

# Tai Chi for Chronic Obstructive Pulmonary Disease (COPD): An Overview of Systematic Reviews

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**Objective:** Since current systematic reviews (SRs) show that results of effectiveness on Tai Chi for chronic obstructive pulmonary disease (COPD) are inconsistent, the purpose of this study is to find the reasons of the disparity by comprehensively appraising the related SRs.

**Methods:** Six databases were systematically searched from the inception date to April 17, 2021. The methodological quality, the risk of bias, the reporting quality, and the quality of evidence were independently assessed by two reviewers with the AMSTAR 2, ROBIS, PRISMA, and GRADE.

**Results:** A total of 12 studies met the inclusion criteria: 10 SRs were rated critically low quality and two SRs were low quality by AMSTAR 2. By the ROBIS, four out of 12 SRs were rated as “low risk”. According to PRISMA, nine out of 12 SRs were adequately reported over 80%. With the GRADE tool, three out of 12 SRs rated the FEV1 as “Moderate”, one out of 12 SRs (1/12, 9%) rated the FEV1/FVC (%) as “Moderate”, three out of 12 SRs assessed the 6MWD as “Moderate”, three out of 12 SRs evaluated the SGRQ as “Moderate”, and the remaining evidence was fully rated as “Low” or “Very Low”.

**Conclusion:** We found that the methodological quality, risk of bias, reporting quality, and quality of evidence of the included SRs on Tai Chi for COPD were suboptimal. These limitations may have a negative impact on SRs, consequently leading to inconsistent results. Further well-conducted SRs with less risk of bias, more rigorous methodology, normative reporting and high-quality of evidence are needed to provide robust evidence on Tai Chi for COPD.

**Registration Number:** This study has been registered in the PROSPERO International Prospective Register of Systematic Reviews (registration number: CRD42019126600).

**Keywords:** Tai Chi, COPD, AMSTAR 2, ROBIS, PRISMA, GRADE, overview

## Background

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and air-flow limitation due to airway and/or alveolar abnormalities.<sup>1</sup> Globally, there are around 3 million deaths annually caused by COPD.<sup>2</sup> By 2030,<sup>3</sup> more than 4.5 million people may die from COPD and related diseases every year. Currently, pharmacological therapies are considered as the first-line treatment for COPD. However, medications mainly focus on relieving symptoms rather than improving pulmonary function and quality-of-life.<sup>4</sup> Guidelines<sup>5</sup> for COPD indicate that exercise, as the core content of pulmonary rehabilitation, should be added to routine treatments for patients with moderate-to-severe COPD.

Tai Chi, as a traditional Chinese exercise with unique cultural characteristics, has been widely used for the rehabilitation in COPD. Clinical studies have

manifested that Tai Chi was beneficial for COPD, due to its effectiveness of strengthening and stretching the body, improving the flow of blood and other fluids throughout the body, and improving balance.<sup>6</sup> With the development of evidence-based medicine, systematic reviews (SRs) have become the standard approach for clinicians to make decisions.<sup>7-9</sup> However, evidence of the effectiveness on Tai Chi for COPD is inconsistent. For example, Wu et al<sup>10</sup> found that Tai Chi significantly increased the forced expired volume in one second per predicted (FEV1%), but Ngai et al<sup>11</sup> showed negative results. In such circumstances, the clinicians and policy-makers may be inundated with inconsistent evidence.

The disparity mainly comes from the methodology, risk of bias, reporting, and the quality of evidence of outcomes. Low methodologic quality may cause the results of SRs to be less reliable.<sup>12</sup> Bias in the design or progress of SRs may lead to uncertain conclusions. Reporting quality is crucial for both authors and readers<sup>13</sup> to obtain the information, yet a large number of suboptimal reporting persists.<sup>14</sup> Because of the inadequate reporting and low quality of evidence, readers cannot fully assess the strengths and weaknesses of SRs, which ultimately means that the findings of SRs cannot be implemented into clinical practice.<sup>15,16</sup> Therefore, a comprehensive overview of SRs, which can comply data from multiple SRs<sup>17</sup> and reduce disparity between SRs, is more intuitive than numbers of SRs with low quality and inconsistent recommendations.

To date, no overview of related SRs on Tai Chi for COPD has been conducted. Our study aimed to conduct a comprehensive overview and to critically appraise the methodology, risk of bias, reporting quality, and quality of evidence of these SRs, by using the tools of A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR 2), Risk of bias in systematic reviews (ROBIS), Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA), and the grading of recommendations assessment, development, and evaluation (GRADE), respectively. Besides, the effectiveness and safety of Tai Chi for COPD were narratively summarized.

## Method

### Protocol and Registration

A priori protocol has been registered in the PROSPERO International Prospective Register of Systematic Reviews (registration number: CRD42019126600).

## Search Strategy

We searched the following electronic bibliographic databases: PubMed, Embase, The Cochrane Library, China National Knowledge Infrastructure (CNKI), Wan Fang database and VIP database, using the keywords of Tai Chi, chronic obstructive pulmonary disease, and systematic review from inception to April 17, 2021. Studies published in English and Chinese were included. The search strategies were listed in [Appendix A](#). In addition, we manually searched the references and relevant domestic journals, including the *Chinese Journal of Rehabilitation Medicine*, *Chinese Journal of Rehabilitation Theory and Practice*, and the *Chinese Journal of Physical Medicine and Rehabilitation*.

## Inclusion and Exclusion Criteria

Inclusion criteria were established as follows: i) types of study: SRs containing more than one randomized controlled trial (RCT); ii) participants: Patients with COPD defined by spirometry; iii) interventions: Any type of Tai Chi with or without routine treatments; iv) comparison intervention: Routine treatments, such as drug therapy, routine activities, and respiratory training; v) outcome indicators: Pulmonary function including forced expiratory volume in 1 second (FEV1), FEV1% predicted normal values (FEV1%), the ratio of FEV1 to forced vital capacity [FEV1/FVC (%)], 6-minute walking distance (6MWD) and the St. George's Respiratory Questionnaire (SGRQ). Exclusion criteria were: i) Guidelines, review comments, overviews of SRs and editorials. ii) Full text unavailable after contacting the author. Literature retrieval was done independently by two researchers (LPY/LYX).

## Data Management and Data Collection

Endnote X7 (Bid 7072) was used to perform data management. Two researchers (YZ/YLZ) independently screened titles and abstracted for potentially relevant studies after eliminating duplications. Full texts were downloaded and read for eligible included studies based on inclusion and exclusion criteria. Then a cross-check after completion was performed to avoid mis-entry. Any discrepancies were discussed by a third reviewer (JRJ).

