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Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease (Review)

Gendron LM, Nyberg A, Saey D, Maltais F, Lacasse Y

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Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease.

Cochrane Database of Systematic Reviews 2018, Issue 10. Art. No.: CD012290.

DOI: [10.1002/14651858.CD012290.pub2](https://doi.org/10.1002/14651858.CD012290.pub2).

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[Intervention Review]

Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease

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Editorial group: Cochrane Airways Group.

Publication status and date: New, published in Issue 10, 2018.

Citation: Gendron LM, Nyberg A, Saey D, Maltais F, Lacasse Y. Active mind-body movement therapies as an adjunct to or in comparison with pulmonary rehabilitation for people with chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews* 2018, Issue 10. Art. No.: CD012290. DOI: [10.1002/14651858.CD012290.pub2](https://doi.org/10.1002/14651858.CD012290.pub2).

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ABSTRACT

Background

Active mind-body movement therapies (AMBMTs), including but not limited to yoga, tai chi, and qigong, have been applied as exercise modalities for people with chronic obstructive pulmonary disease (COPD). AMBMT strategies have been found to be more effective than usual care; however, whether AMBMT is inferior, equivalent, or superior to pulmonary rehabilitation (PR) in people with COPD remains to be determined.

Objectives

To assess the effects of AMBMTs compared with, or in addition to, PR in the management of COPD.

Search methods

We searched the Cochrane Airways Group Specialised Register of trials and major Chinese databases, as well as trial registries from inception to July 2017. In addition, we searched references of primary studies and review articles. We updated this search in July 2018 but have not yet incorporated these results.

Selection criteria

We included (1) randomised controlled trials (RCTs) comparing AMBMT (i.e. controlled breathing and/or focused meditation/attention interventions for which patients must actively move their joints and muscles for at least four weeks with no minimum intervention frequency) versus PR (any inpatient or outpatient, community-based or home-based rehabilitation programme lasting at least four weeks, with no minimum intervention frequency, that included conventional exercise training with or without education or psychological support) and (2) RCTs comparing AMBMT + PR versus PR alone in people with COPD. Two independent review authors screened and selected studies for inclusion.

Data collection and analysis

Two review authors independently selected trials for inclusion, extracted outcome data, and assessed risk of bias. We contacted study authors if necessary to ask them to provide missing data. We calculated mean differences (MDs) using a random-effects model.

Main results

We included in the meta-analysis 10 studies with 762 participants across one or more comparisons. The sample size of included studies ranged from 11 to 206 participants. Nine out of 10 studies involving all levels of COPD severity were conducted in China with adults from 55 to 88 years of age, a higher proportion of whom were male (78%). Nine out of 10 studies provided tai chi and/or qigong programmes as AMBMT, and one study provided yoga. Overall, the term 'PR' has been uncritically applied in the vast majority of studies, which limits comparison of AMBMT and PR. For example, eight out of 10 studies considered walking training as equal to PR and used this as conventional exercise training within PR. Overall study quality for main comparisons was moderate to very low mainly owing to imprecision, indirectness (exercise component inconsistent with recommendations), and risk of bias issues. The primary outcomes for our review were quality of life, dyspnoea, and serious adverse events.

When researchers compared AMBMT versus PR alone (mainly unstructured walking training), statistically significant improvements in disease-specific quality of life (QoL) (St. George's Respiratory Questionnaire (SGRQ) total score) favoured AMBMT: mean difference (MD) -5.83, 95% confidence interval (CI) -8.75 to -2.92; three trials; 249 participants; low-quality evidence. The common effect size, but not the 95% CI around the pooled treatment effect, exceeded the minimal clinically important difference (MCID) of minus four. The COPD Assessment Test (CAT) also revealed statistically significant improvements favouring AMBMT over PR, with scores exceeding the MCID of three, with an MD of 6.58 units (95% CI -9.16 to -4.00 units; one trial; 74 participants; low-quality evidence). Results show no between-group differences with regard to dyspnoea measured by the modified Medical Research Council Scale (MD 0.00 units, 95% CI -0.37 to 0.37; two trials; 127 participants; low-quality evidence), the Borg Scale (MD 0.44 units, 95% CI -0.88 to 0.00; one trial; 139 participants; low-quality evidence), or the Chronic Respiratory Questionnaire (CRQ) Dyspnoea Scale (MD -0.21, 95% CI -2.81 to 2.38; one trial; 11 participants; low-quality evidence). Comparisons of AMBMT versus PR alone did not include assessments of generic quality of life, adverse events, limb muscle function, exacerbations, or adherence.

Comparisons of AMBMT added to PR versus PR alone (mainly unstructured walking training) revealed significant improvements in generic QoL as measured by Short Form (SF)-36 for both the SF-36 general health summary score (MD 5.42, 95% CI 3.82 to 7.02; one trial; 80 participants; very low-quality evidence) and the SF-36 mental health summary score (MD 3.29, 95% CI 1.45 to 4.95; one trial; 80 participants; very low-quality evidence). With regard to disease-specific QoL, investigators noted no significant improvement with addition of AMBMT to PR versus PR alone (SGRQ total score: MD -2.57, 95% CI -7.76 to 2.62 units; one trial; 192 participants; moderate-quality evidence; CRQ Dyspnoea Scale score: MD 0.04, 95% CI -2.18 to 2.26 units; one trial; 80 participants; very low-quality evidence). Comparisons of AMBMT + PR versus PR alone did not include assessments of dyspnoea, adverse events, limb muscle function, exacerbations, or adherence.

Authors' conclusions

Given the quality of available evidence, the effects of AMBMT versus PR or of AMBMT added to PR versus PR alone in people with stable COPD remain inconclusive. Evidence of low quality suggests better disease-specific QoL with AMBMT versus PR in people with stable COPD, and evidence of very low quality suggests no differences in dyspnoea between AMBMT and PR. Evidence of moderate quality shows that AMBMT added to PR does not result in improved disease-specific QoL, and evidence of very low quality suggests that AMBMT added to PR may lead to better generic QoL versus PR alone. Future studies with adequate descriptions of conventional exercise training (i.e. information on duration, intensity, and progression) delivered by trained professionals with a comprehensive understanding of respiratory physiology, exercise science, and the pathology of COPD are needed before definitive conclusions can be drawn regarding treatment outcomes with AMBMT versus PR or AMBMT added to PR versus PR alone for patients with COPD.

PLAIN LANGUAGE SUMMARY

Active mind-body movement therapies for chronic obstructive pulmonary disease

Background

Chronic obstructive pulmonary disease (COPD) is a major cause of ill health and is currently the fourth leading cause of death worldwide. COPD describes a chronic lung condition in which shortness of breath, tiredness, and exercise intolerance are typical symptoms. Active mind-body movement therapies (AMBMTs) consist of mind-body therapies such as controlled breathing and/or focused meditation/attention interventions whereby participants must actively move their joints and muscles (e.g. yoga, tai chi, qigong). Although different forms of AMBMT may differ in origin, they usually share similar principles: movement/posture, controlled breathing, and focused attention/meditation. AMBMT strategies applied to people with COPD have been found to be more effective than usual care. However the effect of AMBMT as an adjunct to or in direct comparison with pulmonary rehabilitation (PR), the cornerstone of COPD management, remains to be determined; this is the objective of the current review.

Study characteristics

We included 10 studies involving 762 participants who were randomly assigned to receive AMBMT alone or in combination with PR or PR alone (mainly unstructured walking training). The quality of included studies was generally poor.

Key results

Given the quality of available evidence, effects of AMBMT in comparison with PR or of AMBMT added to PR in comparison with PR alone remain inconclusive. One key reason for this is that PR programmes used as comparators had major design flaws, for example, the term 'PR' was uncritically used in the vast majority of studies, and PR was often considered equal to unstructured walking training. This, together with the poor quality of evidence, limits our confidence in the observed effects. Available evidence suggests that when AMBMT was compared to PR alone, larger improvements in disease-specific quality of life were observed with AMBMT, although AMBMT was not superior to PR with regard to dyspnoea (breathlessness). AMBMT added to PR resulted in large improvement in generic quality of life when compared with PR alone, although the addition of AMBMT to PR did not lead to further improvements in disease-specific quality of life. However, before definitive conclusions can be drawn, future research studies comparing AMBMT to PR are needed, and these should follow current PR guidelines for designing comparator interventions, preferably delivered by properly trained professionals with a comprehensive understanding of respiratory physiology, exercise science, and the pathology of COPD.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Summary of findings for AMBMT vs PR

Active mind-body movement therapies (AMBMTs) vs pulmonary rehabilitation (PR) for chronic obstructive pulmonary disease

Patient or population: patients with chronic obstructive pulmonary disease

Settings: any setting

Intervention: AMBMT

Control: PR

Outcomes	Illustrative comparative effects* (95% CI)		No. of participants (studies)	Quality of the evidence (GRADE)
	Response on control	Treatment effect		
	PR	AMBMT vs PR		
QoL - Change in SGRQ total score Scale 0 to 100. Lower is better and 4 units is a clinically important difference	Mean change = -1.92 units	Mean change in SGRQ total score in the AMBMT group was 5.83 units lower (95% CI 8.75 to 2.92 to lower)	249 (3 RCTs)	⊕⊕⊕⊕ low^a
QoL - Change in CAT score Scale 0 to 40. Lower is better and 3 units is a clinically important difference	Mean change = 2.74 units	Mean change in CAT score in the AMBMT group was 6.58 units lower (95% CI 9.16 to 4.00 lower)	74 (1 RCT)	⊕⊕⊕⊕ low^b
Dyspnoea - change in CRQ Dyspnoea CRQ Dyspnoea. Scale 1 to 7. Higher is better and 0.5 unit is a clinically important difference	Mean change = 0.24 units	Mean change in CRQ score in the AMBMT group was 0.21 units lower (95% CI 2.81 lower to 2.38 higher)	11 (1 RCT)	⊕⊕⊕⊕ very low^c
Dyspnoea - change in mMRC Scale 0 to 4. Lower is better and 1 unit is a clinically important difference	Mean change = -0.75 units	Mean change in mMRC score in the AMBMT group was 0.00 units lower (95% CI 0.37 lower to 0.37 higher)	127 (2 RCTs)	⊕⊕⊕⊕ very low^d
Dyspnoea - change in Borg Scale Borg CR-10. Scale 0 to 10. Lower is better and 1 unit is a clinically important difference	Mean change = 0.32 units	Mean change in Borg Scale score in the AMBMT group was 0.44 units lower (95% CI 0.88 to 0.00 lower)	139 (1 RCT)	⊕⊕⊕⊕ very low^e
Adverse events ^f	-	-	490 (8 RCTs)	-

*The basis for the response on control is the mean control group response across studies

AMBMT: active mind-body movement therapy; CAT: COPD Assessment Test; CI: confidence interval; CRQ: Chronic Respiratory Questionnaire; MD: mean difference; mMRC: modified Medical Research Council Scale; PR: pulmonary rehabilitation; QoL: quality of life; RCT: randomised controlled trial; SGRQ: St. George's Respiratory Questionnaire

GRADE Working Group grades of evidence

High quality: further research is very unlikely to change our confidence in the estimate of effect

Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate

Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

Very low quality: we are very uncertain about the estimate

^aAllocation concealment was unclear in all studies, no study reported blinding of assessors (1 reported high risk), one study had an attrition bias greater than 20%, and one study had unbalanced groups at baseline (-1 for risk of bias). The exercise component of PR was not consistent with recommendations, i.e., two studies consisted of walking recommendations alone with little (recommendation to walk 30 minutes daily) or no information on duration and no information on intensity nor progression of walking training (-1 for indirectness). In addition, an adequate sample size calculation was not made in any study, the 95% confidence interval crosses the limit for clinically important difference but did not include "no effect"

^bMost risk of bias items were rated unclear, including allocation concealment, incomplete outcome data, and selective reporting, in addition to high risk of bias for blinding of participants and outcome assessment (-1 for risk of bias). The exercise component of PR was not consistent with recommendations, i.e., exercise training consisted of walking recommendations alone with little (recommendation to walk 30 minutes daily) duration and no information on intensity nor progression of walking training (-1 indirectness). In addition, an adequate sample size calculation was not made, the 95% confidence interval crosses the limit for clinically important difference but did not include "no effect"

^cNo blinding of outcome assessors, selective reporting, unbalanced group sizes at baseline (-1 for risk of bias). One small sample study only, and no sample size calculation for selected outcome (-1 inconsistency). The 95% confidence limit crosses the limit for clinically important differences as well as the limit for "no effect" (-1 for imprecision)

^dMost risk of bias items were rated unclear, including allocation concealment, incomplete outcome data, selective reporting (-1 for risk of bias). The exercise component of PR was not consistent with recommendations, i.e., exercise training consisted of walking recommendations alone with little or no information on duration, intensity, nor progression of walking training in both studies (-1 indirectness). No sample size calculation in any study, the 95% confidence limit crosses the limit for clinically important differences as well as the limit for "no effect" (-1 for imprecision)

^eNo blinding of outcome assessors, selective reporting, unbalanced group sizes at baseline (-1 for risk of bias). One small sample study only, and no sample size calculation for selected outcome (-1 inconsistency) The 95% confidence limit crosses the limit for clinically important differences as well as the limit for "no effect" (-1 for imprecision)

^fNo studies reported adverse events

Summary of findings 2. Summary of findings for AMBMT + PR vs PR

Active mind-body movement therapies (AMBMTs) + pulmonary rehabilitation (PR) vs PR for chronic obstructive pulmonary disease

Patient or population: patients with chronic obstructive pulmonary disease

Settings: any setting

Intervention: AMBMT + PR

Control: PR

Outcomes	Illustrative comparative risks* (95% CI)		No. of participants (studies)	Quality of the evidence (GRADE)
	Response on control	Treatment effect		
	PR	AMBMT + PR vs PR		
QoL - SF-36 general Health	Mean change = -4.00 units	Mean change in SF-36 general health score in the AMBMT + PR group was	80 (1 RCT)	⊕⊕⊕⊕ very low^a

Scale 0 to 100. Higher is better		5.42 units higher (95% CI 3.82 to 7.02 higher)		
QoL - SF-36 mental health Scale 0 to 100. Higher is better	Mean change = -3.10 units	Mean change in SF-36 mental health score in the AMBMT + PR group was 3.2 units higher (95% CI 1.45 to 4.95 to higher)	80 (1 RCT)	⊕⊕⊕⊕ very low^a
QoL - Change in SGRQ total score Scale 0 to 100. Lower is better and 4 units is a clinically important difference	Mean change = -3.72 units	Mean change in SGRQ total score in the AMBMT + PR group was 2.57 units lower (95% CI 7.76 lower to 2.62 higher)	192 (1 RCT)	⊕⊕⊕⊕ moderate^b
Dyspnoea - CRQ dyspnoea Scale 1 to 7. Higher is better and 0.5 units is a clinically important difference	Mean change = 0.25 units	Mean change in CRQ dyspnoea score in the AMBMT + PR group was 0.04 units higher (95% CI 2.18 lower to 2.26 higher)	80 (1 RCT)	⊕⊕⊕⊕ very low^c
Adverse events ^d	-	-	272 (2 RCT)	-

*The basis for the response on control is the mean control group response across studies

AMBMT: active mind-body movement therapy; CI: confidence interval; CRQ: Chronic Respiratory Questionnaire; MD: mean difference; PR: pulmonary rehabilitation; RCT: randomised controlled trial; SGRQ: St. George's Respiratory Questionnaire

GRADE Working Group grades of evidence

High quality: further research is very unlikely to change our confidence in the estimate of effect

Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate

Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate

Very low quality: we are very uncertain about the estimate

^aRandom sequence generation and blinding of assessors reported but no allocation concealment and incomplete outcome data while selective reporting was unclear (-1 for risk of bias). The exercise component of PR was not consistent with recommendations, i.e., exercise training consisted of walking recommendations alone with no information on duration, intensity, nor progression of walking training (-1 for indirectness). One study only, low number of events, optimal information size not met, and no sample size calculation made for this outcome (-1 for imprecision). In addition, no information on clinically important differences is available for this outcome but the 95% confidence interval did not include "no effect"

^bRandom sequence generation, allocation concealment, blinding of assessors, no selective reporting reported as well as intention to treat. However, attrition > 20% and one study only (-1 for risk of bias/overall downgrade). The exercise component of PR is consistent with recommendations. In addition, a sample size calculation was made for the selected outcome, the 95% confidence interval did cross the limit for clinically important difference but did not include "no effect"

^cRandom sequence generation and blinding of assessors reported but no allocation concealment and incomplete outcome data while selective reporting was unclear (-1 for risk of bias). The exercise component of PR was not consistent with recommendations, i.e., exercise training consisted of walking recommendations alone with no information on duration, intensity, nor progression of walking training (-1 for indirectness). One study only, low number of events, optimal information size not met, no sample size calculation made for this outcome, the 95% confidence limit crosses the limit for clinically important differences as well as the limit for "no effect" (-1 for imprecision)

^dNo studies reported adverse events

BACKGROUND

Description of the condition

Chronic obstructive pulmonary disease (COPD) is characterised by chronic airflow limitation. It is considered a systemic and multi-component disease with cough, sputum production, and chronic, progressive dyspnoea (breathlessness) and exercise intolerance as typical symptoms (Butcher 2012; GOLD 2018). The number of people living with COPD is steadily increasing, and COPD is a major cause of morbidity and mortality; it is projected to become the third leading cause of death worldwide in 2030 (WHO 2013). The international prevalence of Global Initiative on Obstructive Lung Disease (GOLD) stage 2 and higher COPD has been reported to be 10.1% and is believed to be increasing, which can be explained to some extent by continued exposure to risk factors in combination with ageing of the world's population (Buist 2007; GOLD 2018).

