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Pulmonary rehabilitation for pneumoconiosis: protocol for a systematic review and meta-analysis

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ABSTRACT

Introduction Pneumoconiosis is characterised by diffuse fibrosis in lung tissue, and its incidence is on the rise. At present, there are limited therapeutic options for pneumoconiosis. Pulmonary rehabilitation (PR) has been widely used to treat pneumoconiosis , however, there is limited evidence concerning its efficacy. Therefore, we plan to conduct a systematic review to investigate the efficacy and safety of PR for pneumoconiosis.

Methods and analysis The following databases will be searched from their inception to 1 April 2019: PubMed, Embase, The Cochrane Library, Web of Science, Chinese Biomedical Literature Database, China National Knowledge Infrastructure, Chongqing VIP and Wanfang Data. Randomised controlled trials of PR for pneumoconiosis will be included. Primary outcomes will include 6 min walk distance and St. George's Respiratory Questionnaire. Study selection, extraction of data and assessment of study quality each will be independently undertaken. Statistical analysis will be conducted using Review Manager software.

Ethics and dissemination This systematic review will provide up-to-date information on PR for pneumoconiosis. The review does not require ethical approval and will be disseminated electronically through a peer-reviewed publication or conference presentations.

PROSPERO registration number CRD42018095266.

Strengths and limitations of this study

- This systematic review aims to evaluate the efficacy and safety of pulmonary rehabilitation for pneumoconiosis.
- The review methods were carefully planned to minimise risk of selective bias, reporting bias and publication bias in the completed review according to current guidelines and prospectively registered with the International Prospective Register of Systematic Reviews.
- The search strategy for this review is broad and comprehensive, including studies from multiple electronic databases.
- Limitations may include issues of poor reporting affecting risk of bias assessment and confidence in results.

INTRODUCTION

Pneumoconiosis is a disease characterised by diffuse fibrosis in lung tissue, and is mainly caused by long-term inhalation of productive mineral dust in occupational activities.[1–3] Dust exposure in coal mining has been one of the main occupational hazard factors in China over time, and coal worker pneumoconiosis (CWP) and silicosis are the main types of the 12 kinds of national occupational pneumoconiosis.[3 4] In 2016, the National Occupational Disease Report shows that China has reported a total of 31 789 cases of occupational diseases, including 27 992 cases of occupational pneumoconiosis accounted for 88.06% of the total cases reported.[5] The incidence of pneumoconiosis is on the rise.[6–8] In China, the cumulative incidence of pneumoconiosis in state-owned coal mines ranges from 4% to 17%.[9] A systematic analysis of studies from 2001 to 2011 showed that the pooled prevalence of CWP was 6.02% in China, which was higher compared with UK (0.8%, 1998–2000) and the USA (3.2% in 2000s).[10] During 1999–2016, a total of 38 358 years of potential life lost to life expectancy (mean per decedent=8.8 years) and 2707 years of potential life lost before age 65 years (mean per decedent=7.3 years) were attributed to CWP.[11] Long-term silica dust exposure is associated with substantially increased mortality among Chinese workers.[12]

At present, there are limited therapeutic options for pneumoconiosis.[13] Pulmonary rehabilitation (PR) is a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, social support and behavioural change, which are designed to improve the physical and psychological condition of people with chronic respiratory disease and promote the long-term adherence to health-enhancing behaviours.[14] Evidence-based support for PR in the management of patients with chronic respiratory disease has grown tremendously, and this comprehensive

intervention has been clearly demonstrated to reduce dyspnoea, increase exercise performance and improve health-related quality of life (HRQL).[15] As an effective intervention , PR could provide sustained improvement of functional capacity and reduce healthcare utilisation for occupational respiratory diseases.[16] Recently, PR has been widely used to treat pneumoconiosis.[16–18] However, there is limited evidence concerning its efficacy for pneumoconiosis patients. Therefore, we plan to conduct a systematic review to investigate the efficacy and safety of PR for pneumoconiosis.

METHODS AND ANALYSIS

Study type

All published randomised controlled trials (RCTs) with a parallel, cluster or cross-over design will be included.