Data extraction was independently completed by two researchers (YZ/YLZ). Discrepancies were discussed with a third reviewer (JL). A data extraction form was developed in advance. The main contents of data extraction were as follows:

- General information (title, author, country, and language).
- Study characteristics (numbers of included RCTs, quality assessment tool, interventions and comparisons, data analysis methods).
- Outcomes: effect value, 95% CI, *p*-value.
- Summary of conclusions.

## Assessment of Methodological Quality

AMSTAR 2 is a common instrument to evaluate the methodology of SRs.<sup>18</sup> Two researchers (LPY/DLZ) independently assessed the methodology of SRs using AMSTAR2. AMSTAR2 has 16 items, including seven critical items (item 2/4/7/9/11/13/15) which can critically affect the validity of a SR and its conclusion. Each item was evaluated as “yes,” “partial yes,” and “no” according to the standard of AMSTAR 2 guideline.<sup>18</sup> The details of AMSTAR 2 items and the general rules for results of a SR are seen in [Appendix B](#). Discrepancies were solved by team discussion.

## Assessment of Risk of Bias

ROBIS is a tool designed specifically to assess the risk of bias in SRs,<sup>19</sup> which is comprised of three phases formed by signaling questions. Two researchers (WW/TYL) independently assessed the risk of bias of each SR using ROBIS. Phase 1 assesses the assessing relevance, which is optional. Phase 2, which is comprised of four domains formed by 21 signaling questions, aims to identify concerns with the review process. Phase 3, with three signaling questions, concentrates to judge risk of bias of the SR. All signaling questions were answered as “yes”, “probably yes”, “probably no”, “no”, and “no information”. If all of signaling questions of phase 3 were answered as “yes,” SR was judged as “low risk”. Any of signaling question of phase 3 was answered as “probably no” or “no”, SR was assessed as “high risk”. If the information provided was insufficient to judge, SR was rated as “unclear risk”. Discrepancies were solved by team discussion.

## Assessment of Reporting Quality

PRISMA is a reporting guideline designed to improve transparency of SRs,<sup>20–22</sup> which consisted of a 27-item checklist and a 4-phase flow diagram. Two researchers (YXL/LG) independently assessed reporting quality of included SRs using PRISMA. The highest score is 27. Each item was answered as “yes”, “no”, and “not applicable”. We assessed the completion of the overall SRs’

reporting by using a percentage, which was obtained through summing all items’ score and dividing by the maximum score. The completion for each item was presented in ratio. Discrepancies were solved by team discussion.

## Assessment of Quality of Evidence

GRADE is widely used for rating the quality of evidence of each outcome in SRs.<sup>23</sup> Two researchers (ZDL/LPY) independently utilized the GRADE tool to assess quality of each outcome in included SRs, including FEV1, FEV1/FVC (%), FEV1%, 6MWD, and SGRQ. According to GRADE, evidence based on RCTs begin as high quality, but the quality of evidence may be downgraded dependent on five key factors (Risk of Bias, Inconsistency, Indirectness, Imprecision and Publication bias) of GRADE. Quality of evidence of each outcome was rated as “High”, “Moderate”, “Low”, and “Very Low”.

## Data Synthesis and Presentation

The results of AMSTAR 2, ROBIS, and PRISMA were summarized as a percentage of achievement per item. The results of AMSTAR 2, ROBIS, PRISMA, and the GRADE were summarized via tabulations. The characteristics of included SRs, the effectiveness and safety of Tai Chi for COPD were narratively summarized.

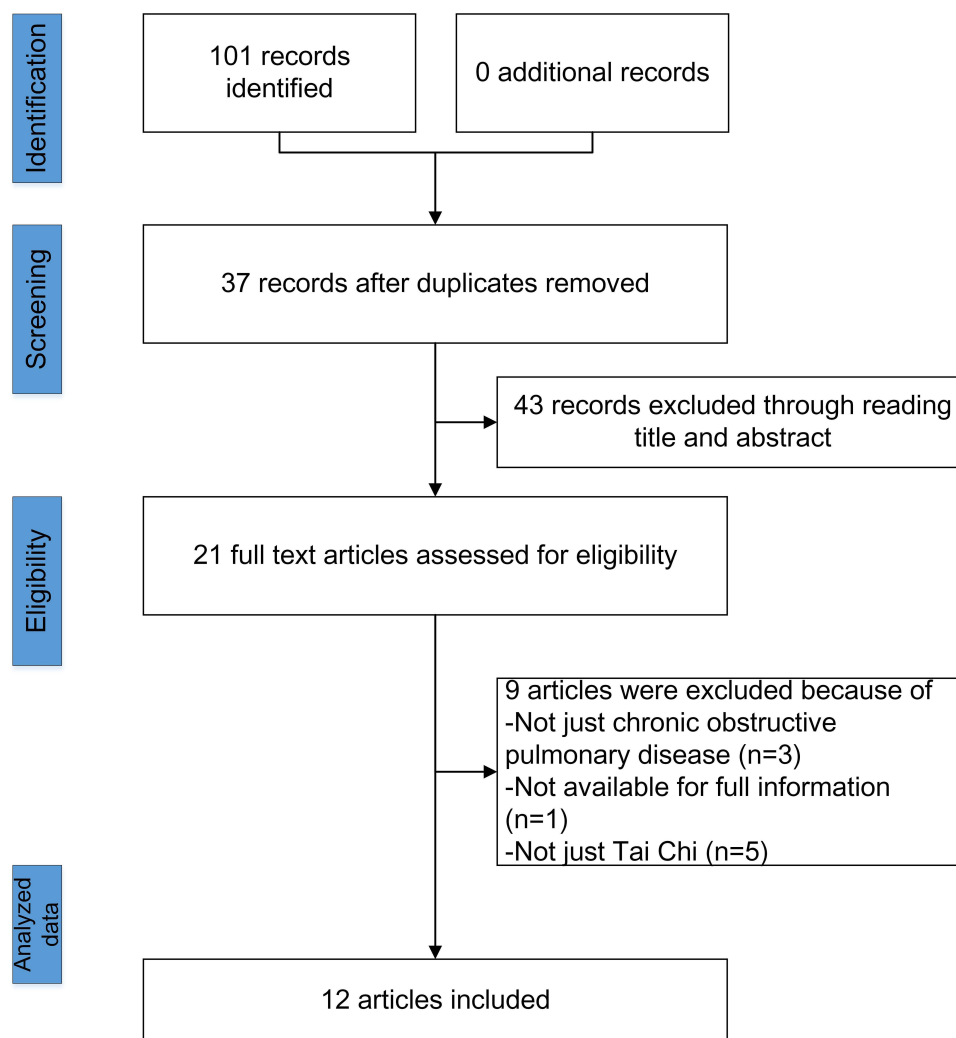
## Results

### Results on Literature Search and Selection

We retrieved 101 citations and excluded 37 duplicates before screening. The 43 citations were excluded by title and abstract screening. After reading full-text, 12 eligible articles were included. A flow diagram of literature search was shown in [Figure 1](#).