COPD is usually caused by long-term exposure to lung irritants that cause damage to the lungs and airways. The most prevalent irritant known to cause COPD is cigarette smoke, but others such as second-hand smoke, air pollution, chemicals, and dust particles from workplace environments have been involved.

Individuals who present with symptoms of dyspnoea, chronic cough, and/or sputum production should be considered for a diagnosis of COPD. To diagnose the disease, a spirometry is mandatory to confirm the presence of airflow limitation. According to GOLD, a ratio of forced expiratory volume in one second (FEV_1)/forced vital capacity (FVC) < 0.70 indicates airflow limitation. If consistent clinical features are noted, persistent airflow limitation confirms the diagnosis of COPD. COPD assessment should determine (1) the severity of airflow limitation, (2) the impact of the disease on the patient's health status, and (3) the risk of future exacerbations, to guide therapy. Coexistent diseases should be actively looked for and treated appropriately if present (GOLD 2018).

Exercise intolerance is considered one of the key features of COPD (Butcher 2012; Houchen 2009). Ventilatory limitation, hyperinflation, gas exchange abnormalities, and cardiac and limb muscle dysfunction, alone or in combination, have been proposed as factors contributing to exercise limitation in COPD (Spruit 2013). As the disease progresses, patients experience recurrent exacerbations, increased dyspnoea, and more frequent hospital visits, collectively leading to poor quality of life (GOLD 2018; Miravittles 2007).

Management of COPD includes identification and reduction of exposure to risk factors, as well as pharmacological and non-pharmacological treatments. With regard to the latter, pulmonary rehabilitation is recognised as a core component of COPD management (Vogelmeier 2017).

Description of the intervention

Active mind-body movement therapies (AMBMTs)

Mind-body practices, as defined by the National Center for Complementary and Integrative Health, from the National Institutes of Health, are classified amongst the most popular complementary health approaches used by adults in the general population (Harris 2012). These practices focus on the interaction between mind and body by using internal awareness, anatomical

alignment, and deep breathing to improve individual wellness. Mind-body practices can be categorised into three different subgroups (adapted from Lee 2014). First, the intervention may be motionless (e.g. meditation, hypnosis, relaxation therapy). Second, the intervention may involve passive movement. In this case, motion is transmitted to parts of the body by an external force (e.g. massage therapy, spinal manipulation). Third, the intervention may include active mind-body movement therapies (AMBMTs), whereby participants must move their joints and muscles (e.g. yoga, tai chi, qigong, Pilates). Although different forms of AMBMT may differ in origin, they usually share similar principles: movement/posture, controlled breathing, and focused attention/meditation (Table 1). The intensity of these interventions has rarely been reported. However, studies have shown that some AMBMTs are exercises of light to moderate intensity (Hagins 2007; Lan 2008). Participants may adjust the difficulty of such exercises to their own desired level of conditioning. A fundamental component of AMBMTs, which sets them apart from conventional exercise training, is mindful awareness. Participants learn to recognise tension or strain in different areas of the body, or aspects of breathing that feel arduous or effortless, while performing a posture or movement. This mindful awareness may complement and improve other components such as posture and relaxation. Preliminary evidence suggests that tai chi and qigong may improve exercise capacity, dyspnoea, quality of life, and lung function compared to conventional exercise or usual care in patients with COPD (Ng 2014a; Yan 2013).

Pulmonary rehabilitation (PR)

Pulmonary rehabilitation (PR) is defined as a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies, which include, but are not limited to, exercise training, education, and behaviour change. Pulmonary rehabilitation is designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote long-term adherence to health-enhancing behaviours (Spruit 2013). For the purposes of this review, we adopted a broad definition of PR to encompass programmes that include exercise training lasting at least four weeks, irrespective of the delivery of education or psychological support - a definition that was used in the most recent Cochrane review of PR in COPD (McCarthy 2015). Pulmonary rehabilitation relieves dyspnoea and improves quality of life and exercise capacity for people with COPD. A recent Cochrane review found these improvements to be moderately large and clinically significant (McCarthy 2015). Rehabilitation serves as an important component in the management of COPD.

How the intervention might work

Mechanisms potentially involved in the effects observed with AMBMT include cardiorespiratory and skeletal muscle conditioning, mindfulness and self-awareness, enhanced concentration, improved breathing control, overall mood and stress management, collective improvement in outcomes of quality of life, exercise capacity, balance, and symptoms in patients with COPD. The combination of self-controlled posture, movement, breathing, and mindfulness is thought to activate naturally occurring mechanisms of self-repair and health recovery (Jahnke 2010). It has been hypothesised that mindfulness training, that is, increasing awareness of breathing and posture, would allow patients with COPD to better anticipate and prepare themselves

for management of aggravating symptoms of dyspnoea and anxiety (Yeh 2014). Breathing techniques taught during AMBMT, such as deep breathing, diaphragmatic breathing, and pursed-lip breathing, may increase tidal volume and decrease respiratory rate while improving gas exchange and air trapping (Cahalin 2002). Furthermore, these techniques may improve both inspiratory and expiratory muscle performance, improving, in turn, the capacity of the chest cavity to create negative and positive pressures during the respiration process (Santaella 2011). Controlled breathing has been shown to reduce breathlessness and fatigue while improving disease-specific quality of life in patients with COPD (Borge 2014). Additionally, AMBMT may have an adjuvant effect when incorporated into conventional PR programmes. Indeed, it has been reported that integrating tai chi into conventional PR led to favourable improvements in exercise capacity and health status when compared with use of conventional PR alone (Ng 2014a).

Why it is important to do this review

Despite high-grade evidence showing the effectiveness of PR in COPD, access to conventional programmes has been estimated to be less than 2% worldwide (Desveaux 2015). AMBMT could address part of the accessibility issue and may be suitable for better long-term adherence, especially for people who dislike structured conventional fitness programmes. Across the globe, complementary health approaches are increasingly popular. In the United States, it has been reported that approximately 38% of adults were using some form of complementary health approach in 2007, and that use of this approach is significantly increasing. Corresponding numbers for adults were 26%, 52%, and 76%, in UK, Australia, and Singapore, respectively (Harris 2012). Therefore, use of AMBMT as an alternative to conventional exercise training and PR is likely to rise in parallel with increased prevalence of COPD. In this regard, a systematic review of the effectiveness of AMBMT and its comparison with conventional PR presents a topic of interest for both patients and healthcare providers.

OBJECTIVES

To assess the effects of active mind-body movement therapies (AMBMTs) compared with, or in addition to, pulmonary rehabilitation (PR) in the management of chronic obstructive pulmonary disease (COPD).

METHODS

Criteria for considering studies for this review

Types of studies

We included published and unpublished randomised controlled trials (RCTs) comparing AMBMT versus PR and those comparing AMBMT in addition to PR versus PR alone for managing COPD.

Types of participants

We included RCTs in which participants:

- had a clinical diagnosis of COPD as defined by GOLD guidelines (GOLD 2018);
- had a best recorded FEV₁/FVC ratio < 0.7; and
- were ≥ 18 years of age.

We accepted studies with mixed populations, but we included only data reported for participants with COPD.

Types of interventions

The review involved two types of comparisons.

- Comparisons to test the hypothesis that AMBMT is inferior, equivalent, or superior to PR: AMBMT versus PR.
- Comparisons to examine the treatment effects of AMBMT on top of PR versus PR alone: AMBMT + PR versus PR.

AMBMTs

AMBMTs are defined as mind-body therapies (i.e. controlled breathing and/or focused meditation/attention interventions whereby patients must actively move their joints and muscles). We included yoga, tai chi, qigong, and Pilates. We also included a category described as 'others', in case we discovered new or differently named interventions that satisfy the AMBMT definition. For instance, we included in this category some traditional Chinese exercises closely related to tai chi and qigong characterised by the same principles espoused by AMBMT (e.g. baguazhang, xing yi quan). We excluded mind and body therapies limited to breathing and/or meditation without active movements/postures (e.g. Pranayama yoga). We included studies that reported on programmes of at least four weeks' duration with no minimum intervention frequency.

PR

We used the following operational definition of PR for the purposes of this review: any inpatient, outpatient, community-based, or home-based rehabilitation programme of at least four weeks' duration with no minimum intervention frequency that included exercise training with or without any form of education and/or psychological support delivered to patients with exercise limitations attributable to COPD (McCarthy 2015). Exercise training is described as any continuous endurance or interval exercise or upper limb or lower limb training in the form of walking (ground-based or on a treadmill) and cycling with or without resistance/strength training, flexibility training, or inspiratory muscle training (Garvey 2016; Spruit 2013).

Types of outcome measures

Primary outcomes

- Disease-specific quality of life (all validated tools were considered, e.g. Chronic Respiratory Disease Questionnaire (CRQ), St. George's Respiratory Questionnaire (SGRQ), COPD Assessment Test (CAT))
- Generic health-related quality of life (e.g. Short Form (SF)-36)
- Dyspnoea (all validated tools were considered, e.g. Medical Research Council (MRC) Scale, BORG Scale, Transitional Dyspnoea Index (TDI), Dyspnoea domain of the CRQ))
- Serious adverse events (all types)

Secondary outcomes

- Exercise capacity
 - * Maximal exercise performance: incremental cycle ergometry (ICE) or incremental shuttle walk test (ISWT)
 - * Functional exercise capacity: 6-minute walk test (6MWT/6MWD), endurance shuttle walk test (ESWT), endurance cycle test
- Pulmonary function
 - * FEV₁ and percentage of predicted values (FEV₁ predicted, %)
 - * FVC
 - * FEV₁/FVC ratio
- Limb muscle function (strength, endurance, and fatigue)
 - * Muscle strength: changes in maximal muscle force (e.g. maximal voluntary contractions (MVCs))
 - * Muscle endurance: changes in muscle force over time (exercise tolerance) (e.g. time to failure when maximal or submaximal contractions were performed)
 - * Muscle fatigue: changes in muscle force over time through a fatigue index, work slope, or similar tool (e.g. measuring twitch muscle force via potentiated or unpotentiated magnetic stimulation)
- Exacerbations (an exacerbation of COPD was defined as a new respiratory event or complication prompting patient evaluation and initiation of additional treatment regimens including antibiotics and/or systemic steroids)
- Adherence (ratio between participants analysed and participants who received intervention)

Search methods for identification of studies

Electronic searches

We contacted the Information Specialist to request a search in the Cochrane Airways Group Register of Trials (CAGR) that includes trials from the following databases: the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Complementary Medicine Database (AMED), and PsycINFO (see [Appendix 1](#) for more details). We have provided the search strategy for the Airways Register in [Appendix 2](#). Furthermore, we searched the following major electronic Chinese databases ([Cohen 2015](#); [Xia 2008](#)): China National Knowledge Infrastructure (CNKI), WANGFAN, VIP, and SinoMed (Chinese Biomedical Literature Database, Chinese Medical Science Literature Database, and Beijing Union Medical Doctor and Master Thesis Database). We also searched the Indian Biomedical Journals Database (IndMED) using the same search terms found in [Appendix 2](#). In [Appendix 3](#), we have presented the search terms that we used for non-CAGR databases.

We searched for ongoing studies in the following databases: the World Health Organization International Clinical Trials Registry Platform (ICTRP), the Chinese Clinical Trial Registry (ChiCTR), the International Standard Randomised Controlled Trial Number (ISRCTN) database, and the National Institutes of Health Clinical Trials Database (ClinicalTrials.gov). We applied no language restrictions in selecting publications, and a qualified translator assisted when required. We searched all sources from their inception up to 5 July 2017. We performed a further search in July 2018. We have added those results to [Studies awaiting classification](#) and will incorporate them into the review at the next update.

Searching other resources

We checked the reference lists of all included studies and review articles for additional related references. We searched conference proceedings relevant to this review, and, if required, we contacted the authors of identified trials to ask about unpublished studies or to request missing information.

Data collection and analysis

Selection of studies

Two review authors (LMcG and AN) independently screened titles and abstracts identified by the search and coded them as 'retrieve' (eligible or potentially eligible/unclear) or 'do not retrieve'. We retrieved full-text study reports/publications, and two review authors (LMcG and AN) independently screened the full-text studies, identified studies for inclusion, and identified and recorded reasons for exclusion of ineligible studies. We resolved disagreements through discussion, or, if required, we consulted a third review author (YL). We identified and excluded duplicates and collated multiple reports of the same study, so that each study rather than each report was the unit of interest in the review. We recorded the selection process in sufficient detail to complete a PRISMA flow diagram ([Moher 2009](#)), as well as an [Excluded studies](#) table.

Data extraction and management

Two review authors (LMcG and AN) independently duplicated data extraction to minimise errors and reduce potential biases. We documented extracted data on a data extraction form and included demographics of participants, a full description of the interventions used (type, duration, setting), and outcome measures (quality of life questionnaires, dyspnoea levels, adverse events, exercise capacity, pulmonary function, muscle function, exacerbations, and adherence). We then entered the extracted data into RevMan software for further analysis.

Assessment of risk of bias in included studies

We evaluated risk of bias by using the Cochrane tool for assessing risk of bias as defined in the *Cochrane Handbook for Systematic Reviews of Interventions*. Two review authors (LMcG and AN) assessed risk of bias independently for each study and resolved disagreements by discussion with a third review author (YL). We graded risk of bias as high, low, or unclear for each study, and we created plots to report risk of bias for (1) random sequence generation; (2) allocation concealment; (3) blinding of participants and personnel (performance bias); (4) blinding of outcome assessments (detection bias); (5) incomplete outcome data; (6) selective outcome reporting; (7) other sources of bias; and (8) overall risk of bias, as described in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)).

Assesment of bias in conducting the systematic review

We conducted the review according to this published protocol and reported any deviations from it in the [Differences between protocol and review](#) section of the systematic review.

Measures of treatment effect

Continuous data

For continuous data, we used mean differences (MDs) to evaluate the overall effect size for different outcomes when study measurements were based on the same scale. We reported results as means with 95% confidence intervals (CIs).

Dichotomous data

For dichotomous measures, we planned to express data as odd ratios (ORs) with 95% CIs. For trials for which standard errors cannot be calculated (i.e. no events are reported in one intervention group), we planned to use the method described in the *Cochrane Handbook for Systematic Reviews of Interventions*, which consists of adding 0.5 to each cell of calculation tables when necessary (automatically added in RevMan).

Unit of analysis issues

The unit of analysis was the participant. We included data from parallel-group studies for meta-analysis. For studies involving repeated measures, we used single time points near the most frequently encountered time frame for analysis. For multi-armed trials, we selected the pair of interventions of interest and excluded the others. For cluster-randomised trials, we planned adjustments to the sample size for each intervention based on the method described in the *Cochrane Handbook for Systematic Reviews of Interventions*.

Dealing with missing data

We contacted study authors of the original investigations to request information on missing numerical data or information regarding randomisation, blinding, or allocation concealment. When the standard deviation (SD) of the change was missing from a study, and it was not possible to obtain the result from study authors, we used the post-intervention value for the SD of the study. We considered studies with attrition greater than 20% to be at high risk of bias (Schulz 2002).

Assessment of heterogeneity

We determined heterogeneity in each meta-analysis by using T^2 , I^2 , and Chi^2 statistics. We interpreted heterogeneity by following guidelines provided in the *Cochrane Handbook for Systematic Reviews of Interventions*. We interpreted a P value less than 0.1 as statistically significant for heterogeneity, and we interpreted further analysis of I^2 as follows.