Participants

Pneumoconiosis patients diagnosed by relevant standard (such as GBZ 70–2015 National occupational health standards)[3] will be included. There will be no restrictions on age, sex, ethnicity, education or economic status. We will exclude studies including participants with complications, such as pulmonary heart disease, tuberculosis and chronic respiratory failure.

Interventions

The intervention we focus on in this review is a comprehensive PR, which is based on exercise training, including or not including health education, nutritional intervention and psychosocial support.

Comparisons investigated are:

- PR versus no treatments;
- PR adjunctive to other treatments versus other treatments alone.

Outcome measures

- Primary outcomes
  The primary outcome measures were functional capacity and HRQL, as measured by 6 min walk distance,[16 19–21] St. George's Respiratory Questionnaire.[16 21 22]
- Secondary outcomes
  The secondary outcomes measures were pulmonary function, symptoms, acute exacerbations and adverse events, as measured by forced vital capacity, forced expiratory volume in the 1 s,[21 22] the modified Medical Research Council dyspnoea scale,[23] frequency of acute exacerbations[16 24] and incidence of adverse events.

Search methods

We will search PubMed, Embase, The Cochrane Library, Web of Science, Chinese Biomedical Literature Database, China National Knowledge Infrastructure, Chongqing VIP and Wanfang Data from their inception to 1 April 2019. We have developed detailed search strategies for each electronic database without language restrictions to attempt to identify all eligible studies. We will also review the reference lists of included studies or relevant systematic reviews to identify any potentially eligible studies. The search strategy for PubMed is shown in table 1.

