TAI CHI FOR PREVENTING AND TREATING HEALTH CONDITIONS

EVIDENCE EVALUATION REPORT

prepared by
HTANALYSTS

for
National Health and Medical Research Council

NHMRC | Natural Therapies Working Committee
Canberra ACT 2601

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Contact

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Report information

Authors

Jorgensen MA[1], Connor E[1], Phan K[1] McCraith S[1],

[1] **HT**ANALYSTS, Level 8, 46 Kippax Street, Surry Hills NSW 2010 Australia

Dates

This evidence evaluation report and accompanying technical reports received approval from the NHMRC Natural Therapies Working Committee (NTWC) on 23 Nov 2023. The protocol for the evidence evaluation received approval from the NHMRC NTWC on 13 July 2020 (PROSPERO: CRD4202020013).

History

NHMRC has been engaged by the Department of Health and Aged Care (Department) to update the evidence underpinning the *2015 Review of the Australian Government Rebate on Natural Therapies for Private Health Insurance* (2015 Review) (1). The natural therapies to be reviewed are Alexander technique, aromatherapy, Bowen therapy, Buteyko, Feldenkrais, homeopathy, iridology, kinesiology, naturopathy, Pilates, reflexology, Rolfing, shiatsu, Tai Chi, Western herbal medicine and yoga. These therapies are among those excluded from the private health insurance rebate as of 1 April 2019.

To support NHMRC in their evidence review, **HT**ANALYSTS were engaged to conduct a systematic review of the evidence of clinical effectiveness of Tai Chi. Eligible studies received from the Department's public call for evidence, the Natural Therapies Review Expert Advisory Panel (NTREAP) and NTWC were assessed for eligibility and where eligible, included in the evidence evaluation.

This evidence evaluation report has been developed by **HT**ANALYSTS in conjunction with NHMRC, NTWC, and NTREAP. It describes the main body of evidence related to the effect of Tai Chi for preventing and treating health conditions. Supplementary data are provided in Appendices A to H. All associated materials have been developed in a robust and transparent manner in accordance with relevant best practice standards (2-5).

Funding

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Membership and other details of the Panel and Committee can be found at:

https://www.health.gov.au/committees-and-groups/natural-therapies-review-expert-advisory-panel

https://www.nhmrc.gov.au/about-us/leadership-and-governance/committees/natural-therapies-working-committee

Contents

List of tables

List of figures

List of appendices

List of abbreviations

BRISA	Regional Base of Health Technology Assessment Reports of the Americas
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COMET	Core Outcome Measures in Effectiveness Trials
COPD	Chronic Obstructive Pulmonary Disease
DBP	Diastolic blood pressure
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HRV	Heart rate variability
ITT	Intent-to-treat
MCID	Minimal Clinically Important Difference
MID	Minimal Important Difference
MD	Mean Difference
NHMRC	National Health and Medical Research Council
NRSI	Nonrandomised study of an intervention
NTREAP	Natural Therapies Review Expert Advisory Panel
NTWC	Natural Therapies Working Committee
OR	Odds ratios
PAHO	Pan American Health Organization
PICO	Population, Intervention, Comparator, Outcome
PP	Per protocol
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomised controlled trial
RoB	Risk of bias
RR	Risk ratios
SBP	Systolic blood pressure
SMD	Standardised mean difference
SR	Systematic review
SD	Standard deviation
TIDIER	Template for Intervention Description and Replication

Plain language summary

What was the aim of this review?

The aim of this review was to identify eligible studies and assess whether they demonstrate that Tai Chi is effective in preventing and/or treating certain injuries, diseases, medical conditions or pre-clinical conditions relevant to the Australian population. Tai Chi is a type of exercise consisting of a series of slow and rhythmic circular motions with the underlying principle involving the combination of deep breathing and relaxation with slow and gentle physical movements of a moderate intensity. This review was targeted for the Australian Government Department of Health and Aged Care to assist in their Natural Therapies Review, which was designed to determine whether certain natural therapies, including Tai Chi, have enough evidence of effectiveness to be considered re-eligible for private health insurance rebates. This review was not designed to be a complete review of all studies published for Tai Chi, nor is it intended to inform decisions about whether an individual or practitioner should use Tai Chi.