- 0% to 40%: might not be important.
- 30% to 60%: may represent moderate heterogeneity.
- 50% to 90%: may represent substantial heterogeneity.
- 75% to 100%: shows considerable heterogeneity.

Assessment of reporting biases

If we included 10 or more studies in a meta-analysis, we planned to use funnel plots to evaluate the presence of publication bias. However, as all meta-analyses included fewer than 10 studies, we created no funnel plots.

Data synthesis

We independently reviewed and presented two comparisons.

- AMBMT versus PR.
- AMBMT + PR versus PR.

We conducted statistical analysis using Review Manager software (RevMan 2014), and we used the random-effects model to obtain the overall summary of average treatment effects across studies. We included a summary of results for different outcomes: forest plots, effect sizes with 95% CIs, and estimates of T^2 , I^2 , and P values.

'Summary of findings' table

In the 'Summary of findings' table, we reported on dyspnoea, quality of life, and adverse events.

We used the five GRADE considerations (study limitations, consistency of effect, imprecision, indirectness, and publication bias) to assess the quality of a body of evidence as it relates to studies that contributed data to the meta-analyses for prespecified outcomes. We applied methods and recommendations described in Section 8.5 and Chapter 12 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011), using GRADEpro GDT software. We justified all decisions to downgrade or upgrade the quality of studies by using footnotes, and we provided comments to aid the reader's understanding of the review when necessary.

Subgroup analysis and investigation of heterogeneity

We performed subgroup analyses, if necessary, to determine possible sources of heterogeneity between studies. We considered the following subgroups.

- Types of AMBMT.
- Intensities of different interventions (duration, times per week).
- COPD severity according to GOLD standards for grading of airflow limitation severity.

Sensitivity analysis

No sensitivity analysis was needed, so we performed none. We would have performed a sensitivity analysis if needed to examine the effects of study quality by excluding studies with inadequate randomisation and/or allocation concealment.

RESULTS

Description of studies

See [Characteristics of included studies](#) and [Characteristics of excluded studies](#) for complete details of included and excluded studies.

Results of the search

We have presented a summary of the search results in [Figure 1](#). We identified a total of 679 records using search methods, and we retained 366 after removing duplicates. After screening of the unique identified records, we excluded 300 upon review of titles and abstracts, and we assessed 66 full-text articles for eligibility. From these full-text articles, we included 10 studies (leading to 18 publications) in the meta-analysis. From an updated search in July 2018, we added eight studies to [Studies awaiting classification](#) and will consider them for inclusion in the update of this review. Agreement between the two review authors (LMcG and AN) was

excellent, as reflected by a calculated kappa value of 0.90 obtained before data were extracted from the included studies.

Figure 1. Study flow diagram.

Figure 1. (Continued)

Included studies

We have presented study details in the [Characteristics of included studies](#) section. Of 10 RCTs, six studies were published in English (Chan 2010; Liu 2012; Ng 2011; Ng 2014; Niu 2014; Papp 2017), and four were published in Chinese (Du 2013; Yang 2009; Zhu 2010; Zhu 2011).

Design

Eight studies compared AMBMT versus PR in COPD (Chan 2010; Du 2013; Liu 2012; Niu 2014; Papp 2017; Yang 2009; Zhu 2010; Zhu 2011). Six of these eight studies were multi-arm RCTs comparing three groups: AMBMT, PR, and control versus no exercise intervention (Chan 2010; Du 2013; Liu 2012; Yang 2009; Zhu 2010; Zhu 2011). Two studies investigated the adjunct effects of AMBMT in PR on COPD (Ng 2011; Ng 2014). Six studies had a programme duration of 12 weeks (Chan 2010; Du 2013; Papp 2017; Yang 2009; Zhu 2010; Zhu 2011), and four studies collected outcome measures at six months post intervention (Liu 2012; Ng 2011; Ng 2014; Niu 2014). Session administration varied from daily to twice a week, and from 30 minutes to 80 minutes per session.

Sample size

The sample size of included studies varied from 11 to 206 participants. When participants from groups not of interest for this review were removed (i.e. groups with no exercise intervention), the total number of included participants was 762.

Setting

Nine studies were conducted in China; of these, three were reported from Hong Kong (Chan 2010; Ng 2011; Ng 2014), and the others were reported from different provinces of mainland China (Du 2013; Liu 2012; Niu 2014; Yang 2009; Zhu 2010; Zhu 2011). Chinese studies were carried out in outpatient clinics of hospitals. One study was conducted in Stockholm, Sweden, and also included an outpatient population (Papp 2017).

Participants

The age of participants varied from 55 to 88 years, and studies included a higher proportion of males (mean percentage of men was 78%, ranging from 59% to 91%). Two studies recruited only patients with mild to moderate COPD (Liu 2012; Du 2013), and others included patients with all types of severities. Papp 2017 included a mixed population of patients with the diagnosis of asthma or COPD; however, we used only data from COPD participants in this review.

Interventions

For the first comparison (AMBMT vs PR), the AMBMT involved qigong (Wuqinxin, Liuzijue, Baduanjin, and routines selected from China's national standardised protocols) in four studies (Liu 2012; Yang 2009; Zhu 2010; Zhu 2011), tai chi (24-Yang style routine and selected routines) in two studies (Du 2013; Niu 2014), tai chi with qigong (a modified 13-form of TQG) in one study (Chan 2010), and yoga (hatha yoga) in one other study (Papp 2017). Training programmes for PR interventions consisted of breathing techniques with self-paced walking in four studies (Chan 2010; Du 2013; Niu 2014; Yang 2009), walking at a pace of 80 to 120 steps/min in two studies (Zhu 2010; Zhu 2011), walking and cycling in one study (Liu 2012), and aerobic exercise with full body resistance exercises in another study (Papp 2017).

For the second comparison (AMBMT + PR vs PR), one study involved qigong (Baduanjin) (Ng 2011), and the other Sun-style tai chi, as AMBMT (Ng 2014). PR interventions consisted of self-paced walking with co-ordinated breathing in one study (Ng 2011). The other study provided a set of warm-up exercises, aerobic activities (treadmill and lower limb ergometry), resistance training (Thera-Band) exercises, and a relaxation period (Ng 2014).

Excluded studies

We excluded 34 studies after reading the full-text articles. Reasons for exclusion included lack of an eligible control group (30 studies), participants with no COPD diagnosis (one study), inclusion of no proper AMBMT (one study), and non-RCT study design (two studies). We have provided additional information in the [Characteristics of excluded studies](#) table.

Studies awaiting classification

Through the most recent search, we retrieved eight studies for potential inclusion in the upcoming update of this review (see [Studies awaiting classification](#)). We could not obtain information and data for two studies (Kaminsky 2011; Price 2006).

Ongoing studies

We found four ongoing studies that were eligible for inclusion in this review (see [Characteristics of ongoing studies](#)): two studies included tai chi (NCT01998724; NCT02370654), and two others included some form of qigong (ChiCTR-IOR-17012437; ChiCTR-TRC-14004404).

Risk of bias in included studies

We have provided a summary of the general risk of bias across all studies in [Figure 2](#) and [Figure 3](#).

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Chan 2010	+	?	-	-	-	?	-
Du 2013	+	?	-	-	?	?	?
Liu 2012	+	?	-	-	+	?	?
Ng 2011	+	-	-	-	-	?	?
Ng 2014	+	+	-	-	-	+	?
Niu 2014	+	?	-	+	?	?	?
Papp 2017	+	+	-	-	+	?	?
Yang 2009	+	?	-	?	?	?	?
Zhu 2010	+	?	-	?	?	?	?
Zhu 2011	?	?	-	?	?	?	?

Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Allocation

All studies described appropriate randomisation procedures; we therefore judged them to be at low risk of bias. Two studies provided a proper description of allocation concealment (Ng 2014; Papp 2017), and we considered them at low risk of bias. We considered one study to be at high risk of selection bias for inadequate allocation (Ng 2011). The remaining studies provided insufficient information to permit judgement of low or high risk.

Blinding

Blinding of participants was mostly implausible for AMBMT and PR interventions; therefore, we considered all studies to be at high risk for performance bias. Six studies provided QoL and dyspnoea scores assessed by participants, rendering detection bias high risk because participants were not blinded to the treatment received (Chan 2010; Du 2013; Liu 2012; Ng 2011; Ng 2014; Papp 2017). We considered Niu 2014 to be at low risk because study authors provided sufficient information regarding blinding of assessors and did not include any self-reporting outcomes. The remaining studies provided insufficient information to permit judgement of low or high risk.

Incomplete outcome data

Of five studies reporting an intention-to-treat analysis (Chan 2010; Liu 2012; Ng 2011; Ng 2014; Papp 2017), two reported an attrition rate less than 20% (Liu 2012; Papp 2017); we considered them at low risk and the remaining three studies to be at high risk. The other studies did not report sufficient information to permit judgement of low or high risk.

Selective reporting

One study showed no differences between registration and outcomes reported in the published results articles (Ng 2014). However, we found no records in clinical trials registers for the other studies, to permit judgement of low or high risk.

Other potential sources of bias

It is unclear whether conducting studies only in China on a Chinese population is a limitation to the external validity of trial results. It is also unclear whether differences between interventions, time points, and disease severity could introduce any other potential sources of bias. Chan 2010 reported an unbalanced baseline exacerbation rate between AMBMT and PR intervention groups, and this could be a potential source of bias.

Effects of interventions

See: [Summary of findings for the main comparison](#) Summary of findings for AMBMT vs PR; [Summary of findings 2](#) Summary of findings for AMBMT + PR vs PR

AMBMT versus PR

Comparisons of AMBMT versus PR included all participants of included studies who were randomly allocated to either AMBMT or PR (see [Characteristics of included studies](#) for additional information).

Primary outcomes

Disease-specific quality of life

Four studies including a total of 381 participants used three different questionnaires - the SGRQ, the CAT, and the Zhongsan COPD Questionnaire - to assess disease-specific quality of life (Chan 2010; Du 2013; Liu 2012; Yang 2009). The SGRQ and the CAT are validated questionnaires that are commonly used among patients with COPD; the Zhongsan COPD Questionnaire, even though it is not commonly used in Western countries, has established validity and reliability in a Chinese population (Cai 2004). The Zhongsan COPD Questionnaire consists of 35 questions, clustered into four categories: 13 questions for activities of daily living (ADLs), seven for social participation, eight for depression, and seven for anxiety. Each question is rated on a 4-point scale, and lower marks indicate better QoL (Liu 2012). Investigators performed separate analyses of questionnaire results.

On the SGRQ (Figure 4), results favoured AMBMT for total score (mean difference (MD) -5.83, 95% confidence interval (CI) -8.75 to -2.92; 249 participants; low-quality evidence; Analysis 1.1), subscale activity (MD -8.96, 95% CI -13.04 to -4.89; 213 participants; low-quality evidence; Analysis 1.1), and subscale impact (MD -3.75, 95% CI -6.78 to -0.73; 213 participants; low-quality evidence; Analysis

1.1) but showed no difference in subscale symptoms (MD -2.22, 95% CI -5.66 to 1.23; 213 participants; low-quality evidence; Analysis 1.1). For SGRQ subscale activity and for SGRQ total score, the common effect size exceeded the MCID of minus four for the SGRQ (Jones 2005), and the 95% CI around the pooled treatment effect did not exceed the MCID.

Figure 4. Forest plot of comparison: 1 AMBMT vs PR, outcome: 1.1 SGRQ.

One study used the CAT (Du 2013). Results favoured AMBMT over PR (MD -6.58, 95% CI -9.16 to -4.00; 74 participants; low-quality evidence; Analysis 1.2), and both the common effect size and the lower limit of the confidence interval exceeded the MCID of three (Alma 2016). Results show no differences between AMBMT and PR alone for any of the CRQ subscales (Figure 5): dyspnoea (MD -0.21, 95% CI -2.81 to 2.38; 11 participants; very low-quality evidence; Analysis 1.3), fatigue (MD -0.98, 95% CI -2.28 to 0.32; 11 participants; very low-quality evidence; Analysis 1.3), mastery (MD -0.31, 95% CI -1.44 to 0.82; 11 participants; very low-quality evidence; Analysis 1.3), or emotion (MD -0.43, 95% CI -1.16 to

0.29; 11 participants; very low-quality evidence; Analysis 1.3). Last, with regard to the Zhongsan COPD Questionnaire, results favoured AMBMT for ADL (MD -1.66, 95% CI -2.98 to -0.34; 83 participants; very low-quality evidence; Analysis 1.4) and showed no differences between AMBMT and PR for social participation (MD -0.09, 95% CI -0.96 to 0.78; 83 participants; very low-quality evidence; Analysis 1.4), depression (MD -0.61, 95% CI -1.35 to 0.13; 83 participants; very low-quality evidence; Analysis 1.4), or anxiety (MD -0.62, 95% CI -1.78 to 0.54; 83 participants; very low-quality evidence; Analysis 1.4). To our knowledge, no MCID is available for the Zhongsan COPD Questionnaire; this precludes assessment of clinical significance.

Figure 5. Forest plot of comparison: 1 AMBMT vs PR, outcome: 1.3 CRQ.

Generic health-related quality of life

None of the trials included in the review addressed this particular outcome.

Dyspnoea

Four studies involving 277 participants measured dyspnoea during exercise (6MWT via Borg Scale) or during daily living (modified Medical Research Council Scale (mMRC) or CRQ Dyspnoea) (Chan 2010; Du 2013; Papp 2017; Zhu 2010). Neither statistically nor clinically significant differences were evident on the Borg Scale (MD -0.44, 95% CI -0.88 to 0.00; 139 participants; very low-quality evidence; Analysis 1.5), the mMRC (MD 0.00, 95% CI -0.37 to 0.37; 127 participants; very low-quality evidence; Analysis 1.6), or the CRQ Dyspnoea domain (MD -0.21, 95% CI -2.81 to 2.38; 11 participants; very low-quality evidence; Analysis 1.3).

Serious adverse events

None of the trials included in the review addressed this particular outcome.

Secondary outcomes

Exercise capacity

Seven studies involving a total of 436 participants used the 6MWT to assess functional exercise capacity. Researchers found no statistically or clinically significant differences between AMBMT and PR (MD 3.05 m, 95% CI -9.97 to 16.07; 436 participants; low-quality evidence; Analysis 1.7). The 6MWT demonstrated substantial heterogeneity in the results obtained. Therefore, investigators performed a subgroup analysis based on the type of AMBMT performed and found no statistically or clinically significant differences between tai chi and PR (three studies; Chan 2010; Du 2013; Niu 2014), or between qigong and PR (three studies; Liu 2012; Yang 2009; Zhu 2010), but they noted a significant difference between yoga and PR favouring the PR group (MD 69.3 m, 95% CI -117.7 to -20.9; 11 participants; very low-quality evidence; test for subgroup differences: $\text{Chi}^2 = 11.01$, $\text{df} = 2$ ($P = 0.004$), $I^2 = 81.8\%$) (Papp 2017). One trial used incremental and constant work rate cycle ergometry to assess exercise capacity and reported no between-group differences in peak oxygen uptake (VO_2) (MD 55 mL/min, 95% CI -157.8 to 267.8; 36 participants; very low-quality evidence; Analysis 1.8) nor in constant work rate exercise time

(MD 0.14 min, 95% CI -1.8 to 2.1; 36 participants; very low-quality evidence; Analysis 1.9).

Pulmonary function

Researchers found no statistically or clinically significant differences between AMBMT and PR in FEV_1 (MD 0.07 L, 95% CI -0.01 to 0.15; 318 participants; low-quality evidence; Analysis 1.10) nor in FVC (MD -0.02 L, 95% CI -0.21 to 0.17; 150 participants; low-quality evidence; Analysis 1.11). Statistical differences favoured AMBMT over PR for the FEV_1/FVC ratio (MD 3.84%, 95% CI 0.68 to 7.01; 260 participants; low-quality evidence; Analysis 1.12) and for FEV_1 predicted (MD 3.95%, 95% CI 1.77 to 6.13; 325 participants; low-quality evidence; Analysis 1.13). Trial results showed no heterogeneity for FEV_1 nor for FVC and FEV_1 predicted but substantial heterogeneity for the FEV_1/FVC ratio. Subgroup analysis performed on the type of AMBMT revealed that heterogeneity for the FEV_1/FVC ratio was absent when Du 2013, which included only patients with mild to moderate COPD, was removed from the analysis. Furthermore, no statistical differences were evident for the FEV_1/FVC ratio (MD 2.70%, 95% CI -0.49 to 5.89; 186 participants; low-quality evidence) nor for FEV_1 predicted (MD 2.65%, 95% CI -0.71 to 6.00; 251 participants; low-quality evidence).