### Characteristics of Included Reviews

Of these 12 SRs, six<sup>24–29</sup> studies were written in Chinese and six<sup>11,30–34</sup> in English. They were published from 2013 to 2021. As for intervention, eight SRs took Tai Chi combined with other treatments (eg, drug treatment, routine rehabilitation therapy) as treatment, and four included Tai Chi alone. Several common treatments were used as comparison, including drug therapy, routine activities, respiratory training, aerobics, strength training, etc. The outcomes of the 12 studies included pulmonary function [FEV1, FEV1%, FEV1/FVC (%)], 6MWD, and SGRQ. In



**Figure 1** Flow diagram of literature search.

addition, seven<sup>11,24,27,29–31,33</sup> of these SRs used The Cochrane Collaboration’s Risk of Bias to assess the risk of bias of the original RCTs. The remaining four<sup>25,26,28,32</sup> SRs used Jadad scores and one SR<sup>34</sup> used the Physiotherapy Evidence Database (PEDro) scale. Details are shown in [Table 1](#).

## Results of Methodological Quality

[Table 2](#) shows the results of methodological quality of the included SRs using AMSTAR 2. Among the 12 included SRs, 10 SRs were considered critically low quality and two SRs<sup>11,30</sup> were low quality. AMSTAR 2 items(I) (ie, lower rates of “yes”) with the lowest compliance rates were I2 (“a prior protocol provided”, 8.33%), I3 (Did the review authors explain their selection of the study designs for inclusion in the review?, 0%), I5 (Did the review authors perform study selection in duplicate?, 42%), I7

(Did the review authors provide a list of excluded studies and justify the exclusions?, 17%), I12 (“the potential impact of RoB in individual studies on the results”, 42%), I13 (“Did the review authors account for RoB in primary studies when interpreting/discussing the results of the review?”, 42%), and I15 (“publication bias assessed”, 42%).

## Results of Risk of Bias

According to [Table 3](#), all SRs were in low risk in Phase 1. In phase 2, low risk of domain 1 was 100%, domain 2 was 33.33%, domain 3 was 66.67%, and domain 4 was 66.67%. Low risk of phase 3 was 33.33%. In addition, signaling questions (Q) of ROBIS with the highest concerns (ie, higher rates of “no”) were Q6 (Did the search include an appropriate range of databases/electronic sources for published and unpublished reports?,

Table 1 Characteristics of Systematic Reviews

Author/Year/ Country	Language	Number of RCTs Included	Quality Assessment Tool for Original Studies Included in SR	Intervention	Comparisons	Data Analysis Methods	Outcomes	Conclusions of the Author
Shao <sup>24</sup> /2016/ China	Chinese	9 RCTs	The Cochrane Handbook 5.1.0	Tai Chi quan exercise or combined with other interventions with routine drug treatment	Conventional medical treatment	Meta- analysis	FEV1%; FEV1; FEV1/FVC(%)	Tai Chi quan group was superior to conventional drug treatment group in improving lung function FEV1 and FEV1%, but there was no significant difference in FV1/FVC%. The results show that Tai Chi quan exercise can improve pulmonary function in stable COPD patients.
Tian et al <sup>25</sup> /2015/China	Chinese	5 RCTs	The Jadad Scale	Tai Chi training	General treatment or other effective targeted treatment	Meta- analysis	FEV1; FEV1%; FEV1/FVC(%) 6MWT; GRQ	In FEV1, there were significant differences between Tai Chi quan intervention group and control group, but in FEV1%, FVC, FEV1/FVC (%) and 6MWT quality-of-life (SGRQ score) there were no significant differences between the two groups.
Wang et al <sup>26</sup> 2015/China	Chinese	6 RCTs	The Jadad Scale	Tai Chi training	Regular activities or routine health guidance	Meta- analysis	FEV1; FEV1%; FEV1/FVC(%) 6MWT	Exercise could improve the lung function and exercise endurance in old patients with stable chronic obstructive pulmonary disease, and has positive rehabilitation effects.
Guo et al <sup>30</sup> / 2015/Canada	English	15 RCTs	The Cochrane Collaboration's Risk of Bias	Tai Chi training	Other type of treatment (drug therapy, routine activities, and respiratory training)	Meta- analysis	6MWT; FEV1; FEV1%; SGRQ FEV1% GRQ	Tai Chi may improve exercise capacity in the short-, mid-, and long-terms. However, no significant long term differences in pulmonary function and quality- of-life were observed for patients with chronic obstructive pulmonary disease.
Ngai et al <sup>11</sup> / 2016/China	English	12 RCTs	The Cochrane Handbook for Systematic Reviews of Interventions	Tai Chi	Usual care or another intervention	Meta- analysis	FEV1; FEV1%; SGRQ FEV1/ FVC(%) 6MWT	When Tai Chi was compared with other interventions alone, there was no additional impact on the symptoms or physical and mental improvement of COPD patients.

(Continued)

Table 1 (Continued).