Key messages

For the populations (or conditions) assessed, Tai Chi appears to provide people with some benefit for some of the included conditions and outcomes, when compared with people who do not practise Tai Chi. The evidence assessed in this review provides low to moderate certainty. The results of this review are consistent with other systematic reviews of Tai Chi that assess comparable priority conditions assessed in this review. Other systematic reviews on populations not prioritised in this review (including healthy individuals) may have different results.

What was studied in this review?

This review identified studies using a planned literature search, with no limit on publication date. To ensure the review was manageable, the review only assessed studies for certain conditions or groups of people. These priority conditions and groups were decided based on Australian survey information and from seeking expert advice about the reasons why people in Australia commonly practise Tai Chi and the types of conditions seen by Tai Chi instructors. Included studies needed to compare the results of people who practised Tai Chi to a group of people who did not. Assessment of cost effectiveness, safety and studies of healthy populations were not included in this review.

Studies published in languages other than English were listed but not included in the assessment. Studies that compared Tai Chi with another intervention (active comparator) were listed but not included in the main analysis, because different studies used different comparators and outcome measures, which did not meet the criteria planned in the protocol.

Studies were assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework. GRADE is a method used to assess how confident (or certain) systematic review authors can be that the estimates of the effect (reported in studies) are accurate. The assessment made by the reviewer is then described as either:

- high certainty – meaning the authors have a lot of confidence that the true effect is similar to the estimated effect
- moderate certainty – meaning that the true effect is probably close to the estimated effect
- low certainty – meaning the true effect may be very different from the estimated effect

- very low certainty – meaning the true effect is probably markedly different from the estimated effect. Reviewers' confidence was so limited that interpretation was not provided.

What studies did we identify in this review?

Using a planned approach, 3288 citations from 11 databases were collected and examined. This included 21 citations submitted though the Department's public call for evidence that were not identified in the search.

Out of the 3288 citations identified, 129 studies covering 19 prioritised conditions were assessed in the evidence evaluation and are included in the results. Tai Chi exercises reported in eligible studies were consistent with how Tai Chi is practised in Australia. Most studies evaluated group Tai Chi classes that were 45 to 60 minutes long, with outcomes evaluated at the beginning and at the end of treatment. Session frequency varied across the studies but were most commonly between one and 4 sessions per week, usually lasting between 10 and 16 weeks after randomisation (or enrolment). A small proportion of studies provided longer-term follow-up data (up to 18-months). Across the included studies, Tai Chi sessions were generally conducted in small groups at tertiary institutions, medical, community or senior citizen centres. In some studies, patients were encouraged to maintain their practice at home with supplemental instruction in the form of videos (e.g. DVDs). The treatment provider was often not specified, but when reported, tended to be experienced and qualified instructors (e.g. Tai Chi master). At the time of the literature search, a further 103 studies were not published in English, 46 had been presented at conferences but did not have complete data available, and 7 studies could not be retrieved. Three studies were published after the literature search. Furthermore, 86 studies were ongoing, registered but not started, or were terminated, or completed but results were not available or could not be retrieved.

What were the main results of the review?

The evidence provides moderate to low certainty that practising Tai Chi is more effective than not practising Tai Chi for some of the conditions assessed in this review. The evidence also provides moderate to very low certainty that Tai Chi has little (or no) benefit for some of the other conditions assessed in this review. There are some conditions and outcomes assessed in this review where the effect of Tai Chi is unknown.

