristics: number, mean age, age range, gender, diagnosis, severity of condition, diagnostic criteria, baseline lung function, smoking history, inclusion criteria, exclusion criteria.
3. Interventions: intervention, comparison, concomitant medications.
4. Outcomes: primary and secondary outcomes specified and collected (at baseline and at the time of intervention completion) and follow-up measures at any other time point reported.
5. Notes: funding for studies and notable conflicts of interest of trial authors.

We will note in the 'Characteristics of included studies' table if outcome data were not reported in a usable way. We will resolve disagreements by consensus or by involving a third person/review author (AEH or JAA). One review author (NSC) will transfer data into the Review Manager file (RevMan 2014). We will double-check that data are entered correctly by comparing the data presented in the systematic review with the study reports. A second review author (PZ) will spot-check study characteristics entered into Review Manager for accuracy against the study report.

Assessment of risk of bias in included studies

Three review authors (NSC, CJH, PZ) will assess risk of bias independently for each randomised controlled trial included using the criteria outlined in Chapter 8 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2017). We will resolve any disagreements by discussion or by involving another author (AEH or JAA). We will assess the risk of bias according to the following domains:

1. random sequence generation;

2. allocation concealment;
3. blinding of participants and personnel;
4. blinding of outcome assessment;
5. incomplete outcome data;
6. selective outcome reporting;
7. other bias.

We will judge each potential source of bias as high, low or unclear and provide a quote from the study report together with a justification for our judgement in the 'Risk of bias' table. We will resolve discrepancies by consensus or by involving another author (AEH or JAA).

For non-randomised controlled trials, we will use the Risk Of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool to assess risk of bias. This assessment will be completed independently by three review authors (NSC, CJH, PZ) using the criteria outlined in *ROBINS-I: Detailed Guidance* (Sterne 2016). For non-randomised controlled trials we will assess the risk of bias according to the following domains.

Pre-intervention bias:

1. due to confounding;
2. in selection of participants into the study.

At-intervention bias:

1. in classification of the intervention.

Post-intervention bias:

1. due to deviations from the intended intervention;
2. due to missing data;
3. in measurement of outcomes;
4. in selection of the reported results.

We will summarise the 'Risk of bias' judgements across different studies for each of the domains listed and summarise results in a 'Risk of bias' table.

We will consider blinding separately for different key outcomes where necessary (e.g. for unblinded outcome assessment, risk of bias for adverse events may be very different than for a patient-reported symptom scale).

When considering treatment effects, we will take into account the risk of bias for the studies that contribute to that outcome.

Assessment of bias in conducting the systematic review

We will conduct the review according to this published protocol and justify any deviations from it in the 'Differences between protocol and review' section of the systematic review.

Measures of treatment effect

We will analyse data for each outcome, irrespective of reported participant dropout (intention-to-treat analysis). We will analyse dichotomous data as odds ratios (ORs) with 95% confidence intervals (CIs). For continuous data we will calculate the mean difference (MD) (for same scale metric) or standardised mean difference (SMD) (for different scale metrics) with 95% CIs. We will describe skewed data narratively using medians and interquartile ranges (IQRs).

We will undertake meta-analyses only where this is meaningful; that is, if the treatments, participants and the underlying clinical question are similar enough for pooling to make sense. If data from rating scales are combined in a meta-analysis, we will ensure they are entered with a consistent direction of effect (e.g. lower scores always indicate improvement).

Where multiple trial arms are reported in a single study, we will include only the relevant trial arms. If two comparisons (e.g. intervention A versus placebo and intervention B versus placebo) are combined in the same meta-analysis, we will halve the control group to avoid double-counting.

If adjusted analyses are available (ANOVA or ANCOVA) we will use these as a preference in our meta-analyses. If both change from baseline and endpoint scores are available for continuous data, we will use change from baseline unless there is low correlation between measurements in individuals.

Unit of analysis issues

Where studies randomly allocate individual participants to a telerehabilitation intervention or control/sham, we will consider the participant as the unit of analysis. We will use the generic inverse variance method to combine the results of cluster-randomised trials with those from parallel group studies, as long as the results have been adjusted (or can be adjusted) to take account of the clusters. We will not include cross-over trials in this review due to the potential carryover effects associated with exercise training or behavioural interventions.

Dealing with missing data

In the event of missing data, we will contact investigators or study sponsors in order to verify key study characteristics and obtain missing numerical outcome data where possible (e.g. when a study is reported only as an abstract only). Where this is not possible, and the missing data are thought to introduce serious bias, we will analyse the impact of including such studies in the overall assessment of results by performing a sensitivity analysis.