Author/Year/ Country	Language	Number of RCTs Included	Quality Assessment Tool for Original Studies Included in SR	Intervention	Comparisons	Data Analysis Methods	Outcomes	Conclusions of the Author
Wu et al <sup>11</sup> / 2014/China	English	11 RCTs	The Cochrane Handbook for Systematic Reviews of Interventions	Tai Chi	Exercise (aerobics, strength training, or breathing exercises)	Meta-analysis	6MWD SGRQ	Preliminary evidence suggests that Tai Chi has beneficial effects on exercise capacity and HRQoL in COPD patients. This exercise can be recommended as an effective alternative training modality in pulmonary rehabilitation programs.
Yan <sup>32</sup> /2013/ China	English	8 RCTs	The Jadad scale	Tai Chi or Tai Chi Qigong with or without other treatments	Any type of control	Meta-analysis	6MWD; FEV1; FEV1%	Findings suggest that TC may provide an effective alternative means to achieve results similar to those reported following participation in pulmonary rehabilitation programs.
Guo et al <sup>32</sup> / 2020/China	English	16 RCTs	Cochrane risk of bias assessment tool	Tai Chi or Qigong with routine treatment	Routine treatment with or without exercise	Meta-analysis	FEV1; FEV1%; SGRQ; 6MWT FEV1/FVC (%);	Tai Chi may represent an appropriate alternative or complement to standard rehabilitation programs. However, whether Tai Chi is better than pulmonary rehabilitation exercise has not been determined.
Chen et al <sup>34</sup> / 2015/Canada	English	4 RCTs	The Physiotherapy Evidence Database (PEDro) scale	Tai Chi training	Other treatments or another exercise intervention	Meta-analysis	6MWT	The results demonstrated a favorable effect or tendency of Tai Chi to improve physical performance and showed that this type of exercise could be performed by individuals with different chronic conditions, including COPD, HF and OA.
Wang and Gao <sup>27</sup> /2020/ China	Chinese	16 RCTs	Cochrane risk of bias assessment tool	Tai Chi training with or without other treatment	Other treatments or no intervention	Meta-analysis	FEV1, FEV1%, FEV1/FVC%, 6MWD	Tai Chi exercise can effectively improve the lung function of elderly patients, so that the patient's breathing is better and smoother, and the exercise capacity is significantly improved.
Wang and Zhou <sup>28</sup> /2020/ China	Chinese	9 RCTs	The Jadad scale	Tai Chi training with or without other treatment	No intervention, or aerobics, or respiratory training	Meta-analysis	FEV1, FEV1/ FVC%, 6MWD, SGRQ	Taijiquan can effectively improve the motor ability, pulmonary function and quality-of-life of COPD patients.
Dong et al <sup>29</sup> /2021/China	Chinese	15 RCTs	Cochrane risk of bias assessment tool	Tai Chi alone	No limitations with intervention	Meta-analysis	6MWD	Taijiquan exercise intervention in the stable period of the elderly patients with chronic obstructive pulmonary disease rehabilitation effect is significant.

**Table 2** The Results of AMSTAR 2

Items	Shao <sup>24</sup>	Tian et al <sup>25</sup>	Wang et al <sup>26</sup>	Guo et al <sup>30</sup>	Ngai et al <sup>11</sup>	Wu et al <sup>31</sup>	Yan <sup>32</sup>	Guo et al <sup>33</sup>	Chen et al <sup>34</sup>	Wang and Gao <sup>27</sup>	Wang and Zhou <sup>28</sup>	Dong et al <sup>29</sup>
I1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I2	Y	N	N	Y	Y	N	N	N	N	N	N	N
I3	N	N	N	N	N	N	N	N	N	N	N	N
I4	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	N
I5	PY	PY	PY	PY	PY	PY	Y	Y	Y	Y	Y	N
I6	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	N	Y
I7	N	N	N	N	Y	Y	N	N	N	N	N	N
I8	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I9	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I10	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I11	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
I12	Y	N	N	Y	Y	Y	Y	N	N	N	N	N
I13	Y	N	N	Y	Y	Y	Y	N	N	N	N	N
I14	Y	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y
I15	N	Y	N	Y	Y	N	N	N	Y	Y	N	N
I16	N	PY	Y	Y	Y	Y	Y	Y	Y	N	N	N
Ranking of quality	Critically low	Critically low	Critically low	Low	Low	Critically low	Critically low	Critically low	Critically low	Critically low	Critically low	Critically low

Abbreviations: Y, yes; PY, partial yes; N, no.

**Table 3** The Result of ROBIS

Signaling Questions of ROBIS	Shao <sup>24</sup>	Tian et al <sup>25</sup>	Wang et al <sup>26</sup>	Guo et al <sup>30</sup>	Ngai et al <sup>11</sup>	Wu et al <sup>31</sup>	Yan <sup>32</sup>	Guo et al <sup>33</sup>	Chen et al <sup>34</sup>	Wang and Gao <sup>27</sup>	Wangand Zhou <sup>28</sup>	Dong et al <sup>29</sup>
1.1 Does the question addressed by the review match the target question?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.1.1(Q1) Did the review adhere to pre-defined objectives and eligibility criteria?	Y	PY	PY	Y	PY	PY	PY	PY	PY	PY	PY	PY
2.1.2(Q2) Were the eligibility criteria appropriate for the review question?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.1.3(Q3) Were eligibility criteria unambiguous?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.1.4(Q4) Were any restrictions in eligibility criteria based on study characteristics appropriate (eg, date, sample size, study quality, outcomes measured)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2.1.5(Q5) Were any restrictions in eligibility criteria based on sources of information, appropriate (eg publication status or format, language, availability of data)?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Concerns regarding specification of study eligibility criteria	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
2.2.1(Q6) Did the search include an appropriate range of databases/electronic sources for published and unpublished reports?	Y	N	N	Y	Y	Y	N	Y	Y	N	Y	Y
2.2.2(Q7) Were methods additional to database searching used to identify relevant reports?	Y	Y	N	N	Y	Y	N	N	Y	PY	N	N
2.2.3(Q8) Were methods additional to database searching used to identify relevant reports?	Y	PN	N	Y	Y	Y	N	Y	Y	N	Y	NI
2.2.4(Q9) Were restrictions based on date, publication format, or language appropriate?	Y	Y	Y	Y	Y	Y	Y	Y	N	PY	Y	NI
2.2.5(Q10) Were efforts made to minimise error in selection of studies?	Y	PY	Y	NI	Y	NI	Y	Y	Y	Y	Y	N
Concerns regarding methods used to identify and/or select studies	Low	High	High	Unclear	Low	Unclear	High	Low	Low	High	High	High





Table 3 (Continued).

Signaling Questions of ROBIS	Shao <sup>24</sup>	Tian et al <sup>25</sup>	Wang et al <sup>26</sup>	Guo et al <sup>30</sup>	Ngai et al <sup>11</sup>	Wu et al <sup>31</sup>	Yan <sup>32</sup>	Guo et al <sup>33</sup>	Chen et al <sup>34</sup>	Wang and Gao <sup>27</sup>	Wangand Zhou <sup>28</sup>	Dong et al <sup>29</sup>
3.2(Q23) Was the relevance of identified studies to the review's research question appropriately considered?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3.3(Q24) Did the reviewers avoid emphasizing results on the basis of their statistical significance?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<b>Risk of bias in the review</b>	Low	Low	High	High	Unclear	Low	Unclear	High	Low	High	High	High

Abbreviations: Y, yes; PY, probably yes; PN, probably no; N, no; NI, no information; Q, signaling questions.

no=33.33%), Q7 (Were methods additional to database searching used to identify relevant reports?, no=50%), Q20 (Were the findings robust, eg, as demonstrated through funnel plot or sensitivity analyses. no=41.67%), and Q22 (Did the interpretation of findings address all of the concerns identified in Domains 1 to 4?, no=50%). According to the final phase of ROBIS, four out 12 of SRs was rated as “low risk”, 6SRs were “High risk”, and two SRs were “Unclear risk”.