The evidence provides moderate certainty that Tai Chi probably:

- reduces pain (6 studies, 524 participants) and stiffness (5 studies, 427 participants) in people with osteoarthritis
- reduces fear of falling in adults at high risk of falling (4 studies, 572 participants)
- improves psychosocial wellbeing in adults with neurocognitive disorders (1 study, 74 participants)

The evidence provides low certainty that Tai Chi may:

- increase activities of daily living and psychosocial wellbeing in people recovering from acute cardiac events (1 study, 61 participants)
- decrease pain in people recovering from acute cardiac events (1 study, 61 participants)
- improve functional mobility and quality of life in people with heart failure (1 study, 30 participants)
- reduce fatigue in cancer survivors (1 study, 30 participants)
- improve state and trait anxiety and quality of life (1 study, 33 participants) in people with symptoms of anxiety

- improve some aspects of quality of life (2 studies, 65 participants) and symptoms of anxiety (1 study, 32 participants) in people living with an anxiety disorder and in perceived stress and state and trait anxiety and cardiovascular health (systolic blood pressure) (1 study, 33 participants) in people with symptoms of anxiety
- improve cardiorespiratory health in people recovering from acute cardiac events (1 study, 50 participants)
- improve motor function in people rehabilitating after stroke (1 study, 28 participants)
- reduce the number of falls in people rehabilitating after stroke (1 study, 58 participants)
- improve quality of life in people with hypertensive heart disease (1 study, 113 participants)
- improve physical functioning (4 studies, 197 participants) and psychosocial wellbeing in people with osteoarthritis (2 studies, 141 participants)
- reduce disability (1 study, 77 participants) and improve quality of life (physical) in people with neck pain (1 study, 160 participants)
- reduce the number of falls (1 study, 76 participants) and improve experience of daily living (1 study, 20 participants) in people living with Parkinson's Disease
- reduce fatigue in people undergoing treatment for cancer (2 studies, 164 participants)

The evidence provides moderate certainty that Tai Chi probably has little (to no) effect on:

- activities of daily living for people rehabilitating after stroke (2 studies, 123 participants)
- balance stability in adults at high risk of falling (1 study, 269 participants)
- pain for people with low back pain (4 studies, 404 participants)

The evidence provides low certainty that Tai Chi may have little (to no) effect on:

- respiratory health (1 study, 50 participants) or the level of dyspnoea-related disability (1 study, 60 participants) for people living with chronic obstructive pulmonary disease
- mobility (3 studies, 278 participants) or the number of people experiencing one or more falls (2 studies, 328 participants) in adults at high risk of falling
- perceived stress in people with hypertensive heart disease (1 study, 64 participants)
- knee-related quality of life in people with osteoarthritis (1 study, 32 participants)
- disability for people with low back pain (1 study, 160 participants)
- pain (2 studies, 96 participants) and psychosocial wellbeing (1 study, 77 participants) in people with neck pain
- pain in people with fibromyalgia (1 study, 31 participants)
- balance stability (2 studies, 109 participants) and motor function (5 studies, 178 participants) in people living with Parkinson's Disease
- sleep quality (1 study, 50 participants) and general health (heart rate variability) for people undergoing treatment for cancer (1 study, 114 participants)
- disease symptoms (improvement or severity) for people with depression (1 study, 38 participants)
- cardiovascular health (diastolic blood pressure) for people living with anxiety (1 study, 33 participants)
- balance stability for people with living with multiple sclerosis (1 study, 34 participants)
- neurocognitive function (2 studies, 145 participants) activities of daily living (1 study, 72 participants) or balance stability (1 study, 68 participants) in adults with neurocognitive disorders
- cardiorespiratory health for adults with coronary heart disease (1 study, 20 participants)

The effect of Tai Chi on rheumatoid arthritis and headache disorders is unknown, as no studies were found for outcomes selected as critical or important by NTWC.

Implications for health policy and research

This review assesses the evidence for certain conditions and groups of people to inform the Australian Government about health policy decisions for private health insurance rebates. The review does not cover all the reasons that people practise Tai Chi, or the reasons practitioners prescribe Tai Chi, and is not intended to inform individual choices about practising Tai Chi. This review listed, but did not assess Tai Chi versus other interventions, so no comment can be made on whether Tai Chi is better or worse than other exercises or other interventions. Studies published in a language other than English were listed, but not included in the assessment. It is not known if including these studies would have affected the overall results but could have increased the certainty of evidence across some outcomes.