Assessment of heterogeneity

We will use the I^2 statistic to measure heterogeneity among the studies in each analysis. If we identify substantial heterogeneity

we will report it and explore the possible causes by prespecified subgroup analysis.

Assessment of reporting biases

If we are able to pool more than 10 studies, we will create and examine a funnel plot to explore possible small study and publication biases.

Data synthesis

For data from randomised controlled trials that are statistically and clinically homogenous, we will perform a pooled quantitative synthesis. We will pool data using a random-effects model to account for between-study heterogeneity in the meta-analysis. Where the trials are clinically heterogeneous we will conduct a narrative synthesis. For instance, we will analyse data for different types of telerehabilitation interventions separately (e.g. those with supervised exercise training versus unsupervised exercise training). For data from non-randomised studies (NRS), where studies are not sufficiently homogeneous to combine, we will display the study results in a forest plot but with the pooled estimate suppressed. Non-randomised studies of different study designs will not be pooled. Where NRS are considered both reasonably resistant to bias and relatively homogenous, we will combine data across studies using a meta-analysis. In this instance, we will analyse adjusted effect estimates using the generic inverse-variance (GIV) methods. We will not combine the results from NRS with the results of randomised controlled trials.

We will analyse trials of telerehabilitation for maintenance separately from trials of telerehabilitation for primary pulmonary rehabilitation, as it is expected that the nature and magnitude of effect for maintenance programmes will differ to that of primary pulmonary rehabilitation.

'Summary of findings' table

We will create a 'Summary of findings' table using the following outcomes.

1. Exercise capacity: maximal or submaximal, measured directly or by a standardised field test.
2. Adverse events.
3. Dyspnoea (any validated measure).
4. Quality of life (generic or disease specific).

We will use the five GRADE considerations (risk of bias, consistency of effect, imprecision, indirectness and publication bias) to assess the quality of a body of evidence as it relates to the studies that contribute data for the prespecified outcomes. We will use the methods and recommendations described in Section 8.5 and Chapter 12 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2017a), using GRADEpro GDT software (GRADEpro GDT). We will use footnotes to justify all decisions to downgrade the quality of evidence, and we will make comments to aid the reader's understanding of the review where necessary.

Subgroup analysis and investigation of heterogeneity

We plan to carry out the following subgroup analyses if appropriate data are available.

1. Duration of intervention (at least 4 weeks but less than 8 weeks; at least 8 weeks but less than 12 weeks; 12 or more weeks).
2. By diagnosis (chronic obstructive pulmonary disease, interstitial lung diseases, bronchiectasis and chronic asthma).

We will use the primary outcomes (exercise capacity, adverse events, dyspnoea and quality of life) for subgroup analyses.

We will use the formal test for subgroup interactions in Review Manager (RevMan 2014).

Sensitivity analysis

We plan to carry out a sensitivity analysis comparing randomised controlled trials to non-randomised trials. Additionally, we will carry out a sensitivity analysis excluding trials that had a high risk of bias for blinding of outcome assessment or a high risk of bias of incomplete outcome reporting, or both.

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* *Indicates the major publication for the study*

APPENDICES

Appendix 1. Sources and search methods for the Cochrane Airways Group's Specialised Register (CAGR)

Electronic searches: core databases

Database	Frequency of search
CENTRAL (the Cochrane Library)	Monthly
MEDLINE (Ovid)	Weekly
Embase (Ovid)	Weekly
PsycINFO (Ovid)	Monthly
CINAHL (EBSCO)	Monthly
AMED (EBSCO)	Monthly

Handsearches: core respiratory conference abstracts

Conference	Years searched
American Academy of Allergy, Asthma and Immunology (AAAAI)	2001 onwards
American Thoracic Society (ATS)	2001 onwards
Asia Pacific Society of Respirology (APSR)	2004 onwards
British Thoracic Society Winter Meeting (BTS)	2000 onwards
Chest Meeting	2003 onwards
European Respiratory Society (ERS)	1992, 1994, 2000 onwards
International Primary Care Respiratory Group Congress (IPCRG)	2002 onwards
Thoracic Society of Australia and New Zealand (TSANZ)	1999 onwards