### Results of Reporting Quality

We used PRISMA to assess the reporting quality of included SRs. We found that the section of title, abstract, introduction, study characteristics, limitation, conclusion, and funding were all well reported. We observed that nine out of 12 SRs were found adequately reported over 80%. However, several items (I) had a lower score (ie, lower rates of “yes”), that were I5 (Protocol and registration, yes=8.33%), I9 (Study selection, yes=41.67%), I11 (Data items, yes=25%), I16 (Additional analyses, yes=60%), and I22 (Risk of bias across studies, yes=25%). These items may account for the main reporting limitations and should be paid attention. The PRISMA checklists of each SR were presented in Table 4.

### Results with GRADE Tool

In our study, evidence of FEV1 in three SRs (3/12, 25%)<sup>11,24,30</sup> was rated as “Moderate”, noevidence of FEV1% was rated as “Moderate”, evidence of FEV1/FVC (%) in one SR (1/12, 9%)<sup>11</sup> was rated as “Moderate”, evidence of 6MWD in three SRs<sup>11,30,31</sup> was rated as “Moderate”, evidence of SGRQ in two SRs<sup>28,33</sup> was rated as “Moderate”, evidence of FEV1/FVC (%) in one SR (1/12, 9%)<sup>11</sup> was rated as “Moderate”, and the remaining evidence was rated as “Low” or “Very Low”. We presentthem in Table 5. Derved to be mentioned, Tai Chi is a physical exercise which consists of different forms and postures, it is not practical for participants to be blinded about group allocation. Lack of blinding may lead to bias. Thus, all studies were graded as “serious (-1)” in category of risk of bias. This may be the reason why there was no high-quality evidence in our study. Besides, the quality of the same outcome among different the included SRs are inconsistent, a comprehensive and rigorous SR is needed to verify the effectiveness of Tai Chi for COPD.

**Table 4** Reporting Quality Assessment of Systematic Reviews by PRISMA

Section	Items	Shao <sup>24</sup>	Tian et al <sup>25</sup>	Wang et al <sup>26</sup>	Guo et al <sup>30</sup>	Ngai et al <sup>11</sup>	Wu et al <sup>31</sup>	Yan <sup>32</sup>	Guo et al <sup>33</sup>	Chen et al <sup>34</sup>	Wang and Gao <sup>27</sup>	Wang and Zhou <sup>28</sup>	Dong et al <sup>29</sup>
Title	I1 Title	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
Abstract	I2 Structured summary	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Introduction	I3 Rationale	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I4 Objectives	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Methods	I5 Protocol and registration	N	N	N	Y	N	N	N	N	N	N	N	N
	I6 Eligibility criteria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I7 Information sources	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I8 Search	Y	NA	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I9 Study selection	Y	NA	N	N	Y	Y	Y	Y	Y	Y	Y	Y
	I10 Data collection process	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I11 Data items	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I12 Risk of bias in individual studies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I13 Summary measures	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I14 Synthesis methods	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I15 Risk of bias across studies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I16 Additional analyses	Y	Y	N	N	NA	Y	Y	Y	N	Y	NA	Y
Results	I17 Study selection	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I18 Study characteristics	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I19 Risk of bias within studies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I20 Results of individual studies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I21 Synthesis of results	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I22 Risk of bias across studies	N	NA	N	Y	Y	N	NA	NA	N	N	N	Y
	I23 Additional analysis	Y	N	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I25 Limitations	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I26 Conclusions	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	I27 Funding	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Funding	I27 Funding	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Total score		24	19	18	24	25	23	21	23	22	22	22	25
Completion rate		89%	70%	67%	89%	93%	85%	78%	85%	81%	81%	81%	93%

Abbreviations: Y, yes; N, no; NA, not applicable.