Limb muscle function

None of the trials included in this review addressed this particular outcome.

Acute exacerbations

Liu 2012 included a comparison of AMBMT versus PR for acute exacerbations and found no differences between conditions (MD 0.03, 95% CI -0.21 to 0.27; 83 participants; very low-quality evidence; Analysis 1.14).

Adherence

None of the trials included in the review addressed this particular outcome.

AMBMT + PR versus PR

Comparisons of AMBMT + PR versus PR alone included all participants of included studies (Ng 2011; Ng 2014). See Characteristics of included studies for additional information.

No subgroup analyses were performed, as results showed no heterogeneity for the main comparisons.

Primary outcomes

Disease-specific quality of life

AMBMT added to PR versus PR alone did not result in any difference in SGRQ total score (MD -2.57, 95% CI -7.76 to 2.62; 192 participants; moderate-quality evidence; [Analysis 2.1](#)) nor in any of the SGRQ subscales ([Figure 6](#)): activity (MD -3.79, 95% CI -9.98 to 2.40; 192 participants; moderate-quality evidence; [Analysis 2.1](#)), symptoms (MD -0.11, 95% CI -5.71 to 5.49; 192 participants; moderate-quality evidence; [Analysis 2.1](#)), or impact (MD -2.64, 95% CI -8.11 to 2.83;

192 participants; moderate-quality evidence; [Analysis 2.1](#)). Nor did the 95% confidence interval around the pooled treatment effect or the common effect size exceed the MCID of minus four ([Jones 2005](#)). Results show no additional benefits of AMBMT + PR versus PR alone for any of the CRQ subscales ([Figure 7](#)): dyspnoea (MD 0.04, 95% CI -2.18 to 2.26; 80 participants; very low-quality evidence; [Analysis 2.2](#)), fatigue (MD 0.18, 95% CI -1.48 to 1.84; 80 participants; very low-quality evidence; [Analysis 2.2](#)), mastery (MD 0.27, 95% CI -2.78 to 3.32; 80 participants; very low-quality evidence; [Analysis 2.2](#)), or emotion (MD 0.31, 95% CI -2.62 to 3.24; 80 participants; very low-quality evidence; [Analysis 2.2](#)). Nor did the 95% confidence interval around the pooled treatment effect or the common effect size exceed the MCID of 0.5 ([Jaeschke 1989](#)).

Figure 6. Forest plot of comparison: 2 PR with AMBMT vs PR, outcome: 2.1 SGRQ.

Figure 7. Forest plot of comparison: 2 PR with AMBMT vs PR, outcome: 2.2 CRQ.

Generic health-related quality of life

One study including 80 participants used the SF-36 questionnaire to assess generic quality of life. Results favoured AMBMT + PR over PR alone for the SF-36 general health subscale (MD 5.42, 95% CI 3.82 to 7.02; 80 participants; very low-quality evidence; [Analysis 2.3](#)) and the SF-36 mental health subscale (MD 3.20, 95% CI 1.45 to 4.95; 80 participants; very low-quality evidence; [Analysis 2.3](#)).

Dyspnoea

Trial results show no additional benefits of AMBMT + PR versus PR alone for the CRQ dyspnoea subscale (MD 0.04, 95% CI -2.18 to 2.26; 80 participants; very low-quality evidence; [Analysis 2.2](#)). Neither statistically nor clinically significant differences were seen on the Borg Scale (MD -0.10, 95% CI -0.37 to 0.17; 192 participants; low-quality evidence; [Analysis 2.4](#)), nor in the Self-efficacy for Managing Shortness of Breath Scale (SEMSOB) (MD 0.23, 95% CI -0.30 to 0.76; 192 participants; very low-quality evidence; [Analysis 2.5](#)) or the

COPD Self-efficacy Scale (CSES) (MD -0.00, 95% CI -0.04 to 0.04; 11 participants; very low-quality evidence; [Analysis 2.6](#)).

Serious adverse events

None of the trials included in this review addressed this particular outcome.

Secondary outcomes

Exercise capacity

Researchers used the 6MWT to assess functional exercise capacity and found no statistically or clinically significant differences between AMBMT + PR and PR alone (MD 14.1 m, 95% CI -3.68 to 31.86; 272 participants; moderate-quality evidence; [Analysis 2.7](#)).

Pulmonary function

Trial results show no statistically or clinically significant differences between AMBMT and PR versus PR alone in FEV₁ (MD 0.06 L, 95% CI -0.09 to 0.21; 192 participants; low-quality evidence; [Analysis 2.8](#)), in FVC (MD 0.13 L, 95% CI -0.09 to 0.35; 192 participants; low-quality evidence; [Analysis 2.9](#)), nor in FEV₁ predicted (MD 3.04%, 95% CI -4.39 to 10.47; 192 participants; low-quality evidence; [Analysis 2.10](#)).

Limb muscle function

None of the trials included in this review addressed this particular outcome.

Exacerbations

None of the trials included in this review addressed this particular outcome.

Adherence

None of the trials included in this review addressed this particular outcome.

DISCUSSION

Summary of main results

The primary aim of this review was to determine whether active mind-body movement therapy (AMBMT) compared with pulmonary rehabilitation (PR), or in addition to PR, would further improve quality of life, symptoms of dyspnoea, and exercise capacity in people with chronic obstructive pulmonary disease (COPD). We included in this review 10 studies with 762 participants; of these, eight studies compared AMBMT versus a conventional PR programme, and two compared the effect of adding AMBMT to PR.

A vast majority of included studies used the term 'PR' uncritically (e.g. unstructured walking training (often self-paced) was the sole component of PR in seven out of 10 included studies), thus making an adequate comparison of AMBMT and PR difficult.

With regard to the comparison of AMBMT versus PR for primary outcomes, we obtained results related to the Chronic Respiratory Questionnaire (CRQ), the COPD Assessment Test (CAT), and the Borg Scale from a single study. We found a statistically and clinically significant effect favouring AMBMT over PR in quality of life assessed by St. George's Respiratory Questionnaire (SGRQ) total score (three studies) and CAT score. Trial results show no significant differences in the CRQ domains of fatigue, emotion, and

mastery. Three studies using different tools to measure levels of dyspnoea (CRQ, modified Medical Research Council Scale (mMRC), Borg Scale) found no significant differences between AMBMT and PR.

Comparison of AMBMT added to PR versus PR alone revealed a statistically significant difference favouring AMBMT added to PR for quality of life measured by Short Form (SF)-36 for general and mental health. However, researchers observed no significant differences for disease-specific quality of life (QoL), assessed by the SGRQ total score. They also found no significant differences between AMBMT added to PR and PR alone for dyspnoea measured by the dyspnoea domain of the CRQ. However, all of these results were drawn from a single study and cannot be conclusive; further research is needed for firm conclusions about the effects of AMBMT added to PR.

We have provided further information regarding main trial results and quality of the evidence in [Summary of findings for the main comparison](#) and [Summary of findings 2](#).

Overall completeness and applicability of evidence

Most studies in this meta-analysis investigated QoL as well as dyspnoea. Furthermore, different trials recruited participants with a wide range of airflow limitations (Global Initiative on Obstructive Lung Disease (GOLD) stages 1 to 4). One study excluded patients with very severe COPD, and another included only patients with mild and moderate COPD (GOLD stages 1 and 2). Interventions included qigong techniques, tai chi, and yoga. Conclusions on the effects of yoga in COPD are highly limited owing to the small number of patients with COPD who were included and the unbalanced group allocation ([Papp 2017](#)). Most studies comparing AMBMT versus walking interventions satisfied the PR definition provided in our review (see [Types of interventions](#)) but do not conform to current recommendations ([Garvey 2016](#); [Spruit 2013](#)). The small number of randomised controlled trials identified, the inadequate descriptions of PR programmes provided, and the lack of information detailing aspects related to risk of bias make it challenging to draw firm conclusions about the effects of AMBMT in COPD.

Quality of the evidence

We used the GRADE system to rate the quality of evidence for the main comparisons. In the comparison of AMBMT versus PR, the quality of evidence was low for disease-specific QoL, and very low for dyspnoea. The main reasons for downgrading the quality of evidence were limitations in study quality and possible indirectness in study results, mainly due to the fact that study authors poorly described the training component of PR (e.g. no information on duration or intensity of the walking training performed). Evidence for the comparison of AMBMT + PR versus PR alone was also of low quality for generic QoL. We attributed this to limitations in study quality, indirectness in study results, and the small number of events reported by a single study without adequate sample size calculation for this outcome. In this comparison, the quality of evidence for disease-specific QoL ranged from moderate to very low. We have provided reasons for downgrading the quality of evidence in [Summary of findings for the main comparison](#) and [Summary of findings 2](#).

Potential biases in the review process

Two review authors (LMcG and AN) independently reviewed all articles throughout each step of the inclusion process. Agreement between the two review authors was excellent, as is reflected by a kappa of 0.90. Also, two review authors independently extracted data, assessed risk of bias, and resolved discrepancies by discussion with a third review author (YL). If necessary, we contacted the authors of individual studies to ask for missing or additional information. We used only published data, potentially influencing the calculated treatment effect.

Agreements and disagreements with other studies or reviews

To date, seven systematic reviews and meta-analyses have examined the effects of AMBMT strategies, mainly tai chi and/or qigong, in people with COPD (Chen 2016; Ding 2014; Guo 2016; Ng 2014a; Ngai 2016; Wu 2014; Yan 2013).

Chen 2016 included tai chi as the AMBMT strategy that was compared with usual care. Yan 2013 and Guo 2016 also included tai chi as the AMBMT strategy. However, researchers compared tai chi versus several different control interventions (e.g. usual care, exercise training, respiratory exercises, drug therapy), all of which were pooled together. Thus, results reported in these reviews may be different from results reported in the present review, and a direct comparison between reviews is not appropriate.

Similar to the present review, Wu 2014 included comparisons of tai chi versus exercise training, and Ng 2014a and Ngai 2016 included comparisons of tai chi and/or qigong + exercise training versus exercise training alone. However, in Wu 2014 and Ng 2014a, researchers considered different types and combinations of breathing exercises alone as exercise training. Thus the definitions of exercise training used in these reviews are not the same as the definition used in the present review, and this precludes direct comparisons of results (Garvey 2016; Spruit 2013).

In Ngai 2016, investigators compared AMBMT (tai chi) and PR versus PR alone using the same definition of PR that was provided in the present review. With regard to effects of AMBMT (tai chi) added to PR on disease-specific QoL, pulmonary function, and six-minute walking distance (6MWD), the present review did not include any studies other than those included by Ngai 2016 thus, the results for these outcomes are similar between reviews. However, in contrast to Ngai 2016, the present review included additional outcomes such as dyspnoea, generic quality of life for additional AMBMT strategies (qigong and yoga), and a comparison of AMBMT versus PR alone.

Last, Ding 2014 included three studies that evaluated the effects of tai chi and seven studies that evaluated the effects of qigong, three of which included a comparison of the effects of tai chi and/or qigong versus PR on walking distance and lung function. Similar to the present review, exercise training within PR mainly consisted of walking training. Researchers found no differences in walking distance on the 6MWD nor in forced expiratory volume in one second (FEV₁) between tai chi/qigong and PR; this is similar to the findings reported for AMBMT versus PR in the present review. Review authors performed a subanalysis in which the PR group was divided into one group for which exercise intensity of the walking training was controlled and another group for which it was

uncontrolled. Review authors found a larger increase in walking distance on the 6MWD with tai chi/qigong over PR when exercise intensity was uncontrolled and noted no difference when it was controlled. Thus, the difference in results between uncontrolled and controlled intensity emphasises the importance of using PR of adequate design for accurate comparisons.

Limited information on duration and progression of the training programmes used as comparators is a major limitation for interpretation of the walking training provided in included studies in both the present and previous reviews on this topic. As recommended in the latest American Thoracic Society (ATS)/European Respiratory Society (ERS) statement on PR, the following exercise training principles are mandatory for the design of an effective PR programme, irrespective of the exercise modality used (Spruit 2013): (1) the total training load must reflect the individual's specific requirements, (2) the training load must exceed loads encountered during daily life, and (3) adequate duration, intensity, and progression of training are essential. This information should be reflected in the final trial report.

AUTHORS' CONCLUSIONS

Implications for practice

The fact that unstructured walking training was the sole component of PR in most included studies makes it challenging to draw firm conclusions about the effects of AMBMT compared with or provided as an adjunct to PR. Results of this meta-analysis indicate that clinically relevant improvements in disease-specific QoL may be seen with AMBMT when compared with PR. However, the quality of evidence for this is low, and our confidence in this observed effect is therefore highly limited. Similarly, the low quality of evidence for the dyspnoea data provided limits our conclusions about these results. Results of this meta-analysis also indicate that AMBMT added to PR may be more effective than PR alone for improving generic QoL (very low-quality evidence) but not disease-specific QoL in this population (moderate- to very low-quality evidence). The overall poor quality of evidence derived from the comparison of AMBMT + PR versus PR alone limits our confidence in these results. Thus, limited available findings showing effects of AMBMT versus PR or of AMBMT added to PR versus PR alone remain inconclusive.

Implications for research

The small number of included studies, the low overall quality of study methods and evidence, vast differences in the definitions of PR provided within studies, and the predominance of studies from China, reducing generalisation of the results, highlight that further studies comparing AMBMT as an adjunct to PR or versus PR alone are warranted. Future studies should include PR programmes that are properly designed and reported in accordance with current recommendations and guidelines (Garvey 2016; Spruit 2013). These programmes should be delivered by properly trained professionals who have a comprehensive understanding of respiratory physiology, exercise science, and the pathology of COPD. Furthermore, in addition to measurements of QoL, dyspnoea, and exercise capacity, assessment of the potential effects of AMBMT on limb muscle function parameters such as limb muscle strength, endurance, and/or fatigue is warranted, given the negative consequences of limb muscle dysfunction for this population (Maltais 2014). Future studies are also needed

to evaluate the impact of AMBMT strategies on patients after an exacerbation of COPD. Finally, given the different types of AMBMT strategies included in the present review, additional studies are needed to examine the individual influence of each of these different strategies.

ACKNOWLEDGEMENTS

We thank Ms Andrea Falk for her assistance with Chinese translation.

Sally Spencer was the Editor for this review and commented critically on the review.

The [Background](#) and [Methods](#) sections of this review are based on a standard template used by Cochrane Airways.

This project was supported by the National Institute for Health Research (NIHR), via Cochrane Infrastructure funding to the Cochrane Airways Group. The views and opinions expressed therein are those of the review authors and do not necessarily reflect those of the Systematic Reviews Programme, NIHR, NHS, or the Department of Health.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES
Characteristics of included studies [ordered by study ID]
Chan 2010

Methods	Design <ul style="list-style-type: none"> Single-blind RCT; COPD patients were randomly assigned to 3 groups: tai chi/qigong group, exercise group, and control group Three-month intervention programme and 6-month follow-up
Participants	Setting <ul style="list-style-type: none"> Participants were recruited from 5 general outpatient clinics in Hong Kong, China Participants <ul style="list-style-type: none"> 206 participants were randomly assigned to groups: tai chi/qigong (TCQ) group (n = 70), exercise group (n = 69), and control group (n = 67) Ages ranged from 55 to 88, with a mean age of 73 187 participants (91%) were male; 19 (9%) were female Mean duration of COPD was 11 years; 43% were at a severe stage of COPD, 42% at a moderate stage, and 16% at a mild stage Inclusion criteria <ul style="list-style-type: none"> Clinical diagnosis of COPD as defined by the American Thoracic Society Ability to walk independently Exclusion criteria <ul style="list-style-type: none"> Inability to walk independently Severe sensory or cognitive impairment Symptomatic ischaemic heart disease Practice in TCQ within a year before commencement of the study Baseline imbalances <ul style="list-style-type: none"> Gender and exacerbation rates
Interventions	AMBM <p>Participants completed 60-minute TCQ practice sessions twice a week for 3 months. The TCQ intervention routine consisted of 13 movements of Breathing Regulating TCQ (BRTCQ), which were selected and modified from the 18 movements of Taiji Qigong produced by the Department of Health. The 13 modified forms of BRTCQ were designed for easy learning and for mastery in a shorter period. The 13 BRTCQ forms were referred to 2 TCQ experts to ensure their validity and feasibility for use with COPD clients. The TCQ class was led by a qualified TCQ master. Participants were required to co-ordinate their breathing with prescribed movements. They were also advised to practice TCQ exercises for an hour every day, apart from the 2 TCQ sessions. A DVD and TCQ pictures were given to each participant</p>

Chan 2010 (Continued)

to facilitate daily self-practice. A diary was given to participants, so they could record the frequency of their self-practice.