The results of this review indicate that Tai Chi may improve some conditions and outcomes and not others. However, these conclusions are sometimes based on a small number of studies with limited numbers of participants, with results across studies often imprecise and inconsistent and outcomes that are relevant to patients were often not reported. Many of the studies focused on the effect of Tai Chi in people who received treatment for 12 weeks or less, so we do not know if there are benefits of Tai Chi that occur in people who continue the practice for more than 12 weeks. Information regarding the sustainability of the effect (if you stop practising Tai Chi) is also unknown.

There is a need for more studies evaluating the effectiveness of Tai Chi compared to what people usually do to treat their health conditions, with better collecting and reporting of outcomes that would be considered critical or important for decision-making.

How up to date is this review?

Searches were conducted from the earliest date included in the databases until 6 and 7 August 2020. Studies published after this date are not included. A search for recent systematic reviews was conducted up to June 2022 and results of this review were compared (where applicable) for completeness.

Executive summary

Background

Tai Chi originated as an ancient martial art in China but is now also used by people with a broad range of clinical and preclinical conditions, including problems associated with chronic pain (e.g. rheumatoid arthritis) and ageing (e.g. heart failure, chronic obstructive pulmonary disease) as well as conditions related to neuromuscular dysfunction (e.g. multiple sclerosis, balance disorders and falls prevention). Tai Chi involves a series of movements performed in a slow, focused manner and accompanied by deep breathing. It is a non-competitive, self-paced system of gentle physical exercise and stretching. There are a several styles of Tai chi, with the most practised being 'Chen', 'Wu', 'Yang', and 'Sun'. Tai Chi is often taught in classes that normally range from 45 to 90 minutes in length, dependent partly on the complexity and number of Tai Chi forms performed and can be practised without specialised equipment in any location where there is sufficient space. Classes can be tailored (e.g., Seated Tai Chi for the elderly). Most often, Tai Chi is practised with an accredited Tai Chi instructor providing supervised exercise and teaching mindful movement. It is also commonly taught through media such as DVDs.

In 2015, an overview of systematic reviews conducted for the Australian Government found no reliable evidence demonstrating the effectiveness of Tai Chi in treating any clinical condition. This systematic review includes a broader range of study types, including studies assessing the effectiveness of Tai Chi delivered for primary prevention.

Objectives

The objective of this review was to evaluate the effectiveness of Tai Chi in individuals with a described injury, disease, medical condition, or preclinical condition, including primary prevention in at-risk individuals, on outcomes that align with the reasons why people practise Tai Chi in Australia. This information will be used by the Australian Government in deciding whether private health insurance cover should be reinstated to Tai Chi, after it was excluded in 2019. This review was not designed to assess all the reasons that people practise Tai Chi, or the reasons practitioners prescribe Tai Chi and was not intended to inform individual choices about practising Tai Chi.

Search methods

Literature searches were conducted in EMBASE, MEDLINE, EMCARE, PsycINFO, AMED, CINAHL, SPORTDiscus, CENTRAL, PEDro, PUBMED and PAHO VHL to identify relevant studies published from database inception to 6 and 7 August 2020. Reference lists of key relevant articles were checked to identify any additional studies not identified through searches of the primary databases. The public was also invited by the Department of Health to submit references for published research evidence. There were no limitations on language or date of publication in the search.

Selection criteria

Randomised controlled trials that examined Tai Chi compared to control or another intervention were eligible for inclusion. Quasi-randomised studies, as well as cluster-randomised or crossover trials were also eligible. Any exercise activity named as Tai Chi that was delivered by an instructor to an individual or group of individuals, or Tai Chi that was self-practised was eligible for inclusion. There were no limits on intensity, duration of practice, style of Tai Chi practised or mode of delivery. Studies that examined Tai Chi delivered as an adjunct to another therapy were also eligible for inclusion provided that both groups received the other therapy.