Table 5 Summary of the Results of GRADE

Outcomes	Author	Mean Difference or Std. Mean difference (95% CI), P-value	No of Participants (Studies)	Heterogeneity	Quality of the Evidence (GRADE)
FEV1	Shao <sup>24</sup>	0.09 (0.03, 0.15), P=0.02*	381 (6 studies)	I <sup>2</sup> =0%, P=0.74	⊕⊕⊕⊕ Moderate <sup>a</sup>
	Tian et al <sup>25</sup>	0.09 (0.04, 0.13), P<0.0001*	229 (4 studies)	χ <sup>2</sup> =3.15, P=0.37	⊕⊕⊕⊕ Very low <sup>abc</sup>
	Wang et al <sup>26</sup>	0.02 (-0.10, 0.14), P=0.76	200 (2 studies)	I <sup>2</sup> =0%, P=0.39	⊕⊕⊕⊕ Low <sup>abc</sup>
	Guo et al <sup>30</sup>	0.04 (-0.03, 0.12), P=0.26 (≤3 months)	425 (4 studies)	I <sup>2</sup> =0%, P=0.74	⊕⊕⊕⊕ Low <sup>ab</sup>
		0.10 (0.01, 0.19), P=0.03* (6 months)	524 (6 studies)	I <sup>2</sup> =62%, P=0.02	⊕⊕⊕⊕ Moderate <sup>c</sup>
		0.03 (-0.08, 0.14), P=0.59 (≥12 months)	96 (2 studies)	I <sup>2</sup> =0%, P=0.08	⊕⊕⊕⊕ Very low <sup>abc</sup>
		0.11 (0.02, 0.20), P=0.012*	258 (4 studies)	I <sup>2</sup> =0%, P=0.59	⊕⊕⊕⊕ Moderate <sup>a</sup>
		0.13 (0.06, 0.20), P=0.0002* (≤3 months)	219 (3 studies)	I <sup>2</sup> =12%, P=0.32	⊕⊕⊕⊕ Low <sup>abc</sup>
		0.15 (0.08, 0.21), P=0.01* (4-6 months)	136 (3 studies)	I <sup>2</sup> =59%, P=0.09	⊕⊕⊕⊕ Very low <sup>abc</sup>
		0.46 (0.20, 0.72), P<0.01*	1,492 (17 studies)	I <sup>2</sup> =29.5%, P>0.05	⊕⊕⊕⊕ Very low <sup>abcd</sup>
FEV1	Wang and Gao <sup>27</sup>	0.74(0.09, 1.38), P<0.00001*	539 (9 studies)	I <sup>2</sup> =22.3%, P=0.28	⊕⊕⊕⊕ Very low <sup>abcd</sup>
	Wang and Zhou <sup>28</sup>	-0.02 (-0.08, 0.04), P<0.00001*	383 (5 studies)	I <sup>2</sup> =0%, P=0.77	⊕⊕⊕⊕ Very low <sup>ab</sup>
	Dong et al <sup>29</sup>				
	Shao <sup>24</sup>	0.09 (0.04, 0.13), P<0.0001*	374 (7 studies)	I <sup>2</sup> =50%, P=0.06	⊕⊕⊕⊕ Low <sup>abc</sup>
	Tian et al <sup>25</sup>	0.14 (-2.77, 3.52), P=0.81	158 (3 studies)	χ <sup>2</sup> =0.66, P=0.72	⊕⊕⊕⊕ Very low <sup>abc</sup>
	Wang et al <sup>26</sup>	4.95 (0.33, 9.57), P=0.04*	220 (3 studies)	I <sup>2</sup> =56%, P=0.10	⊕⊕⊕⊕ Very low <sup>abc</sup>
	Ngai et al <sup>11</sup>	1.33 (-4.25, 6.91), P=0.64	527 (5 studies)	I <sup>2</sup> =80%, P=0.0004	⊕⊕⊕⊕ Very low <sup>abc</sup>
	Guo et al <sup>33</sup>	0.22 (-1.80, 2.23), P=0.83 (≤3 months)	142 (2 studies)	I <sup>2</sup> =0%, P=0.56	⊕⊕⊕⊕ Low <sup>abc</sup>
		3.33 (-1.17, 7.84), P=0.15 (4-6 months)	96 (2 studies)	I <sup>2</sup> =30%, P=0.23	⊕⊕⊕⊕ Low <sup>abc</sup>
		5.78 (-3.75, 15.31), P=0.07 (>6 months)	234 (2 studies)	I <sup>2</sup> =073%, P=0.05	⊕⊕⊕⊕ Very low <sup>abc</sup>
FEV1/FVC%	Wang and Gao <sup>27</sup>	0.35 (0.21, 0.48), P<0.01*	939 (12 studies)	I <sup>2</sup> =37%, P>0.05	⊕⊕⊕⊕ Very low <sup>abcd</sup>
	Shao <sup>24</sup>	0.02 (-0.10, 0.14), P=0.76	313 (5 studies)	I <sup>2</sup> =63%, P=0.03	⊕⊕⊕⊕ Very low <sup>abc</sup>
	Tian et al <sup>25</sup>	-0.09 (-1.34, 1.15), P=0.88	319 (5 studies)	χ <sup>2</sup> =0.46, P=0.98	⊕⊕⊕⊕ Low <sup>abc</sup>
	Wang et al <sup>26</sup>	4.62 (0.73, 8.51), P=0.02*	227 (4 studies)	I <sup>2</sup> =43%, P=0.15	⊕⊕⊕⊕ Low <sup>abc</sup>
	Guo et al <sup>30</sup>	1.50 (-3.17, 6.17), P=0.53 (≤3 months)	260 (5 studies)	I <sup>2</sup> =78%, P=0.001	⊕⊕⊕⊕ Low <sup>abc</sup>
		0.35 (-1.22, 1.92), P=0.66 (6 months)	156 (3 studies)	I <sup>2</sup> =0%, P=0.97	⊕⊕⊕⊕ Low <sup>ac</sup>
		2.13 (-1.73, 5.99), P=0.28 (>6 months)	96 (2 studies)	I <sup>2</sup> =0%, P=0.91	⊕⊕⊕⊕ Very low <sup>abc</sup>
		5.35 (-0.93, 11.64), P=0.095	120 (3 studies)	I <sup>2</sup> =61%, P=0.08	⊕⊕⊕⊕ Moderate <sup>a</sup>
		3.33 (-2.92, 9.58), P=0.3 (≤3 months)	120 (3 studies)	I <sup>2</sup> =61%, P=0.08	⊕⊕⊕⊕ Low <sup>abc</sup>
		0.51 (0.05, 0.97), P<0.05*	661 (12 studies)	I <sup>2</sup> =86.7%, P<0.01	⊕⊕⊕⊕ Very low <sup>abcd</sup>
	0.57 (0.19, 0.96), P<0.00002*	593 (6 studies)	I <sup>2</sup> =81%, P<0.00001	⊕⊕⊕⊕ Very low <sup>abcd</sup>	