PR

Participants were taught pursed-lip breathing and diaphragmatic breathing, co-ordinated with self-paced walking as a physical exercise. Expiration time was twice the inspiration time to slow down the breathing rate. Participants were instructed to inhale through the nose, push the stomach out, then exhale through pursed lips slowly, while pulling the stomach in. Return demonstrations of breathing techniques were performed by participants to ensure proper practice. Participants were advised to perform breathing and walking exercises for 1 hour, which could be split into 2 or 3 sessions to prevent fatigue. Leaflets with pictures and instructions were given to participants to facilitate daily self-practice. A diary was also given to each participant for recording the frequency of self-practice sessions. The breathing techniques of participants were re-assessed at the 6-week and 3-month time points to ensure that proper skills were maintained. The breathing component in this group was different from that in the TCQ group, as the TCQ group did not require pursed-lip breathing and placed no restriction on time for breathing in and out.

Other group (not of interest for this review)

- Participants were advised to maintain routine activities

Time points measured

- Baseline, week 6, 3 months, 6-month follow-up

Outcomes	<ul style="list-style-type: none">• Hong Kong Chinese version of the SGRQ, unit• Multi-dimensional Scale of Perceived Social Support - Chinese version (MSPSS-C), unit• Pulmonary function: spirometry (FEV₁, L; FVC, L)• 6MWD, m• Self-rated dyspnoea and fatigue scale (modified Borg Scale (0 to 10), unit)• Oxygen saturation level (SaO₂), %• Compliance rate, %• TQG attendance rate, %• TQG skill performance (1 to 3, unit)• TQG programme satisfaction (1 to 5, unit)	
Notes	Funding source <ul style="list-style-type: none">• Health and Health Services Research Fund (HHSRF:06070201)• Lee Hysan Foundation Research Grant and Endowment Fund Research Grant (CA11125)	
<i>Risk of bias</i>		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random allocation done via a randomiser software
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants not blinded to the interventions

Chan 2010 (Continued)

Blinding of outcome assessment (detection bias) All outcomes	High risk	Research assistants for data collection were blinded to the study minimise researcher bias; however, quality of life was assessed by participants who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	High risk	To preserve the value of randomisation, an intention-to-treat analysis was applied. Data from last observation were carried forward for withdrawals; attrition rate was 23%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	High risk	Confounding bias: unbalanced exacerbation rates at baseline

Du 2013

Methods	Design <ul style="list-style-type: none"> Patients with COPD were randomly divided into 3 groups: tai chi group, exercise group, and control group 12-Week intervention programme
Participants	Setting <ul style="list-style-type: none"> Participants were recruited in Qiaodong District of Zhangjiakou, Hebei, China Participants <ul style="list-style-type: none"> 112 participants were randomly assigned to groups: Taijiquan (TJQ) group (n = 36), exercise group (n = 38), and control group (n = 38) Age ranged from 60 to 79 years 70 participants (63%) were male; 42 (37%) were female 71% were at a moderate stage of COPD; 29% were at a mild stage Inclusion criteria <ul style="list-style-type: none"> Clinical diagnosis of COPD as defined by GOLD Lack of engagement in tai chi practice for 5 years before study commencement Exclusion criteria <ul style="list-style-type: none"> Mental disorders Severe perceptual disorders Inability to walk independently Symptomatic ischaemic heart disease Poor compliance Dropout due to increased disease severity during the intervention period or for another reason
Interventions	AMBMT <p>Participants followed supervised 60-minute tai chi sessions twice a week plus daily self-practice (60 minutes with instructional tai chi CD and log book) for a total of 3 months. The tai chi intervention consisted of a 24-form Yang style routine with breathing co-ordination.</p> PR <p>Participants were instructed to perform daily 30 minutes of self-paced walking sessions and 60 minutes of pursed-lip breathing and diaphragmatic breathing. Participants could split their training into 2 or 3 sessions to prevent fatigue. Leaflets with instructions were given to participants to facilitate daily self-</p>

Du 2013 (Continued)

practice. A diary was given to each participant for recording self- practice sessions and was monitored at 6-week and 3-month time periods.

Other group (not of interest for this review)

- Participants were advised to maintain routine activities

Time points measured

- Baseline, week 6, 3 months

Outcomes	<ul style="list-style-type: none"> • BODE Index, unit • Pulmonary function: spirometry (% pred FEV₁, %; ratio FEV₁/FVC, %; MVV, L) • COPD Assessment Test (CAT), unit • Oxygen saturation level (SaO₂), % • Blood gas analysis (pH, unit; PaCO₂, mmHg; PaO₂, mmHg) • SGRQ, unit • mMRC, unit • BMI, kg/m² • 6MWD, m • Self-rated dyspnoea and fatigue scale (modified Borg Scale (0 to 10)), unit
Notes	Funding source <ul style="list-style-type: none"> • Not mentioned

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number table
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants not blinded to interventions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quality of life assessed by participants who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Liu 2012

Methods	<p>Design</p> <ul style="list-style-type: none"> Single-blind, RCT design Patients with COPD were randomly allocated to Health Qigong Group (HQG), conventional PR group, or medical treatment group
Participants	<p>Setting</p> <ul style="list-style-type: none"> Patients were recruited from settings under the care of respiratory specialists of Jiangsu Province Hospitals, China, from October 2008 to October 2010 <p>Participants</p> <ul style="list-style-type: none"> A total of 132 patients with confirmed diagnosis of COPD were randomly assigned to groups: HQG group (n = 60), PR group (n = 36), and control group (n = 36) Average age of all participants was 62 years 77% were male 48% were GOLD stage 1, and 52% were GOLD stage 2 <p>Inclusion criteria</p> <ul style="list-style-type: none"> Severity level at GOLD stages 1 and 2 <p>Exclusion criteria</p> <ul style="list-style-type: none"> Serious comorbidities (e.g. pulmonary tuberculosis, emphysema, congestive heart failure)
Interventions	<p>AMBMT</p> <p>The HQG group received 1 week of HQG training under the supervision of professional HQG coaches, and then were encouraged to participate in a peer-led weekly practice group thrice a week, lasting 1 hour each time, for 6 months. The adopted HQG protocol was developed by Professor Hong-Zhu Jin and his team at the Jiangsu Province Hospitals, and development was guided by the following 2 principles. First, it should be based on routines selected from the 4 national standardised HQG protocols: Tendon Changing Classic or Yijinjing (易筋經), Frolics of Five Animals or Wuqinxi (五禽戲), The Art of Expiration in Producing Six Different Sounds or Liuzijue (六字訣), and Eight Excellent Movements or Baduanjin (八段錦). Second, selected routines should have been studied for their effect in fostering lung health according to TCM principles.</p> <p>PR</p> <p>The conventional PR group also received a similar amount of professional input on coaching pursed-lip breathing and aerobic exercise (e.g. walking, cycling on static bicycle). Participants were then encouraged to participate in peer-led weekly walking and ball game activities thrice a week, 1 hour each time, for 6 months.</p> <p>Other group (not of interest for this review)</p> <ul style="list-style-type: none"> The medical treatment group received only health education and was advised to continue exercising by themselves before the 6-month follow-up <p>Time points measured</p> <ul style="list-style-type: none"> Baseline data were taken before randomisation, and outcome data were ascertained at 6-month follow-up
Outcomes	<ul style="list-style-type: none"> Pulmonary function: spirometry (% pred FEV₁, %; ratio FEV₁/FVC, %) Six-minute walk test: distance (6MWD, m) Zhongshan COPD Questionnaire for QoL, unit Immune cell factors (TNF-α, ng/mL; IL-8, ng/mL; IL-6, ng/mL) Acute exacerbation of COPD (AECOPD), unit

Liu 2012 (Continued)

Notes	Funding source	
	<ul style="list-style-type: none"> Not mentioned 	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Participant allocation list was drawn based on the random order of a block
Allocation concealment (selection bias)	Unclear risk	All outcome assessors were blinded to each participant's allocated group as well as to objectives of the study to minimise bias. However, no information on how allocation was kept concealed
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Research assistants for data collection were blind to the study to minimise researcher bias; however, quality of life was assessed by participants who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	Low risk	To preserve the value of randomisation, an intention-to-treat analysis was applied in calculating missing values at other time points. In the case of withdrawals, data were carried forward; attrition rate was 11%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Ng 2011

Methods	Design
	<ul style="list-style-type: none"> 80 patients with COPD receiving conventional PR programme were randomised to the Health Qigong (HQG) intervention group (n = 40) and the control exercise group (n = 40)
Participants	Setting
	<ul style="list-style-type: none"> The study was undertaken in a respiratory care hospital that has provided ambulatory rehabilitation programmes for patients with COPD since the early 1990s, in Hong Kong, China
	Participants
	<ul style="list-style-type: none"> A total of 80 patients with COPD were randomly assigned to groups: HQG + PR group (n = 40) and PR group (n = 40) Average age of all participants was 73 years 87% were male
	Inclusion criteria
	<ul style="list-style-type: none"> Diagnosis of COPD confirmed by both medical history and air flow limitation (i.e. ratio of forced expiratory volume in the first second (FEV₁) to forced vital capacity was less than 70%), as reflected by spiro-

Ng 2011 (Continued)

metric readings measured after post-bronchodilator therapy and according to the American Thoracic Society standard

- Medically stable as interpreted by no hospital admissions for chest problems in the month before PR
- Cessation of smoking for at least 6 months
- No other disabling diseases (e.g. stroke, Parkinson's)

Exclusion criteria

- Prior history of practising qigong

Interventions	<p>PR + AMBMT</p> <p>Each patient received four 45-minute training sessions on HQG led by a trained therapist at the ninth, tenth, eleventh, and twelfth sessions of the PR programme, together with a home learning package in the form of audiovisual materials. The specific form of HQG chosen was Baduanjin. It consisted of 8 distinct movement routines, with each movement routine repeated 6 times. The whole protocol usually took 12 to 15 minutes to complete at a usual pace. To address the special needs of patients with COPD, an expert panel review was conducted to assess potential clinical effectiveness. Before the RCT was begun, a field test was conducted to study safety in its application to patients with COPD. To maximise the potential benefits of training, the minimal dosage of the training protocol that experts advised was practice at least 1 time per day at least 4 times a week until 6-month follow-up. To keep a record of their own practice, patients were issued a daily log.</p> <p>PR</p> <p>Each patient received the same number and duration of additional training sessions, reinforcing the breathing (including pursed-lip and co-ordinated breathing) and walking exercises of the conventional programme to make it comparable to the treatment group in terms of additional staff attention given to participants. In addition, another set of audiovisual training material on corresponding aspects was issued to all control participants, who were also advised to keep walking daily for not less than 30 minutes until 6-month follow-up.</p> <p>Time points measured</p> <ul style="list-style-type: none"> • Baseline and 6-month follow-up
Outcomes	<ul style="list-style-type: none"> • SF-36 general health subscale, unit • SF-36 mental health subscale, unit • CCRQ, unit • 6MWD, m • MFTE, unit • Compliance rate, % • Attrition rate, %
Notes	<p>Funding source</p> <ul style="list-style-type: none"> • Work was supported by the Area of Excellence Grant (A102), Department of Rehabilitation Sciences of The Hong Kong Polytechnic University

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random numbers
Allocation concealment (selection bias)	High risk	The occupational therapist opened the list file and assigned participants to treatment or control group accordingly

Ng 2011 (Continued)

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcomes assessments were administered by blinded assessors who were ignorant of the treatment arm to which each participant was assigned; however, quality of life was assessed by participants who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	High risk	Analysis was first conducted via the ITT approach, which included all randomised participants classified according to their randomisation and irrespective of their completion of treatment and follow-up assessments. Missing values at discharge, 3-month follow-up, and 6-month follow-up were imputed via the "last observation carried forward" method; however, attrition rate was 35%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Ng 2014

Methods	Design <ul style="list-style-type: none"> Single-blind randomised controlled study conducted to compare self-efficacy and quality of life parameters of patients with COPD who underwent pulmonary rehabilitation with or without incorporation of tai chi elements in the exercise component
Participants	Setting <ul style="list-style-type: none"> Study conducted from March 2011 to May 2012, with a total of 192 participants recruited from 4 general outpatient clinics in Hong Kong, China Participants <ul style="list-style-type: none"> A total of 192 patients with clinical diagnosis of COPD were randomly assigned to groups: PR + AMBMT group (n = 94) and PR group (n = 98) Average age of all participants was 74 years 91% were male 20% were GOLD stage 1, 41% GOLD stage 2, 30% GOLD stage 3, and 9% GOLD stage 4 Inclusion criteria <ul style="list-style-type: none"> Clinical diagnosis of COPD as defined by American Thoracic Society (ATS) and Global Initiative for Chronic Obstructive Lung Disease (2010 GOLD) Medical Research Council (MRC) dyspnoea score ≥ 2 on the 1 to 5 scale version Decreased forced expiratory ratios (FEV_1/FVC) $< 70\%$ poorly reversible with bronchodilators Exclusion criteria <ul style="list-style-type: none"> Poor mobility Severe sensory or cognitive impairment Severe comorbidities including acute myocardial infarction in 6 months before the programme Tai chi practised within a year before study commencement

Ng 2014 (Continued)

Interventions

PR + AMBMT

Both groups received rehabilitation consisting of 2 sessions per week for 6 weeks with totally identical content, except that tai chi exercises were added for tai chi group. Data collection was performed at baseline and at 2 and 6 months post intervention. Each session would last for 1 hour and 20 minutes, with 6 to 10 participants per session. Upon entering the intervention protocol, all participants in both groups were required to participate in a 30-minute educational session conducted by a physiotherapist to improve their knowledge and skills in COPD management. A COPD booklet and home diary were provided as supplementary materials. In the TC group, the formal pulmonary rehabilitation programme was identical to that in the PR group, except that 15 minutes of tai chi exercises was substituted for 15 minutes of relaxation exercise. Five forms of Sun Style tai chi were taught by a tai chi accredited physiotherapist for ease of mastery. The TC group was also instructed to perform 1 hour of daily unsupervised home exercises identical to those performed by the PR group, except for 15 minutes of tai chi replacing the relaxation exercises for 5 to 7 days per week. Both groups were instructed to document their home exercises in their compliance diary.

PR

Each session would last for 1 hour and 20 minutes with 6 to 10 participants per session. Upon entering the intervention protocol, all participants in both groups were required to participate in the 30-minute educational session conducted by the physiotherapist to improve their knowledge and skills in COPD management. A COPD booklet and home diary were provided as supplementary materials. The formal pulmonary rehabilitation programme in the PR group would consist of warm-up and cool-down exercises and aerobic exercises. Patients performed 5 minutes of warm-up exercises, then 2 aerobic activities including treadmill and lower limb ergometry exercises, each lasting 20 minutes. A 15-minute rest period was given between exercises. After aerobic exercises, a 5-minute cool-down period was followed by 15 minutes of relaxation exercise conducted before participants completed their session. The PR group was instructed to perform 1 hour of daily unsupervised home exercises consisting of a 5-minute warm-up, 5 minutes of Thera-Band exercises, 30 minutes of aerobic exercises, 5 minutes of cool-down, and 15 minutes of relaxation exercises for 5 to 7 days a week. Thera-Band exercises, which utilised a rubber-based resistance band known to optimise muscle strengthening, were also taught as home exercises for both groups. Both groups were instructed to document home exercises in their compliance diary.