MEDLINE search strategy used to identify studies for the CAGR

Condition search

1. exp Asthma/
2. asthma$.mp.
3. (antiasthma$ or anti-asthma$).mp.
4. Respiratory Sounds/
5. wheez$.mp.
6. Bronchial Spasm/
7. bronchospas$.mp.
8. (bronch$ adj3 spasm$).mp.
9. bronchoconstrict$.mp.
10. exp Bronchoconstriction/
11. (bronch$ adj3 constrict$).mp.
12. Bronchial Hyperreactivity/
13. Respiratory Hypersensitivity/
14. ((bronchial$ or respiratory or airway$ or lung$) adj3 (hypersensitiv$ or hyperreactiv$ or allerg$ or insufficiency)).mp.
15. ((dust or mite$) adj3 (allerg$ or hypersensitiv$)).mp.
16. or/1-15
17. exp Aspergillosis, Allergic Bronchopulmonary/
18. lung diseases, fungal/
19. aspergillosis/
20. 18 and 19
21. (bronchopulmonar$ adj3 aspergillosis).mp.
22. 17 or 20 or 21
23. 16 or 22
24. Lung Diseases, Obstructive/
25. exp Pulmonary Disease, Chronic Obstructive/
26. emphysema$.mp.
27. (chronic$ adj3 bronchiti$).mp.
28. (obstruct$ adj3 (pulmonary or lung$ or airway$ or airflow$ or bronch$ or respirat$)).mp.
29. COPD.mp.
30. COAD.mp.
31. COBD.mp.
32. AECB.mp.
33. or/24-32
34. exp Bronchiectasis/
35. bronchiect$.mp.
36. bronchoect$.mp.
37. kartagener$.mp.
38. (ciliary adj3 dyskinesia).mp.
39. (bronchial$ adj3 dilat$).mp.
40. or/34-39
41. exp Sleep Apnea Syndromes/
42. (sleep$ adj3 (apnoea$ or apnoea$)).mp.
43. (hypopnoea$ or hypopnoea$).mp.
44. OSA.mp.
45. SHS.mp.
46. OSAHS.mp.
47. or/41-46
48. Lung Diseases, Interstitial/
49. Pulmonary Fibrosis/
50. Sarcoidosis, Pulmonary/
51. (interstitial$ adj3 (lung$ or disease$ or pneumon$)).mp.

52. ((pulmonary$ or lung$ or alveoli$) adj3 (fibros$ or fibrot$)).mp.
53. ((pulmonary$ or lung$) adj3 (sarcoid$ or granulom$)).mp.
54. or/48-53
55. 23 or 33 or 40 or 47 or 54

Filter to identify RCTs

1. exp "clinical trial [publication type]"/
2. (randomised or randomised).ab,ti.
3. placebo.ab,ti.
4. dt.fs.
5. randomly.ab,ti.
6. trial.ab,ti.
7. groups.ab,ti.
8. or/1-7
9. Animals/
10. Humans/
11. 9 not (9 and 10)
12. 8 not 11

The MEDLINE strategy and RCT filter are adapted to identify studies in other electronic databases.

Appendix 2. Search strategy to identify relevant studies from the Cochrane Airways Trials Register

#1 MeSH DESCRIPTOR Asthma Explode All AND INSEGMENT
#2 asthma*:ti,ab AND INSEGMENT
#3 MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive Explode All AND INSEGMENT
#4 MeSH DESCRIPTOR Bronchitis, Chronic AND INSEGMENT
#5 (obstruct*) near3 (pulmonary or lung* or airway* or airflow* or bronch* or respirat*) AND INSEGMENT
#6 (COPD OR COAD OR COBD OR AECOPD):TI,AB,KW AND INSEGMENT
#7 BRONCH:MISC1 AND INSEGMENT
#8 MeSH DESCRIPTOR Bronchiectasis Explode All AND INSEGMENT
#9 bronchiect* AND INSEGMENT
#10 MESH DESCRIPTOR Lung Diseases, Interstitial EXPLODE ALL AND INSEGMENT
#11 MESH DESCRIPTOR Pulmonary Fibrosis EXPLODE ALL AND INSEGMENT
#12 (interstitial* NEAR3 (lung* or disease* or pneumon*)):ti,ab AND INSEGMENT
#13 ((pulmonary* or lung* or alveoli*) NEAR3 (fibros* or fibrot*)):ti,ab AND INSEGMENT
#14 ((pulmonary* or lung*) NEAR3 (sarcoid* or granulom*)):ti,ab AND INSEGMENT
#15 AST:MISC1 OR COPD:MISC1 OR BRONCH:MISC1 OR ILD:MISC1 AND INSEGMENT
#16 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15
#17 MESH DESCRIPTOR Telerehabilitation AND INSEGMENT
#18 MESH DESCRIPTOR Telemedicine AND INSEGMENT
#19 MESH DESCRIPTOR Videoconferencing EXPLODE ALL AND INSEGMENT
#20 MESH DESCRIPTOR telecommunications AND INSEGMENT
#21 MESH DESCRIPTOR Computer Communication Networks EXPLODE ALL AND INSEGMENT
#22 MESH DESCRIPTOR Remote Consultation AND INSEGMENT
#23 MESH DESCRIPTOR Telephone EXPLODE ALL AND INSEGMENT
#24 MESH DESCRIPTOR Electronic Mail AND INSEGMENT
#25 MESH DESCRIPTOR Text Messaging AND INSEGMENT
#26 MESH DESCRIPTOR Internet EXPLODE ALL AND INSEGMENT
#27 (telemedicine or tele-medicine or telemetry or telerehab* or tele-rehab* or telehealth or tele-health or telehomecare or tele-homecare or telecoaching or tele-coaching or telecommunication* or tele-communication or videoconference* or video-conferenc* or videoconsultation or video-consultation or teleconference* or tele-conference* or teleconsultation or tele-consultation or telecare or tele-care):ti,ab,kw AND INSEGMENT