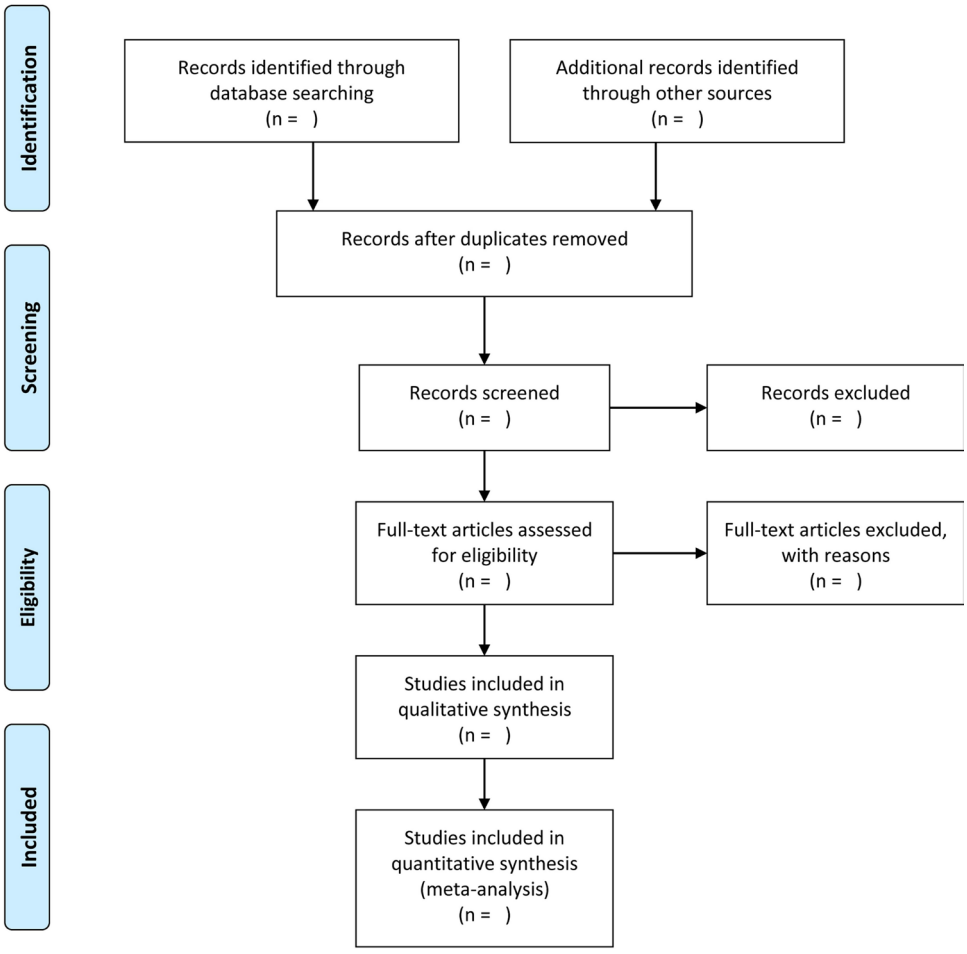
Table 1 Search strategy for PubMed

No	No search terms
#1	Pneumoconiosis [MeSH Terms]
#2	pneumoconiosis [Title/Abstract]
#3	Asbestosis [MeSH Terms]
#4	asbestosis [Title/Abstract]
#5	Silicosiss [MeSH Terms]
#6	silicosis [Title/Abstract]
#7	Anthracosis [MeSH Terms]
#8	Anthracosis [Title/Abstract]
#9	Anthracosilicosis [MeSH Terms]
#10	Anthracosilicosis [Title/Abstract]
#11	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10
#12	rehabilitation [MeSH Terms]
#13	rehabilitation [Title/Abstract]
#14	health education [MeSH Terms]
#15	health education [Title/Abstract]
#16	psychological counselingTitle/Abstract]
#17	nutritional guidance [Title/Abstract]
#18	Baduanjin [Title/Abstract]
#19	eight-section brocade [Title/Abstract]
#20	respiratory training [Title/Abstract]
#21	sports training [Title/Abstract]
#22	exercise therapy [MeSH Terms]
#23	exercise therapy [Title/Abstract]
#24	physical fitness [MeSH Terms]
#25	physical fitness [Title/Abstract]
#26	physical exertion [MeSH Terms]
#27	physical exertion [Title/Abstract]
#28	kinesiotherapy [Title/Abstract]
#29	muscle training [MeSH Terms]
#30	muscle training [Title/Abstract]
#31	physical endurance [MeSH Terms]
#32	physical endurance [Title/Abstract]
#33	#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
#34	#11 AND #33

This search strategy will be modified as required for other electronic databases.

Searching other resources

We will conduct a search on the website of ClinicalTrials.gov, WHO International Clinical Trials Registry platform



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

Figure 1 PRISMA flow diagram.

and Chinese Clinical Trial Registry, Conference Proceedings Index (Web of Science Core Collection) to identify additional ongoing or unpublished studies.

Study selection

Two review authors (JW and XL) will independently examine titles and abstracts retrieved from the search and select all potentially eligible studies. Then these full-text articles will be obtained and the same review authors will review them independently according to the inclusion criteria. We will resolve all disagreements by consensus, and a third review author (HZ) will act as an arbiter when consensus cannot be reached. The review authors will record all full texts that do not meet the inclusion criteria and provide the rationale for their exclusion. We will count multiple publications reporting the same group of participants or their subsets as one single study. Details of the selection process are presented in figure 1.

Data extraction and management

Two investigators (JW and XL) will independently extract data from included studies. A structured and standardised data extraction form will be used to extract the relevant information. We will complete a data extraction sheet for every study included in the review, involving information on details of authors, year of publication, study design, characteristics of participants, intervention, comparator and outcomes.

Included studies with greater than 20% attrition will be considered at high risk of attrition bias.[25] When SDs of the change of included studies are missing, we will substitute for them the mean SD of other included studies.[26] We will exclude from the analysis studies, in which only medians and percentiles are available and there are no means of calculating mean change scores.[26]

Quality assessment and analysis

Methodological quality will be independently assessed using the Cochrane Collaboration's tool for assessing

risk of bias in RCTs.[27] The assessment details include: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, selective reporting and other sources of bias. Each domain will be assessed as 'low risk', 'high risk' or 'unclear risk' according to the description details of eligible studies. Two review authors (JW and XL) will complete the data extraction and score each study, with a third review author (HZ) acting as an arbiter when differences occur between JW and XL. We will summarise the risk of bias and settle differences in author interpretation of data through discussion.