Outcomes

- Hong Kong Chinese version of the SGRQ, unit
- Pulmonary function: spirometry (FEV₁, L; FVC, L; % pred FEV₁, %)
- 6MWD, m
- Self-rated dyspnoea scale (modified Borg Scale (0 to 10)), unit
- SaO₂, %
- COPD self-efficacy scale (COPD-CSES), unit
- Self-efficacy for managing shortness of breath (SEMSOB), unit
- Compliance rate, %
- Attendance rate, %

Time points measured

- Outcome measures were collected at baseline (T1) and at 2 months (T2) and 6 months (T3) post intervention

Notes

Funding source

- Health Services Research Fund

Risk of bias

Bias

Authors' judgement

Support for judgement

Random sequence generation (selection bias)

Low risk

Random number sequences

Ng 2014 (Continued)

Allocation concealment (selection bias)	Low risk	The same research assistant would conceal the allocation sequence using sequentially numbered envelopes. Each participant would receive 1 envelope that would be opened for allocation to assigned grouping by a different research assistant upon recruitment
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	High risk	To minimise researcher bias, research assistants for data collection were blinded to the study; however, quality of life was assessed by participants, who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	High risk	Intention-to-treat approach was used for data analysis. For participants lost to follow-up, the last known data were carried forward to replace missing values; however, attrition rate was 28%
Selective reporting (reporting bias)	Low risk	No difference between results of registered study (NCT01259245) and outcomes reported in the manuscript
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Niu 2014

Methods	Design <ul style="list-style-type: none"> Single-blind randomised controlled trial Participants were assigned randomly to 2 groups: the control group and the tai chi group, in a 1:1 allocation ratio
Participants	Setting <ul style="list-style-type: none"> Patients with COPD were recruited from January 2011 to June 2011, from outpatient clinics of the Department of Respiratory Medicine, Xiangya Hospital, Central South University, China Participants <ul style="list-style-type: none"> A total of 40 patients with clinical diagnosis of COPD were randomly assigned to groups: tai chi group (n = 20) and control group (n = 20) Average age of all participants was 60 years 91% were male Inclusion criteria <ul style="list-style-type: none"> Clinical diagnosis of moderate to severe COPD FEV₁ < 65% of predicted, and ratio of FEV₁ to forced vital capacity < 0.70 45 years of age or older Exclusion criteria <ul style="list-style-type: none"> COPD exacerbation that required systemic steroids, antibiotics, a visit to the ER, or hospitalisation during the month before the programme Any planned major pulmonary intervention (e.g. lung volume reduction surgery) in the coming 6 months of the programme Severe peripheral vascular disease and claudication or other physical condition that would preclude a 6MWT

Niu 2014 (Continued)

- Severe cognitive dysfunction (Mini Mental State Examination score ≤ 24)

Interventions	<p>AMBMT</p> <p>Participants in the tai chi group underwent 4 sessions of a supervised tai chi programme and 3 sessions of a home-based tai chi programme per week, 1 session per day. The entire programme lasted 6 months. Each session consisted of a 10-minute pre-exercise warm-up, followed by 30 minutes of tai chi and 10 minutes of post-exercise relaxation. The intensity was then adjusted for each patient with COPD according to her/his toleration of the programme. Participants in the tai chi group were trained by a physiotherapist who was an accredited tai chi trainer with extensive experience in chronic lung disease therapy. A tai chi training booklet and DVD developed by an accredited trainer were provided to each participant in the tai chi group for use in home sessions. A workout diary was supplied to all participants to record their practice time for each home session and was routinely checked. Programme adherence for both supervised and at-home sessions was calculated separately as an average percentage of sessions completed.</p> <p>PR</p> <p>Participants were instructed to walk for 30 minutes daily and were subjected to routine medical care for 6 months after baseline measurement. Routine medical care included, in addition to daily walking, tiotropium 10 mg inhalation and lip breathing for 10 to 15 minutes.</p>
Outcomes	<ul style="list-style-type: none"> • Lung function (FEV₁, L; FEV₁ % of pred, %) • Exercise tolerance (6MWD, m) <p>Time points measured</p> <ul style="list-style-type: none"> • Outcome measures were collected at baseline and at 6 months post intervention
Notes	<p>Funding source</p> <ul style="list-style-type: none"> • Self-funded study with no external support

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	A computer-generated randomisation algorithm was adopted to generate treatment assignments
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcomes were assessed by researchers who were unaware of the study design
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Attrition rate of 2%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Papp 2017

Methods	<p>Design</p> <ul style="list-style-type: none"> The aim of this RCT was to evaluate the effects and feasibility of hatha yoga (HY) vs a conventional training programme (CTP) on functional capacity, lung function, and quality of life in patients with obstructive pulmonary disease
Participants	<p>Setting</p> <ul style="list-style-type: none"> The study was performed at the Karolinska University Hospital, Stockholm, Sweden, among outpatients <p>Participants</p> <ul style="list-style-type: none"> Forty patients (24 women, median age 64, age range 40 to 84 years) were randomised to HY or CTP. Out of 36 participants who completed the programme, 25 were given a diagnosis of asthma and 11 COPD (GOLD stages 1 to 3). Of 11 patients with a diagnosis of COPD, 8 were randomised to the HY group and 3 to the CTP group <p>Inclusion criteria</p> <ul style="list-style-type: none"> Age 35 to 85 years with diagnosis of COPD (mild to severe obstruction) Diagnosis of asthma with FEV₁ % predicted between or equal to 30% and 90% <p>Exclusion criteria</p> <ul style="list-style-type: none"> Severe neurological, orthopaedic, or rheumatologic injury or disease Inability to walk less than 200 metres Decreased mobility and chronic disease that can affect performance Surgery within 6 months Severe mental disease diagnosis Heart infarction within the last 12 months Change in medications during the last 6 weeks before the programme
Interventions	<p>AMBMT</p> <p>Yoga exercises were based on hatha yoga. Two sessions a week, with sessions extending over 60 to 70 minutes, for 12 weeks, with a total of 24 sessions. Started on chair or meditation chair, in a quiet room without music. Props included yogic blocks and blankets. Exempting questions for the teacher, no talking was permitted during the yoga class. Most participants were novice to yoga. Asanas (eyes open): important instruction throughout class to rest when needed by switching into child pose (balasana), or alternatively to lean forward on the chair with legs apart, and to work at the participant's own capacity. General postural instructions and centreing were given at the beginning of classes. General breathing instructions: extended exhalations, all breathing through nostrils (if possible). Complete deep yogic breathing using the diaphragm extensively during all asanas. Uddiyana bandha (pulling stomach in using pelvic floor muscles first, and then the navel, with light pull in towards the spine during all exhalations) was introduced after approx. 6 weeks. Used complete yogic breathing - 3 levels on inhalation and 3 levels on exhalation. Instructions were given to move hands along with the breathing movement, with inhalation starting at the lower abdominal navel area, then at the upper waist/middle chest and at the upper chest below the clavicles. Exhalation starting at upper chest, then at the middle chest, and finally ending as lower abdominal movement. Vinyasa with back bending tadasana on inhalation and deep utkatasana on exhalation, instruction without arms and then with arms extended above the head, alternatively keeping the hands resting on the shoulders. Utkatasana progressed by sitting all the way down to the chair, and later by squatting all the way down to the floor while letting the heels come up. Ardha Chandrasana (standing side stretch, 1 arm up with the other arm down, the other arm supported on the thigh). Dynamic, then progressed to static holding (approx. 30 seconds on each side) alternatively while sitting on chair if breathing restriction occurred. Trikonasana with chair, foot on floor under chair's seat, and hand on chair's seat or on the back-rest of the chair. Rotation of head during the final pose. Small sun salutation, dog down and dog up (adho mukha svanasana, urdhva mukha svanasana)</p>

Papp 2017 (Continued)

dynamic poses with breathing, 4 to 5 times with hands on the seat of the chair. Dog pose with the wall (hands on the wall at shoulder height) was also suggested if no weight on the upper body was possible (approx. 2 minutes). Parsvakonasana with chair with foot under chair's seat and hand on the seat (after 4 to 5 weeks) with emphasis on turning the chest and head. Bharadvajasana, using both sitting and standing variations, with both legs folded to the left and twisted right first. Standing variation (utthita marichyasana), with right side to the wall with right leg up on a chair and with hands used to the wall and twisted to the right (alternative given with block under heel of standing foot), then changing sides. Tiger breathing flow, cat (marjaryasana) and cow, on all fours using extended exhalations. Strong abdominal draw-in while exhaling. Variation used by some; sitting vertically on a chair using simple back flexion and extension (no weight on arms).

Another variation in cat pose consisted of flexion of the wrists on the floor (palms down, thumbs facing out, and palms up, thumbs facing towards each other). Sphinx pose (salamba bhujangasana), walked on underarms to the right, and then to the left. Bhujangasana, resting on abdomen, then arms wide with fingertips facing outwards extending up on inhalation. Setu bhandasana (bridge pose) with 1 leg up, progressed to feet on a chair to achieve inversion. Hip resting on the block with both legs up (viparita dandasana variation), then lowered 1 leg at a time to the floor (stretching hip flexors), then in setu bandha with block. Universal pose: supine twist to the right first with strong abdominal activity and straight spine. Rotation of head opposite the legs to improve neck mobility. Fish pose (matsyasana) supported back bent with yoga block (wood) on thoracic spine behind the heart, to increase mobility in the chest (chest opener), with the option of using a rolled mat or blanket under the chest. Alternative was given with weights on elbows, and alternatively baddha konasana. Yogic breathing exercises (pranayama), sitting on a chair or meditation chair, straight spine, chin slightly lowered (eyes closed, approx. 30 minutes). Asthma mudra was used during some exercises. Metronome was used during the last 5 to 6 weeks to get the timing and awareness of breathing during breathing exercises. Kapalabhati (breath of fire), starting with 10 times worked up to 30 times. Hands on lower abdominals to increase awareness of the abdominals drawing in during exhalation. Slowly first, then trying to speed up the pace. At the end of courses, this involved 20 x 4. Focused on exhalation, with no attention to inhalation, 2 to 3 minutes. Bhastrika, hands on lower abdomen, 20 times. Alternated nostril breathing (nadi shodhana), using nashiki mudra, started exhalation through left nostril, inhaled left, exhaled right, inhaled right, exhaled left. First equal inhaled and exhaled (5 seconds in and 5 seconds out suggested), then tried varied lengths of breathing ratios; 2-0-4-0, 6-0-12-0 with no pauses, with important prolonged exhalation. No pauses after inhalation. Focus on extended exhalations and, if possible, on short pausing after each exhalation, 5 to 10 minutes. Sitkari (inhaled through teeth, exhaled through nose and closed mouth) to be used only during the first 4 to 5 weeks. Bharmari (mmmmm sound on exhalation), humming bee, extended outbreaths - 10 minutes, powerful outbreaths with sound (sometimes with sanmukhi mudra), moved sound to upper back palate and towards third eye. Viloma (Dirghal part breath). Divided inhalations and exhalations into 3 parts, inhalation started at abdomen, same inhalation at middle ribs and last, then at collarbones. Exhalation started at collarbones, middle ribs, abdomen for 2 to 3 minutes (sometimes with prana mudra). Hands moving to the active region of the chest. Sitting at beginning of courses while supined on back at the end. Sukhasana with forward bend, hands on block or chair. Shavasana (body scanning, focus on synchronisation of equal relaxation between left and right sides of the body and letting the weight drop to the floor), sometimes elevated legs with feet or calves on the meditation chair, once during the intervention with weights on thighs. Feet closer than arms, keeping back of shoulders on the floor. Approx. 5 to 8 minutes of home training with this programme was provided on a DVD (in Swedish). The time in each yoga pose was gradually increased, and each pose was held from 5 to 40 seconds; each breathing exercise was performed for a longer duration with fewer pauses towards the end of the intervention. Different variations of poses were gradually introduced (using walls, chairs, and floor). Synchronisation of breathing during exercises was emphasised. Strength was not measured in the HY group.

PR

Two sessions per week, with sessions extending over 60 to 70 minutes for 12 weeks, including a total of 24 sessions. Working with strength and conditioning equipment (each 2 to 4 sets with 10 to 20 repetitions) and cycling 10 to 15 minutes (intensity ratings of 12 to 14 on Borg 20 Scale, 50 to 60 rpm per minute approx.). Conventional training was performed at a gym (with gym equipment and stationary exercise bikes, adjacent to the yoga room) with background radio/music while 2 physiotherapists coached participants. Participants were allowed to talk to each other and to the physiotherapists, and sometimes to the other participants in the room. Exercises included leg extensions (sitting position), standing arm pull-backs with thera-band, sitting leg press, shoulder press, squats to chair with crossed

Papp 2017 (Continued)

arms in front of chest, seated rowing arm pull-backs in machine, heel lifts holding back of chair, triiceps press in machine, torso rotation in machine, standing biceps curls with free weights, wide sitting on chair and torso twists with stick behind chest, hands resting shoulder height on stick, seated side stretches with extended arm (lower arm resting on hip), shoulder shrugs, seated big upward swimming arm movements with arms above the head. Home programme for pulmonary rehabilitation on a DVD was distributed with the programme on paper. Thera-bands were supplied for home training. Strength increased during the 12-week period in the conventional training programme: leg extension by 49%, straight arm pull-backs by 44.6%, and during leg press by 29.4%, with starting kg/kg increased during the intervention.

Outcomes	***Mixed populations; only data from participants with COPD were used and were obtained by contacting study authors.*** <ul style="list-style-type: none">Pulmonary function: spirometry (FEV₁, L; FVC, L; FEV₁/FVC,%)6MWD, mCRQ, unitEQ-5D, unit Time points measured <ul style="list-style-type: none">Outcome measures were collected at baseline and at 12 weeks post intervention	
Notes	Funding source <ul style="list-style-type: none">None mentioned	
Risk of bias		
Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation was performed by an external person. Blank papers were scattered on a table, with each participant's identification code facing down. Then 1 paper was randomly categorised into the HY group, while the next was categorised into the CTP group, and so on
Allocation concealment (selection bias)	Low risk	Randomisation was performed by an external person. Blank papers were scattered on a table, with each participant's identification code facing down. Then 1 paper was randomly categorised into the HY group, while the next was categorised into the CTP group, and so on
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quality of life was assessed by participants who were not blinded to the interventions
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat approach was used for data analysis. For participants lost to follow-up, the last known data were carried forward to replace missing values; attrition rate was 10%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Yang 2009

Methods	<p>Design</p> <ul style="list-style-type: none"> The aim of this study was to determine the effects of TCM on patients with COPD by randomly dividing patients into 3 groups: TCM group, Western group, and control group
Participants	<p>Setting</p> <ul style="list-style-type: none"> From April 2008 to March 2009, participants were recruited from Guangzhou's Chinese Medicine Hospital Respiratory Clinic <p>Participants</p> <ul style="list-style-type: none"> A total of 57 participants were randomly divided into 3 groups: TCM group (n = 19), Western group (n = 19), and control group (n = 19) Average age of all participants was 67 years 76% were male No significant differences between the 3 groups at baseline <p>Inclusion criteria</p> <ul style="list-style-type: none"> Meeting Western criteria Age 40 or older Stable COPD for 4 or more weeks Meeting Chinese medicine criteria of deficiency of vital energy and phlegm stasis Constitution fitting deficiency of vital energy type, damp (phlegmy) type, or blood stasis type <p>Exclusion criteria</p> <ul style="list-style-type: none"> History of bronchitis Inability to take part in leg exercises Serious cardiovascular disease: unstable angina pectoris, heart condition not controlled by medication, recent infarction, frequent heart extrasystole Severe high blood pressure History of fainting after exercise Serious liver or kidney function problems Inability to co-operate because of cognitive or other mental issues
Interventions	<p>AMBM</p> <ul style="list-style-type: none"> Baduanjin (8 brocades) light exercises to warm up, mid-level abdominal breathing and pursed-lip breathing, then heavier exercise to increase heart rate. Specifically within the 8 brocades: push up to support the sky, left and right to pull the bow, turn the waist to push back, left and right swinging, press the knees, and solidify the waist, horse stance with fists. These exercises used large movements and relatively increased strength, such as push up the sky, which required that the heels leave the ground, with the waist turning to push back, required a full turn of the torso; pull the bow, swinging, solidify the waist and fists all used the horse stance. Speed was adjusted appropriately with the degree of movement and height of the horse stance to achieve a heart rate of 60% to 80% of max. The group first underwent a detailed teaching session and received corrections to their movements, along with instructions on how to regulate their heart rate. They were then given a recorded 8-brocade video to take home, to help them with their performance. They practised at home 4 times a week for 30 minutes per time According to the constitutional type of the patient and basic diet therapy methods, a diet therapy plan for each patient was determined for (1) deficiency of vital energy type: ginseng black chicken soup, yam mutton porridge, hetao milk drink; (2) Damp (phlegmy) type: lotus seed duck soup, white fulling fungus porridge, yam winter melon drink; and (3) blood stasis type: pseudo-ginseng stewed chicken soup, peach kernel non-glutinous rice porridge, lingzhi fungus pseudo-ginseng hawthorn drink. Note: participants took the 3 potions according to their symptoms, picking as they wished, at least 3 times a week

Yang 2009 (Continued)

- A packet of Chinese medicine (secret recipe) from Peili Pharmaceutical Company, Nanning, was added to 300 mL boiled water, and was drunk when it was fully dissolved, once per day after breakfast