#28 (ehealth or e-health or "mobile health" or mhealth or m-health):ti,ab,kw AND INSEGMENT
#29 ((remote* or distance* or distant) NEAR5 (rehab* or therap* or treatment or consultation)):ti,ab,kw AND INSEGMENT
#30 ((rehab* or therap* or treatment or communication or consultation) NEAR5 (telephone* or phone* or video* or internet* or computer* or modem or web* or email)):ti,ab,kw AND INSEGMENT
#31 #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17
#32 #31 AND #15

Appendix 3. MEDLINE search strategy

1. exp asthma/
2. (asthma$ or wheez$).ti,ab.
3. exp Pulmonary Disease, Chronic Obstructive/ or Lung Diseases, Obstructive/
4. (obstruct$ adj3 (pulmonary or lung$ or airway$ or airflow$ or bronch$ or respirat$)).ti,ab.
5. (COPD or COAD or COBD or AECB or AECOPD).ti,ab.
6. exp Bronchiectasis/
7. bronchiect$.ti,ab.
8. exp Lung Diseases, Interstitial/
9. exp Pulmonary Fibrosis/
10. (interstitial$ adj3 (lung$ or disease$ or pneumon$)).ti,ab.
11. ((pulmonary$ or lung$ or alveoli$) adj3 (fibros$ or fibrot$)).ti,ab.
12. ((pulmonary$ or lung$) adj3 (sarcoid$ or granulom$)).ti,ab.
13. (chronic$ adj3 (lung$ or respiratory$ or pulmonary$)).ti,ab.
14. or/1-13
15. Telerehabilitation/
16. Telemedicine/
17. exp Videoconferencing/
18. telecommunications/
19. exp Computer Communication Networks/
20. Remote Consultation/
21. exp Telephone/
22. electronic mail/ or text messaging/
23. exp Internet/
24. (telemedicine or tele-medicine or telemetry or telerehab$ or tele-rehab$ or telehealth or tele-health or telehomecare or tele-homecare or telecoaching or tele-coaching or telecommunication$ or tele-communication or videoconference$ or video-conferenc$ or videoconsultation or video-consultation or teleconference$ or tele-conference$ or teleconsultation or tele-consultation or telecare or tele-care).ti,ab.
25. (ehealth or e-health or "mobile health" or mhealth or m-health).ti,ab.
26. ((remote$ or distance$ or distant) adj5 (rehab$ or therap$ or treatment or consultation)).ti,ab.
27. ((rehab$ or therap$ or treatment or communication or consultation) adj5 (telephone$ or phone$ or video$ or internet$ or computer$ or modem or web$ or email)).ti,ab.
28. or/15-27
29. (controlled clinical trial or randomized controlled trial).pt.
30. (randomized or randomised).ab,ti.
31. placebo.ab,ti.
32. dt.fs.
33. randomly.ab,ti.
34. trial.ab,ti.
35. groups.ab,ti.
36. or/29-35
37. Animals/
38. Humans/
39. 37 not (37 and 38)

CONTRIBUTIONS OF AUTHORS

NSC and AEH conceived the idea for this Cochrane Review. All protocol authors contributed to the development of the protocol. NSC will be guarantor of the review.

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