Data analysis

We plan to pool data from the outcomes of each study to provide an overall measure of the effect. For dichotomous outcome data, we will present the effect using relative risks with 95% CI. For continuous data, we will present the effect using mean differences with 95% CI. We will convert the unit to the commonly used one, when different units of measurement are employed. For example, we will convert the 'month' or 'year' into 'weeks'.

We plan to use a χ^2 test to estimate heterogeneity. Further analysis can be performed using the I^2 statistic. A random-effect model will be used to interpret the results if heterogeneity is statistically significant, whereas a fixed-effect model will be used if heterogeneity is not statistically significant. We will regard heterogeneity as substantial when I^2 is greater than 50% or a low p value (<0.01) is reported for the χ^2 test for heterogeneity.[28]

When 10 or more studies are included in the meta-analysis, we will investigate reporting biases (such as publication bias) by using funnel plots.[27]

We will undertake statistical analysis by using Review Manager software.[29] As with cross-over trials, we will consider only the first phase and exclude from the analysis data obtained during the second phase (ie, up until the point of crossover).

Subgroup analysis

If data permit, we plan to conduct subgroup analyses for different intervention forms to assess whether the treatment effects are different in different subgroups. Different intervention forms refer to whether exercise training is combined with other rehabilitation measures, such as health education, nutritional intervention and psychosocial support.

Sensitivity analysis

We will conduct sensitivity analyses to explore the robustness of the findings regarding the study quality and sample size. We will exclude studies one by one and comparing the results in the analysis.[30] Sensitivity analyses will be showed in a summary table.

Quality of evidence assessment

The quality assessment of the body of evidence is performed to determine the extent to which an estimate of effect is close to the true quantity/value, that is, it is not distorted by internal or external bias within and across studies. The assessment will be conducted by outcome of interest using the Grading of Recommendations Assessment, Development and Evaluation system.[31] The quality of outcome measures will be categorised as high, moderate, low and very low.

Patient and public involvement

Patients were not involved in the development of the research question or the design of this study at this stage.

The procedure for this protocol will be conducted according to the guidance provided by the Preferred Reporting Item for Systematic Reviews and Meta-analyses protocols.[32]

Potential amendments

We do not envisage any further amendments to this protocol. However, in case of any changes, the amendment shall be detailed out in the final report.

DISCUSSION

Pneumoconiosis is a disease with no end to treatment, there are limited therapeutic options. As a comprehensive treatment, PR has been proved to improve the quality of life of patients with respiratory diseases (eg, chronic obstructive pulmonary disease, asthma and idiopathic pulmonary interstitial fibrosis).[33–35] At present, PR has been used in the treatment of pneumoconiosis, and the efficacy of PR for patients with pneumoconiosis was already evaluated by meta-analysis of RCTs.[36] However, due to the inaccuracy of a small number of trials, the small number of participants, and the indirectness of evidence, the quality of the evidence is low. Therefore, it is necessary to make an update. The objective of this study is to provide a protocol of systematic review and meta-analysis to update PR for pneumoconiosis. This systematic review will provide a detailed summary of the current evidences related to the efficacy and safety of PR in improving breathlessness, exercise limitation and health status impairment of pneumoconiosis patients. This evidence may be useful to clinicians, patients and health policy-makers with regard to the use of PR in pneumoconiosis treatment.

Ethics and dissemination

This systematic review will provide up-to-date information on PR for pneumoconiosis. This review will be disseminated electronically through a peer-reviewed publication or conference presentations.

Contributors HZ drafted the protocol and will arbitrate any disagreements. YX and JL conceived the study and revised the manuscript. JW and XL will independently screen the potential studies, extract data from the included studies and assess the risk of bias. HZ will search the literature and conduct the data analysis. All authors have read and approved the final manuscript for publication.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval This review does not require ethical approval.

Provenance and peer review Not commissioned; externally peer reviewed.

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