PR (Western group)

- Education on rehabilitation: smoking cessation, respiratory system (anatomy and physiology), symptoms of COPD, breathing training, education in nutrition, standard physiotherapy methods (use of medicine, side effects, oxygen treatment, inhalation treatment, self-care), how to recognise and take care of exacerbations, how to reduce breathing difficulties, the meaning of pulmonary rehabilitation treatments
- Home training: stair climbing or walking outside as training, 4 times per week for 30 minutes per time (with 5 minutes warm-up and cool-down), to reach the desired heart rate of 60% to 80% of max. Participants were taught how to take their heart rate. They received a phone call once a week to check up

Outcomes

- Pulmonary function: spirometry (FEV₁, L; FEV₁/FVC, %; percentage of predicted FEV₁, %)

Time points measured

- Outcome measures were collected at baseline and at 3 months

Notes

Funding source

- None mentioned

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation via software PEMS 3.1
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Attrition rate of 5%
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Zhu 2010

Methods

Design

- Aim was to observe the efficacy of Health Qigong of Wuqinxi in early intervention for patients with stable COPD

Zhu 2010 (Continued)

- 78 cases were randomly divided into Wuqinxi group, walking group, and control group

Participants	<p>Setting</p> <ul style="list-style-type: none"> • From July 2004 to April 2008, patients were recruited from the Chinese Medicine Hospital Respiratory Department, Jiangsu, China <p>Participants</p> <ul style="list-style-type: none"> • A total of 78 patients with stable COPD were randomly divided into groups: Wuqinxi group (n = 26), walking group (n = 27), and control group (n = 21) • Average age of all participants was 55 years • 49% were male • No significant differences between the 3 groups at baseline <p>Inclusion criteria</p> <ul style="list-style-type: none"> • Meeting diagnostic criteria for Chinese and Western medicine for COPD • Grade I to II in stable period • Age 45 to 75 • Consent to take part in the experiment <p>Exclusion criteria</p> <ul style="list-style-type: none"> • Confirmed tuberculosis, fungi, cancer, silicosis, irritating gas, allergies, chronic cough, wheezing, and diagnosis of bronchial asthma, asthma, bronchiectasis, congestive heart failure, occlusive bronchioles, bronchitis, diffuse pan-bronchiolitis • Serious concurrent cardiopulmonary dysfunction • These conditions combined with cardiovascular, urinary, digestive, hematopoietic, endocrine system, and other serious primary disease and mental illness • Pregnancy or lactation
Interventions	<p>AMBM</p> <p>Patients underwent daily early morning collective practice, led by an instructor of the 2003 State Sports General Administration of China, New Health Qigong Wu Qinxu (5 animal frolics). From the starting position to regulate breathing, they went through tiger play, deer play, bear play, ape play, and bird play, and then repeated bird play, and finally returned to original qi position. They repeated this sequence 2 to 3 times. Exercise time and intensity: First week of basic training consisted of learning movements and breathing essentials to master techniques. Practised once every day, each time for 45 minutes, so that the practitioner's heart rate reached the target heart rate, which was maintained for longer than 10 minutes. Practice was adjusted in accordance with the different problems of patients; appropriate adjustment of activity levels involved adjusting the height and strenuousness of movements. Continuous practice for 3 months. Target heart rate: 60 years old and above, heart rate = 170 minus age; younger than 60 years old, heart rate = 180 minus age (exercise intensity was based on the Jungmann formula).</p> <p>PR</p> <p>The walking group was treated with the same conventional therapy with the addition of walking exercises. Every morning, walking was done on a flat surface, speed was maintained at 80 to ~ 120 steps per minute, with duration of at least 45 minutes, so that the practitioner's heart rate reached the target heart rate, which was maintained for longer than 10 minutes. A small number of patients, in the initial phase, rested a number of times, with gradual extension of each session duration, shortening the time and number of rest periods.</p>
Outcomes	<ul style="list-style-type: none"> • Pulmonary function: spirometry (FVC, FEV₁, L; FEV₁/FVC, %; percentage of predicted FEV₁, %) • BMI • Dyspnoea scale (mMRC) • Exercise tolerance (6MWD) • Number of hospitalisations due to acute exacerbations

Zhu 2010 (Continued)

Time points measured

- Outcome measures were collected at baseline and at 3 months

Notes

Funding source

- None mentioned

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number digital table
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Zhu 2011

Methods

Design

- The aim of this study was to observe health Qigong's effect on patients with COPD by randomly dividing patients into 3 groups: health Qigong group, walking group, and control group

Participants

Setting

- Participants were recruited from the community of Nanjing, Jiangsu, China

Participants

- A total of 61 patients with confirmed diagnosis of COPD were randomly divided into groups: HQG group (n = 20), PR group (n = 19), and control group (n = 22)
- Average age of all participants was 61 years
- 59% were male
- No significant differences between the 3 groups at baseline

Inclusion criteria

- Diagnosis of COPD in line with Western diagnostic criteria for chronic obstructive pulmonary disease

Zhu 2011 (Continued)

- Stable COPD
- Age between 45 and 75 years

Exclusion criteria

- Not meeting Western diagnostic criteria
- Heart failure class 4 and respiratory failure type 3
- Mental disorder
- Severe comorbidities (cardiovascular, urinary, digestive, hematopoietic, endocrine system, and other diseases)
- Pregnancy or breast-feeding

Interventions	<p>AMBM</p> <p>The HQG group received daily morning training on “The Art of Expiration in Producing Six Different Sounds”, or Liuzijue (六字訣). A set was repeated 2 to 3 times per day for 3 months.</p> <p>PR</p> <p>Morning walk sessions on a flat uniform surface. Walking speed was maintained at 80 to 120 steps/min, for a cumulative walking duration of at least 45 minutes. Patients were allowed to take resting periods that would be progressively reduced in duration during the programme.</p>
Outcomes	<ul style="list-style-type: none"> • Pulmonary function: spirometry (FEV₁, L; FEV₁/FVC, %; percentage of predicted FEV₁, %) <p>Time points measured</p> <ul style="list-style-type: none"> • Outcome measures were collected at baseline and at 3 months
Notes	<p>Funding source</p> <ul style="list-style-type: none"> • None mentioned

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Information about the sequence generation process insufficient to permit judgement of 'low risk' or 'high risk'
Allocation concealment (selection bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were not blinded to the interventions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
Selective reporting (reporting bias)	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'

Zhu 2011 (Continued)

Other bias	Unclear risk	Information insufficient to permit judgement of 'low risk' or 'high risk'
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6MWD: six-minute walk distance; 6MWT: six-minute walk test; AECOPD: acute exacerbation of COPD; AMBMT: active mind-body movement therapy; ATS: American Thoracic Society; BMI: body mass index; BODE: body-mass index, airflow obstruction, dyspnoea, and exercise multi-dimensional scoring system; BRTCQ: breathing regulating tai chi qigong; CAT: COPD Assessment Test; CCRQ: Chinese Chronic Respiratory Questionnaire; COPD: chronic obstructive pulmonary disease; COPD-CSES: COPD Self-efficacy Scale; CRQ: Chronic Respiratory Questionnaire; CTP: conventional training programme; DVD: digital optical disk; EQ-5D: EuroQol group measure of health-related quality of life; FEV₁: forced expiratory volume in one second; FVC: forced vital capacity; GOLD: Global Initiative for Chronic Obstructive Lung Disease; HQG: health qigong; HY: hatha yoga; IL: interleukin; ITT: intention-to-treat; MFTE: monitored functional task evaluation; mMRC: modified Medical Research Council Dyspnoea Scale; MRC: Medical Research Council; MSPSS-C: Multi-dimensional Scale of Perceived Social Support - Chinese version; MVV: maximal voluntary ventilation; PaCO₂: partial pressure of carbon dioxide; PaO₂: partial pressure of oxygen; PR: pulmonary rehabilitation; QG: qigong; QoL: quality of life; QMVC: quadriceps maximum voluntary contraction; RCT: randomised controlled trial; SaO₂: oxygen saturation; SEMSOB: Stanford Self-efficacy for Managing Shortness of Breath; SF-36: Short Form Health Survey; SGRQ: St. George's Respiratory Questionnaire; TC: tai chi; TCM: Traditional Chinese Medicine; TCQ: tai chi qigong; TJQ: Taijiquan; TNF: tumour necrosis factor; TQG: tai chi with qigong.

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Chen 2015	No PR comparator
Cheng 2000	Not an RCT
Cheng 2015	No PR comparator
Deng 2016	No PR comparator
Donesky-Cuenco 2009	No PR comparator
Dongxing 2011	No PR comparator
Fukuoka 2016	No proper AMBMT
Gao 2016	No PR comparator
Guo 2013	No PR comparator
Li 2012	No PR comparator
Li 2015	No PR comparator
Li 2016	No PR comparator
Liang 2016	No PR comparator
Liu 2013	No PR comparator
Ma 2000	No PR comparator
Ma 2009	No PR comparator
Ni 2017	No PR comparator
Shi 2011	No PR comparator

Study	Reason for exclusion
Tan 2016	No PR comparator
Tsang 2003	Not COPD
Wang 2015	No PR comparator
Wei 2015	No PR comparator
Xu 2010	No PR comparator
Xue 2015	No PR comparator
Yao 2004	No PR comparator
Yuan 2012	No PR comparator
Zhang 2006	No PR comparator
Zhang 2012	No PR comparator
Zhang 2014	No PR comparator
Zhang 2016c	No PR comparator
Zhang 2016d	Not an RCT (Review)
Zhou 2009	No PR comparator
Zhu 2012	No PR comparator
Zhu 2016	No PR comparator

AMBMT: active mind-body movement therapy; COPD: chronic obstructive pulmonary disease; PR: pulmonary rehabilitation; RCT: randomised controlled trial.

Characteristics of studies awaiting assessment *[ordered by study ID]*

[Cao 2016](#)

Methods	Not yet assessed
Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

[Gao 2017](#)

Methods	Not yet assessed
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Gao 2017 *(Continued)*

Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Kaminsky 2011

Methods	
Participants	
Interventions	
Outcomes	No outcome data published; contacted study author; no data will be published in the future
Notes	

Polkey 2018

Methods	Not yet assessed
Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Price 2006

Methods	
Participants	
Interventions	
Outcomes	No outcome data published; contacted study author and received no response
Notes	

Ren 2017

Methods	Not yet assessed
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Ren 2017 (Continued)

Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Singh 2016

Methods	Not yet assessed
Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Xiao 2015

Methods	Not yet assessed
Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Zhang 2016a

Methods	Not yet assessed
Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Zhang 2016b

Methods	Not yet assessed
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Zhang 2016b (Continued)

Participants	Not yet assessed
Interventions	Not yet assessed
Outcomes	Not yet assessed
Notes	Not yet assessed

Characteristics of ongoing studies [ordered by study ID]

ChiCTR-IOR-17012437

Trial name or title	Effects of Shaolin-Exercise on Pulmonary Rehabilitation for Elderly Patients With Stable COPD
Methods	Randomised parallel controlled trial
Participants	<p>Countries of recruitment and research settings</p> <p>Beijing Hospital of Traditional Chinese Medicine Affiliated to Capital Medical University</p> <p>Inclusion criteria</p> <ul style="list-style-type: none"> • Male or female aged 60 to 75 years old • Stable stage of chronic obstructive pulmonary disease under regular treatment with some symptoms • Obstructive ventilation dysfunction of any severity • Willingness to participate in the programme actively <p>Exclusion criteria</p> <ul style="list-style-type: none"> • Refusal to sign the informed consent form • Communication barriers • Other pulmonary diseases, such as pneumonia, and AECOPD ruled out • Determination by a doctor that individual cannot complete the programme or 6MWT safely • Unstable factors that impeded implementation of rehabilitation, like instability of complications, serious life-threatening primary disease and mental disease • Already doing pulmonary rehabilitation exercise
Interventions	<p>AMBMT</p> <p>Shaolin exercise (SE)</p> <p>PR</p> <p>Western exercise</p>
Outcomes	<ul style="list-style-type: none"> • SGRQ • 6MWT • CRQ • Lung function • TCM symptom score scale

ChiCTR-IOR-17012437 (Continued)

- CAT

Starting date	2017-08-21 to 2019-12-31
Contact information	Jinxu Lin; mayjinxu@outlook.com
Notes	

ChiCTR-TRC-14004404

Trial name or title	A Randomized Controlled Trial of Health Qigong for Chronic Obstructive Pulmonary Disease Rehabilitation
Methods	Random parallel controlled trial
Participants	<p>Inclusion criteria</p> <ul style="list-style-type: none"> • Stable chronic obstructive pulmonary disease • GOLD stage 1 to 4 <p>Exclusion criteria</p> <ul style="list-style-type: none"> • Acute myocardial ischaemia • Unstable angina • Severe stenosis or regurgitation • Congenital heart disease • Decompensated heart failure • Uncontrollable arrhythmia • Unstable hypertension or systolic blood pressure ≥ 180 mmHg • Diabetes with serious complications • Post stroke • Rheumatoid or rheumatoid arthritis or musculoskeletal disease or physical disability that seriously affects normal physical activity
Interventions	<p>AMBM</p> <p>Health qigong group</p> <p>PR</p> <p>Routine exercise rehabilitation</p>
Outcomes	<ul style="list-style-type: none"> • 6MWT • mMRC • CAT • SGRQ • SF-36 • Lung function

ChiCTR-TRC-14004404 (Continued)

Starting date	2014
Contact information	Chen Xianhai; Chenxianhai18@163.com
Notes	

NCT01998724

Trial name or title	Tai Chi After Pulmonary Rehabilitation in Patients With COPD: A Randomized Trial (LEAP)
Methods	The main purpose of this study is to determine the feasibility and effects of a 6-month tai chi exercise programme as compared to a 6-month group walking programme and standard care for patients with COPD who have recently completed a pulmonary rehabilitation programme
Participants	<p>Inclusion criteria</p> <ul style="list-style-type: none"> • COPD defined as FEV₁ (forced expiratory volume in 1 second)/FVC (forced vital capacity) < 0.70 • Chest CT evidence of emphysema • Age > 40 years • COPD of any severity as defined by GOLD (Global Obstructive Lung Disease) stage 1, 2, 3, or 4 • Completion of standard pulmonary rehabilitation of at least 8 weeks' duration within 24 weeks before study entry* <p>*Defined as attending 65% of programme sessions with a minimum of 10 sessions</p> <p>Exclusion criteria</p> <ul style="list-style-type: none"> • COPD exacerbation requiring steroids, antibiotics, ED visit, or hospitalisation within the past 2 weeks unless physician deems patient at baseline • Hypoxaemia on walk test (O₂ sat < 85% on oxygen) • Inability to ambulate due to vascular or other neuromuscular conditions that would preclude a walk test • Clinical signs of unstable cardiovascular disease (i.e. chest pain on walk test) • Severe cognitive dysfunction (documented Mini Mental Status Exam ≤ 24) • Non-English-speaking • Current regular practice of tai chi • Current diagnosis of lung cancer or treatment for lung cancer within the past 5 years • Unstable/untreated mental health issue that precludes informed consent or otherwise affects ability to participate in the intervention
Interventions	<p>AMBMT</p> <p>Tai chi</p> <p>24-Week tai chi intervention designed for individuals with COPD</p> <p>PR</p> <p>Group walking exercise</p>

NCT01998724 (Continued)

24-Week group walking intervention

Outcomes	<ul style="list-style-type: none"> • Feasibility of tai chi intervention (time frame: 24 weeks) • Willingness to participate, adherence, and safety • CRQ • 6MWT • University of California, San Diego, Shortness of Breath Questionnaire • Center for Epidemiologic Studies Depression Scale • Perceived Stress Scale • COPD Self-Efficacy Scale • Multi-dimensional Scale of Perceived Social Support • Pulmonary function • Daily exercise activities, step counts
Starting date	August 2012 to June 2018
Contact information	Gloria Y. Yeh; gloria_yeh@hms.harvard.edu
Notes	

NCT02370654

Trial name or title	Chen-style Tai Chi in Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease
Methods	This study will evaluate the effects of Chen-style tai chi compared to conventional exercise in pulmonary rehabilitation for patients with COPD. Half of participants will receive the Chen-style tai chi intervention, and the other half will receive the conventional exercise intervention. Both groups will receive the same education and support during pulmonary rehabilitation
Participants	<p>Inclusion criteria</p> <ul style="list-style-type: none"> • FEV₁ between 30% and 80% of predicted normal values • FEV₁/FVC ratio < 70% <p>Exclusion criteria</p> <ul style="list-style-type: none"> • Very severe COPD (GOLD stage 4) • COPD exacerbation within 2 weeks before baseline assessment • Significant hypoxaemia at rest or during exercise (SpO₂ < 85%) • Already following a rehabilitation programme • Physical limitations that compromise participation in a tai chi or conventional exercise programme
Interventions	<p>AMBM</p> <p>Tai chi</p> <p>12-Week tai chi intervention, 3 sessions per week, 90 minutes per session</p> <p>PR</p> <p>12-Week conventional exercise intervention, 3 sessions per week, 90 minutes per session</p>
Outcomes	<ul style="list-style-type: none"> • Lung function • CRQ

NCT02370654 (Continued)

- 6MWT
- Endurance cycle test
- Berg's Balance Test
- CAT
- Quads isometric force
- Quads isokinetic function

Starting date	March 2014
Contact information	Louis Gendron; louis.gendron@criucpq.ulaval.ca
Notes	

6MWT: 6-minute walk time; AECOPD: acute exacerbation of COPD; CAT: COPD Assessment Test; COPD: chronic obstructive pulmonary disease; CRQ: Chronic Respiratory Questionnaire; CT: computed tomography; ED: emergency department; FEV₁: forced expiratory volume in one second; FVC: forced vital capacity; GOLD: Global Initiative on Obstructive Lung Disease; mMRC: modified Medical Research Council Questionnaire; SE: Shaolin exercise; SF-36: Short Form-36 Questionnaire; SGRQ: St. George's Respiratory Questionnaire; SpO₂: peripheral capillary oxygen saturation; TCM: Traditional Chinese Medicine.