6MWD	Tian et al <sup>25</sup> Wang et al <sup>26</sup> Guo et al <sup>30</sup>	50.9 (-45.7, 147.51), P=0.3 33.81 (6, 61.41), P=0.02* 16.02 (2.86, 29.17), P=0.02* (≤3 months)	123 (2 studies) 326 (5 studies) 302 (4 studies)	$\chi^2=15.14$ , P<0.0001 $I^2=87%$ , P<0.0001 $I^2=50%$ , P=0.06	⊕⊕⊕⊕ Very low <sup>abc</sup> ⊕⊕⊕⊕ Low <sup>ac</sup> ⊕⊕⊕⊕ Low <sup>ac</sup>
6MWD	Guo et al <sup>30</sup> Guo et al <sup>28</sup> Ngai et al <sup>11</sup> Wu et al <sup>31</sup> Yan <sup>32</sup> Guo et al <sup>33</sup>	30.90 (6.88, 54.93), P=0.01* (6 months) 24.63 (2.30, 46.95), P=0.03* (≥12 months) 29.64 (10.52, 48.77), P=0.0024* 39.99 (15.63, 56.35), P=0.0005* 34.22 (21.25, 47.20), P<0.00001* 24.29 (6.29, 42.28), P=0.008* (≤3 months) 37.35 (3.96, 70.75), P=0.03* (4–6 months)	464 (5 studies) 94 (2 studies) 318 (6 studies) 456 (4 studies) 306 (3 studies) 363 (6 studies) 76 (2 studies)	$I^2=82%$ , P=0.002 $I^2=0%$ , P=0.64 $I^2=59%$ , P=0.03 $I^2=86%$ , P<0.00001 $I^2=0%$ , P=0.38 $I^2=77%$ , P=0.0006 $I^2=70%$ , P=0.007	⊕⊕⊕⊕ Moderate <sup>ac</sup> ⊕⊕⊕⊕ Very low <sup>abc</sup> ⊕⊕⊕⊕ Moderate <sup>a</sup> ⊕⊕⊕⊕ Moderate <sup>a</sup> ⊕⊕⊕⊕ Low <sup>ac</sup> ⊕⊕⊕⊕ Low <sup>ac</sup> ⊕⊕⊕⊕ Very low <sup>abc</sup>
6MWD	Guo et al <sup>33</sup> Chen et al <sup>34</sup> Wang and Gao <sup>27</sup> Wang and Zhou <sup>28</sup> Dong et al <sup>29</sup>	47.73 (-14.96, 110.42), P=0.14 (>6 months) 1.58 (0.01, 0.73), P=0.05 20.35 (16.95, 23.95), P<0.01* 0.78 (0.30, 1.26), P<0.00001* 57.3 (39.42, 75.17), P<0.00001*	96 (2 studies) 368 (3 studies) 1,630 (20 studies) 531 (7 studies) 532 (8 studies)	$I^2=77%$ , P=0.04 $I^2=61%$ , P=0.08 $I^2=88.8%$ , P<0.01 $I^2=84%$ , P<0.00001 $I^2=75%$ , P=0.00002	⊕⊕⊕⊕ Very low <sup>abc</sup> ⊕⊕⊕⊕ Low <sup>ac</sup> ⊕⊕⊕⊕ Very low <sup>abc,d</sup> ⊕⊕⊕⊕ Very low <sup>ac,d</sup> ⊕⊕⊕⊕ Low <sup>ac</sup>
SGRQ	Tian et al <sup>25</sup> Guo et al <sup>28</sup>	-0.93 (-5.53, 3.67), P=0.69 -6.58 (-11.87, -0.64), P=0.02* (≤3 months) -2.01 (-5.74, 1.73), P=0.29 (6 months)	130 (2 studies) 485 (5 studies) 312 (3 studies)	$\chi^2=0.19$ , P=0.67 $I^2=64%$ , P=0.02 $I^2=0%$ , P=0.88	⊕⊕⊕⊕ Very low <sup>abc</sup> ⊕⊕⊕⊕ Moderate <sup>c</sup> ⊕⊕⊕⊕ Moderate <sup>a</sup>
SGRQ	Yan <sup>32</sup> Guo et al <sup>33</sup> Wang and Zhou <sup>28</sup>	-4.08 (-7.52, -0.64), P=0.02* -0.19 (-4.57, 0.72), P=0.15 (≤3 months) -0.25 (-0.41, -0.09), P=0.003*	366 (3 studies) 525 (4 studies) 624 (8 studies)	$I^2=24%$ , P=0.27 $I^2=38%$ , P=0.19 $I^2=68%$ , P=0.003	⊕⊕⊕⊕ Low <sup>ac</sup> ⊕⊕⊕⊕ Moderate <sup>c</sup> ⊕⊕⊕⊕ Very low <sup>ac,d</sup>

**Notes:** 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. ⊕⊕⊕⊕: The evidence is rated as "moderate" quality; ⊕⊕⊕⊕: "low" quality; ⊕⊕⊕⊕: "very low" quality. <sup>a</sup>No mention of blind and allocation concealment; <sup>b</sup>The optimal sample size is not reached. <sup>c</sup>There was a huge heterogeneity between the included original studies. <sup>d</sup>There was a huge problem of statistics. \*P<0.05. The value of P<0.05 is considered significant.

## The Effectiveness and Safety of Tai Chi

We summarized the information from included SRs and found that their results were inconsistent. The details are shown in Table 5. FEV1, as we all know, has always been used as a primary metric of severity for obstructive lung disease.<sup>35,36</sup> Among the SRs, seven out of nine SRs (78%) reported that FEV1 was significantly enhanced in the Tai Chi group, and one SR (11%) reported not. One SR (11%) reported that FEV1 was significantly improved after 6-months of Tai Chi training, but with no significance less than 3 months or over 12 months.

Both FEV1% and FEV1/FVC% were the main indicators for the diagnosis of COPD.<sup>35,37</sup> According to the results of FEV1%, three out of six SRs (50%) reported that FEV1% was significantly enhanced in the Tai Chi group, and three SRs (50%) reported not. As for FEV1/FVC%, three out of eight SRs (38%) reported that FEV1/FVC% was significantly enhanced in the Tai Chi group, five SRs (62%) reported that Tai Chi had no priority in FEV1/FVC%.

6MWD is a simple and reproducible test aiming to a global and integrated response of both physical (pulmonary and non-pulmonary factors) and psychological factors.<sup>38–40</sup> It can be used to assess the functional exercise capacity.<sup>41</sup> Of the 12 SRs, nine (75%) reported that 6MWD was significantly enhanced in the Tai Chi group. Only one SR (8%) reported that Tai Chi had no priority, and one SR (7%) reported that there was a significant increase at 3 months and 6 months, but no significance over 6 months.

SGRQ is a widely used instrument that is able to assess the health status and health-related quality-of-life in COPD.<sup>42,43</sup> Among the five included SRs, three SRs (60%) reported that SGRQ was significantly enhanced in the Tai Chi group. Two SRs (40%) reported that Tai Chi had no priority in SGRQ.

Only two SRs made subgroup analysis based on the duration and the remaining SRs had an ambiguous description of duration for Tai Chi. We found that the duration of Tai Chi affected the results of SR. For example, Guo et al<sup>30</sup> found that FEV1 was significant increased after 6-months of Tai Chi training, but had no significance less than 3 months or over 12 months. Guo et al<sup>33</sup> discovered that FEV1 could be improved after 3-months of Tai Chi training.

Among the 12 included studies, the intervention in the experimental group in nine SRs was Tai chi combined other rehabilitation therapy, only three SRs adopted Tai Chi alone. Wu et al<sup>31</sup> and Chen et al<sup>34</sup> only reported the

results of 6MWD. However, they got opposite results. Wu et al<sup>31</sup> reported that 6MWD was significantly enhanced in the Tai Chi group, but Chen et al<sup>34</sup> observed no significant difference. The result of 6MWD in a study of Dong et al<sup>29</sup> was consistent with Wu et al.<sup>31</sup> Dong et al<sup>29</sup> also reported that FEV1 was not significantly enhanced in the Tai Chi group. In addition, among the 12 included SRs, no adverse effects of Tai chi on COPD were reported.