DATA AND ANALYSES

Comparison 1. AMBMT vs PR

Outcome or sub-group title	No. of studies	No. of participants	Statistical method	Effect size
1 SGRQ	3		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 Total	3	249	Mean Difference (IV, Random, 95% CI)	-5.83 [-8.75, -2.92]
1.2 Activity	2	213	Mean Difference (IV, Random, 95% CI)	-8.96 [-13.04, -4.89]
1.3 Impact	2	213	Mean Difference (IV, Random, 95% CI)	-3.75 [-6.78, -0.73]
1.4 Symptoms	2	213	Mean Difference (IV, Random, 95% CI)	-2.22 [-5.66, 1.23]
2 CAT	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
3 CRQ	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Dyspnoea	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.2 Fatigue	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.3 Mastery	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.4 Emotion	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Zhongshan COPD Questionnaire	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 ADL	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Outcome or sub-group title	No. of studies	No. of participants	Statistical method	Effect size
4.2 Social participation	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4.3 Depression	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4.4 Anxiety	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Borg CR10 - Dyspnoea	1		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
6 mMRC	2	127	Mean Difference (IV, Random, 95% CI)	0.00 [-0.37, 0.37]
7 6MWD	7	436	Mean Difference (IV, Random, 95% CI)	3.05 [-9.97, 16.07]
7.1 Tai chi	3	253	Mean Difference (IV, Random, 95% CI)	19.22 [-1.86, 40.30]
7.2 Qigong	3	172	Mean Difference (IV, Random, 95% CI)	-0.16 [-10.11, 9.80]
7.3 Yoga	1	11	Mean Difference (IV, Random, 95% CI)	-69.3 [-117.73, -20.87]
8 ICE	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
9 CWR	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
10 FEV ₁	6	318	Mean Difference (IV, Random, 95% CI)	0.07 [-0.01, 0.15]
10.1 Tai chi	2	179	Mean Difference (IV, Random, 95% CI)	0.10 [-0.04, 0.24]
10.2 Qigong	3	128	Mean Difference (IV, Random, 95% CI)	0.07 [-0.08, 0.23]
10.3 Yoga	1	11	Mean Difference (IV, Random, 95% CI)	-0.01 [-0.22, 0.19]
11 FVC	2	150	Mean Difference (IV, Random, 95% CI)	-0.02 [-0.21, 0.17]
12 FEV ₁ /FVC	5	260	Mean Difference (IV, Random, 95% CI)	3.84 [0.68, 7.01]
12.1 Tai chi	1	74	Mean Difference (IV, Random, 95% CI)	6.02 [3.72, 8.32]
12.2 Qigong	3	175	Mean Difference (IV, Random, 95% CI)	3.51 [-1.24, 8.26]
12.3 Yoga	1	11	Mean Difference (IV, Random, 95% CI)	1.90 [-3.41, 7.21]
13 FEV ₁ predicted	6	325	Mean Difference (IV, Random, 95% CI)	3.95 [1.77, 6.13]
13.1 Tai chi	2	114	Mean Difference (IV, Random, 95% CI)	4.97 [2.16, 7.79]
13.2 Qigong	4	211	Mean Difference (IV, Random, 95% CI)	2.42 [-1.07, 5.91]
14 AECOPD	1		Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 1.1. Comparison 1 AMBMT vs PR, Outcome 1 SGRQ.

Analysis 1.2. Comparison 1 AMBMT vs PR, Outcome 2 CAT.

Analysis 1.3. Comparison 1 AMBMT vs PR, Outcome 3 CRQ.

Analysis 1.4. Comparison 1 AMBMT vs PR, Outcome 4 Zhongshan COPD Questionnaire.

Analysis 1.5. Comparison 1 AMBMT vs PR, Outcome 5 Borg CR10 - Dyspnoea.

Analysis 1.6. Comparison 1 AMBMT vs PR, Outcome 6 mMRC.

Analysis 1.7. Comparison 1 AMBMT vs PR, Outcome 7 6MWD.

Analysis 1.8. Comparison 1 AMBMT vs PR, Outcome 8 ICE.

Analysis 1.9. Comparison 1 AMBMT vs PR, Outcome 9 CWR.

Analysis 1.10. Comparison 1 AMBMT vs PR, Outcome 10 FEV₁.

Analysis 1.11. Comparison 1 AMBMT vs PR, Outcome 11 FVC.

Analysis 1.12. Comparison 1 AMBMT vs PR, Outcome 12 FEV₁/FVC.

Analysis 1.13. Comparison 1 AMBMT vs PR, Outcome 13 FEV₁ predicted.

Analysis 1.14. Comparison 1 AMBMT vs PR, Outcome 14 AECOPD.

Study or subgroup	AMBMT		PR		Mean Difference Random, 95% CI	Mean Difference Random, 95% CI
	N	Mean(SD)	N	Mean(SD)		
Liu 2012	51	-0.3 (0.5)	32	-0.3 (0.6)		0.03[-0.21,0.27]
					Favours AMBMT	Favours PR

Comparison 2. AMBMT with PR vs PR

Outcome or sub-group title	No. of studies	No. of participants	Statistical method	Effect size
1 SGRQ	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Total	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 Activity	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.3 Symptoms	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.4 Impact	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 CRQ	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Dyspnoea	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.2 Fatigue	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.3 Mastery	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2.4 Emotion	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 SF-36	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 General health	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3.2 Mental health	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Borg CR10 - Dyspnoea	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
5 SEMSOB	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
6 CSES	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
7 6MWD	2	272	Mean Difference (IV, Random, 95% CI)	14.09 [-3.68, 31.86]
8 FEV₁	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
9 FVC	1		Mean Difference (IV, Random, 95% CI)	Totals not selected
10 FEV₁ predicted	1		Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 2.1. Comparison 2 AMBMT with PR vs PR, Outcome 1 SGRQ.

Analysis 2.2. Comparison 2 AMBMT with PR vs PR, Outcome 2 CRQ.

Analysis 2.3. Comparison 2 AMBMT with PR vs PR, Outcome 3 SF-36.

Analysis 2.4. Comparison 2 AMBMT with PR vs PR, Outcome 4 Borg CR10 - Dyspnoea.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Ng 2014	94	-0.1 (1)	98	-0.1 (1)		-0.1[-0.37,0.17]
					Favours PR + AMBMT	Favours PR

Analysis 2.5. Comparison 2 AMBMT with PR vs PR, Outcome 5 SEMSOB.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Ng 2014	94	0.5 (1.8)	98	0.3 (2)		0.23[-0.3,0.76]
					Favours PR	Favours PR + AMBMT

Analysis 2.6. Comparison 2 AMBMT with PR vs PR, Outcome 6 CSES.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Ng 2014	94	0 (0.1)	98	0 (0.1)		-0[-0.04,0.04]
					Favours PR	Favours PR + AMBMT

Analysis 2.7. Comparison 2 AMBMT with PR vs PR, Outcome 7 6MWD.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI		Random, 95% CI
Ng 2011	40	27.8 (84.9)	40	10.7 (84.9)		22.81%	17.1[-20.1,54.3]
Ng 2014	94	28.1 (74.2)	98	14.9 (68.5)		77.19%	13.2[-7.02,33.42]
Total ***	134		138			100%	14.09[-3.68,31.86]
Heterogeneity: Tau ² =0; Chi ² =0.03, df=1(P=0.86); I ² =0%							
Test for overall effect: Z=1.55(P=0.12)							
					PR -100 -50 0 50 100 PR with AMBMT		

Analysis 2.8. Comparison 2 AMBMT with PR vs PR, Outcome 8 FEV₁.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Ng 2014	94	0.1 (0.5)	98	0.1 (0.5)		0.06[-0.09,0.21]
					Favours PR	Favours PR with AMBMT

Analysis 2.9. Comparison 2 AMBMT with PR vs PR, Outcome 9 FVC.

Study or subgroup	PR with AMBMT		PR		Mean Difference	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Random, 95% CI	Random, 95% CI
Ng 2014	94	0.1 (0.8)	98	0 (0.8)		0.13[-0.09,0.35]
Favours PR -1 -0.5 0 0.5 1 Favours PR with AMBMT						

Analysis 2.10. Comparison 2 AMBMT with PR vs PR, Outcome 10 FEV₁ predicted.

Study or subgroup	PR with AMBMT		PR	Mean Difference		Mean Difference
	N	Mean(SD)		Random, 95% CI	Random, 95% CI	
Ng 2014	94	6.1 (27.7)	98	3.1 (24.8)		3.04[-4.39,10.47]
Favours PR -20 -10 0 10 20 Favours PR with AMBMT						

ADDITIONAL TABLES

Table 1. Description of different AMBMTs

Intervention	Description	Reference
Tai chi	Originally developed as a martial art in China around the 16th century (origins unclear), training emphasises focusing attention, co-ordinating breathing with movements, and aligning proper posture in a rhythmical sequence and at a constant rate	Ng 2014a
Qigong	Originating from Traditional Chinese Medicine (TCM) and refined for over 5000 years, qigong exercises consist of postures, breathing techniques, and meditation, all designed to enhance Qi function (concept of force or energy in TCM) through attainment of deeply focused and relaxed states	Jahnke 2010
Yoga	Practised in India as early as 3000 before common era and can be simplified as a combination of postures (Asanas), breathing techniques (Pranayamas), and sustained concentration (Dhyana)	Taneja 2014
Pilates	Created in the United States in the early 20th century and matured as a combination of structured physical exercises focusing on concentration, control, centreing, flowing movement, precision, and breathing	Bullo 2015

TCM: Traditional Chinese Medicine.

APPENDICES

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

Electronic searches: core databases

Database	Frequency of search
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(Continued)

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 Respiriology (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 trials for the CAGR

COPD search

1. Lung Diseases, Obstructive/
2. exp Pulmonary Disease, Chronic Obstructive/
3. emphysema\$.mp.
4. (chronic\$ adj3 bronchiti\$).mp.
5. (obstruct\$ adj3 (pulmonary or lung\$ or airway\$ or airflow\$ or bronch\$ or respirat\$)).mp.
6. COPD.mp.
7. COAD.mp.
8. COBD.mp.
9. AECB.mp.
10. or/1-9

Filter to identify RCTs

1. exp "clinical trial [publication type]"/
2. (randomized 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 trials in other electronic databases.

Appendix 2. Search strategy to identify trial reports from the Airways Register (via the Cochrane Register of Studies platform)

- #1 MeSH DESCRIPTOR Pulmonary Disease, Chronic Obstructive Explode All
- #2 MeSH DESCRIPTOR Bronchitis, Chronic
- #3 (obstruct*) near3 (pulmonary or lung* or airway* or airflow* or bronch* or respirat*)
- #4 COPD:MISC1
- #5 (COPD OR COAD OR COBD OR AECOPD):TI,AB,KW
- #6 #1 OR #2 OR #3 OR #4 OR #5
- #7 MeSH DESCRIPTOR Tai Ji
- #8 "tai ji"
- #9 taiji
- #10 "t'ai chi"
- #11 "tai chi"
- #12 taichi
- #13 shadow NEXT boxing
- #14 MeSH DESCRIPTOR Yoga
- #15 yoga*
- #16 Pranayam*
- #17 asana*
- #18 qigong*
- #19 "qi gong" or qi-gong

#20 "chi gong" or chi-gong

#21 "Chi kung"

#22 Baduanjin

#23 Yinjinjing

#24 "Yinjin jing"

#25 "wu qin xi"

#26 wuqinxi

#27 "Zhan Zhuang"

#28 pilates*

#29 mind* NEAR2 body*

#30 meditat* NEAR3 (exercis* OR movement*)

#31 #7 or #8 or #9 or #10 or #11 or #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

#32 #6 and #31

[Note: in search line #4, MISC1 denotes the field in the record where the reference has been coded for condition, in this case, COPD]

Appendix 3. Search strategy or keywords used for non-CAGR databases

COPD filter

"阻塞性肺病" (obstructive lung disease)

"copd"

"慢性阻塞性呼吸道病" (coad, chronic obstructive airways disease)

"急性加剧慢性支气管炎" (aecb, acute exacerbations chronic bronchitis)

"慢性呼吸道限制" (chronic airway limitation)

"肺气肿" (pulmonary emphysema)

"慢性支气管炎" (chronic bronchitis)

AMBMT filter

"太极拳" (tai ji quan)

"瑜伽" (Yoga)

"气功" (Qigong)

"气功疗法" (Qigong therapy)

"气功治疗" (Qigong treatment)

"气功组" (Qigong group)

"中医气功" (medical Qigong)

"气功锻炼" (Qigong training)

"健身气功" (fitness qigong)

"八段锦" (Baduanjin)

"易筋经" (Yi jin jing)

"五禽戏" (Wu qin xi)

"形神" (Mind and body)

"普拉提" (Pilates)

"练功" (Liangong)

"tai chi"

"Qigong"

"Yoga"

"Pilates"

CONTRIBUTIONS OF AUTHORS

LMcG and AN contributed equally to this work.

LMcG co-ordinated the review; designed search strategies; undertook searches and extraction and entry of data into RevMan; and contributed to data analysis and interpretation.

AN designed search strategies; undertook searches and extraction and entry of data into RevMan; and contributed to data analysis and interpretation.

DS contributed to interpretation of data and provided a clinical perspective and general advice on the review.

FM contributed to interpretation of data and provided a clinical perspective and general advice on the review.

YL provided a methodological perspective, a clinical perspective, and general advice on the review; and contributed to interpretation of data.

All review authors contributed to reading, writing, and approval of this review.

The review will be updated by LMcG and AN.

DECLARATIONS OF INTEREST

LMcG: none known.

AN: none known.

DS: none known.

Francois Maltais: grants for investigator-initiated research from Boehringer Ingelheim; grants for contract research paid to his institution from Novartis, Boehringer Ingelheim, AstraZeneca, and GlaxoSmithKline; speaker honoraria paid to his group of respirologists from Boehringer Ingelheim and Novartis; consultancy fees from Boehringer Ingelheim; and position as CIHR/GlaxoSmithKline research chair on COPD.

YL: none known.

SOURCES OF SUPPORT

Internal sources

- The review authors declare that no such funding was received for this systematic review, Other.

External sources

- The review authors declare that no such funding was received for this systematic review, Other.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Regarding the *Measures of treatment effect*, the original protocol stated that when the standard deviation (SD) of the change was missing from a study, the mean value for the SD of other studies reporting that outcome was supposed to be used. Most included studies did not report the SD of change; therefore, we used instead the SD from the post-intervention time point selected for analysis.

We included in this review the domain 'Risk of bias for performance bias'.

INDEX TERMS

Medical Subject Headings (MeSH)

Attention; Breathing Exercises [methods]; Dyspnea [rehabilitation] [therapy]; Meditation [methods]; Mind-Body Therapies [*methods]; Pulmonary Disease, Chronic Obstructive [rehabilitation] [*therapy]; Quality of Life; Walking

MeSH check words

Aged; Aged, 80 and over; Female; Humans; Male; Middle Aged