## Discussion

### The Main Findings

We narratively summarized the results of included SRs, and appraised the methodological quality, risk of bias, reporting quality, and quality of evidence of these SRs. Among the 12 SRs, 10 were considered as “critically low” in methodological quality and two<sup>11,30</sup> were low quality according to AMSTAR 2. By the ROBIS, six SRs were rated as “High” risk of bias, four were “Low” risk, and two were “Unclear risk”. With the PRISMA checklist, we found most of the SRs (75%) were of relatively good reporting quality. However, the methodological quality, risk of bias, reporting quality, and quality of evidence of these SRs on Tai Chi for COPD were still suboptimal. Due to these limitations, the reliability of evidence for Tai Chi on COPD was weakened, and we should be cautious when recommending Tai Chi as an alternative treatment or alone treatment for improving pulmonary function and quality-of-life on COPD.

In addition, in this present study, we mainly focus on the methodology, risk of bias, and reporting quality of SRs about Tai Chi on COPD. We found that some items of AMSTAR 2, ROBIS, and PRISMA, may be repetitive. So, according to the results, we highlighted several common weaknesses of the included SRs as follows: 1) absence of a protocol registration or publication statement prior to the conduct of SR; 2) lack of a comprehensive literature search strategy and some additional methods for retrieving; 3) lack of appropriate instruments to assess the risk of bias (or methodological quality); 4) lack of prospectively describing the additional analyses in method; an 5) lack of appropriate methods to solve the heterogeneity and examine the robustness of the findings.

### Implications for Clinicians and Producers of Further Study

#### For Clinicians

Firstly, according to our results, Tai Chi was a safety treatment for COPD patients as no adverse events were reported in the included SRs. Secondly, we found that Tai

Chi is prone to improve the functional capacity and quality-of-life in COPD patients, rather than pulmonary function. 75% of included SRs reported the significant increase for 6MWD in Tai Chi group, 60% for SGRQ, 78% for FEV1, 50% for FEV1%, and only 38% for FEV1/FVC%. Thirdly, due to the limitation of these SRs and the inconsistent results, we should be cautious when recommending Tai Chi as an alternative treatment or alone treatment on COPD.

## For Producers of Further SR

Most of these shortcomings can be avoided if the producers pay more attention to methodology, risk of bias, and standard reporting quality of SRs. Therefore, we have several suggestions for SR producers.

We suggest that the producers should register SR on registration platform like the international databases PROSPERO (<https://www.crd.york.ac.uk/prosperto/>). Numerous studies have indicated that prospective registration may benefit the design, conduct, and reporting of SRs.<sup>44–46</sup> For producers of SRs, it is important to perform additional methods to ensure that more eligible studies can be retrieved, such as citation searches, contacting experts, reference checking, and handsearching. A list of excluded studies is necessary, otherwise there may be a risk that they remain invisible and the impact of their exclusion from the review is unknown. Risk of bias (or methodological quality) should be formally assessed using appropriate criteria. Of the 11 SRs, four, using the Jadad Scale, were all rated as “probably no” for absence of allocation concealment by AMSTAR2. The Jadad score does not include allocation concealment which has been shown to be a major potential risk of bias in RCTs.<sup>47</sup> In addition, we suggest authors prospectively describe the additional analyses in statistical method, such as sensitivity analyses, subgroup analyses, and meta-regression.

For results of SR, the authors should focus on heterogeneity and robustness of findings. Heterogeneity may arise as a result of clinical or methodological differences between studies.<sup>48</sup> Between-study variation might be inspected either visually or through statistical tests. Visual inspection mainly refers to the examination of the forest plots and the degree of overlap of the associated confidence intervals.<sup>49</sup> Statistical heterogeneity may be confirmed through statistical tests, such as the  $I^2$  statistic.<sup>50</sup> The Cochrane Collaboration has proposed the use of four categories when interpreting heterogeneity based on  $I^2$  as follows: 0–40% unimportant heterogeneity, 30–60%

moderate, 50–90% substantial, and 75–100% considerable heterogeneity.<sup>51</sup> As for inevitable heterogeneity, we suggest the authors of SRs to perform meta-regression or subgroup analyses. In addition, robustness of the findings, which is often examined by funnel plots. Heterogeneity, reporting bias, and chance may all lead to asymmetry funnel plots.<sup>52</sup> Therefore, we suggest the authors of SRs to perform a sensitivity analysis or use the funnel plots to examine relationships between effect size and study size.

## Strengths and Limitations

There are some strengths in our study. First, it is the first overview which comprehensively appraised the SRs of Tai Chi for COPD with AMSTAR 2, ROBIS, PRISMA, and GRADE. It can help the physicians and patients to have a better understanding of the effectiveness on Tai Chi for COPD in clinical practice. Second, in order to reduce the risk of bias in the review, we prospectively registered on the PROSPERO platform to ensure the transparency of the study. Despite the advantages, this study also had some limitations. First, there might be some missing information since we only searched studies in English and Chinese language. Second, since there are overlapping studies between the included SRs, we only made narratively described the effectiveness and safety of Tai Chi on COPD, but did not synthesize the data from original RCT included in eligible SRs.

## Conclusion

There are more and more SRs concerning the Taiji treatment of COPD. However, through assessing the current SRs on Tai Chi for COPD, we found that the methodological quality, risk of bias, reporting quality, and quality of evidence of these SRs were suboptimal. Further well-conducted SRs with less risk of bias, more rigorous methodology, normative reporting, and high-quality of evidence are needed to provide robust evidence on Tai Chi for COPD.

## Abbreviations

COPD, chronic obstructive pulmonary disease; CNKI, China National Knowledge Infrastructure; VIP database, Wei Pu database; RCT, randomized controlled trials; SR, systematic review; FEV1, forced expiratory volume in one second; FVC, forced vital capacity; 6MWD, 6-minute walking distance; SGRQ, the St. George's Respiratory Questionnaire; ROBIS, risk of bias in systematic reviews; PRISMA, the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses; GRADE, the grading of recommendations assessment, development and evaluation; PICO, participants, interventions, controls, and outcomes; PEDro, the physiotherapy evidence database; MCID, the minimum clinically important difference; EQ-5D, EuroQol-5 Dimension; SF-36, the 36-Item Short Form Health Survey.

## Ethics Approval and Consent to Participate

Ethical assessment and informed consent were not required since our research did not involve individual data.

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## Disclosure

The authors declare no conflicts of interest for this work.

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