The search included studies in people of any age with any injury, disease, medical condition or preclinical condition. Studies that examined Tai Chi for at-risk individual participants, but not studies assessing at-risk populations in general, were also eligible for inclusion.

The search was not restricted by comparators; however, the main comparator of interest was Tai Chi compared with control (inclusive of no intervention, waitlist or usual care if considered inactive). The secondary comparator of interest was Tai Chi compared with other comparators (inclusive of usual care, if considered active). Outcomes were not part of the eligibility criteria and were not included in the search terms but were prioritised as described below. Studies were not excluded based on country of origin, but studies published in a language other than English were not translated and were not included in the synthesis. These studies were listed in an inventory for completeness.

Data collection and analysis

After the initial search and screening process, but before data extraction, a list of conditions (and at-risk populations) in the eligible studies was collated. Priority conditions were then nominated by the NTWC for inclusion in the evidence synthesis. In determining the priority populations, the NTWC were guided by relevant Australian survey data and expert advice from NTREAP. After this, a blinded outcome prioritisation process was undertaken that included all prespecified outcome domains and measures in each eligible randomised control trial (RCT), supplemented with outcome domains or measures derived from core outcome sets (where available) or recent Cochrane reviews for that condition. The NTWC nominated up to 7 'critical' or 'important' outcomes for inclusion in the analysis and evidence synthesis of the review. For outcome domains, the NTWC applied the GRADE scoring of 0 (of limited importance for decision making) to 9 (critical for decision making). Where a study did not report a prioritised outcome for that population or condition, this was noted as an evidence gap in the review.

For each included study, data were collected and appraised by a minimum of 2 researchers, the first collected data using data extraction forms and the second checked the forms for completeness and accuracy. Risk of Bias of the RCTs was conducted using the most appropriate risk of bias assessment tool recommended by The Cochrane Collaboration (according to study design features).

In the data analysis and synthesis for each priority population, the overall certainty of evidence for a maximum of 7 critical or important outcomes were reported in GRADE summary of findings tables, with corresponding evidence statements assigned to each outcome. Reported outcomes were assessed at the 'end of treatment' and were judged based on reported minimal clinically important differences (MCIDs) (if available). In the absence of MCIDs, thresholds for effect estimates were generally considered on 3 levels: small (MD <10% of the scale) moderate (MD between 10% to 20% of the scale), or large (MD more than 20% of the scale). If the effect was quantified using an SMD, we used Cohen's guidance for interpreting the magnitude of the SMD, where 0.2 represents a small difference, 0.5 is moderate, and 0.8 is large.

Main results

A total of 191 studies were identified as eligible for inclusion in this review. Of these, 129 studies covering 19 conditions were considered in the evidence evaluation and are included in the results. For the synthesis there were 56 studies covering 17 prioritised conditions that compared Tai Chi with inactive control (no intervention, wait list or usual care). Results for studies of prioritised conditions with active comparators are presented in Appendix F2, but not in the synthesis, as the wide range of comparators and outcomes did not allow for synthesis as planned in the protocol.

At the time of the search, an additional 159 studies were awaiting classification and an additional 86 studies were recorded as ongoing (registered but not published at the time of the search). Of the studies awaiting classification, 103 were not published in English, 46 were conference abstracts with the remaining 10 studies not able to be retrieved (7) or published after the literature search (3) and therefore not assessed. Of the ongoing studies, at the time of the search, 2 studies were active but not recruiting, one study was completed but its results were not published, 25 were complete but results were not available, 22 studies were not yet recruiting participants, 25 studies were still recruiting participants, 3 studies had just completed participant recruitment, 2 studies had terminated and the status of 6 studies was unknown. Results for approximately 13 ongoing studies, that were complete but not yet available for full text review, may have been eligible for inclusion for conditions prioritised in this review, and have reported on some of the outcomes considered critical or important by NTWC.

The synthesis generally comprised of one to 5 studies for each prioritised condition. Summary of findings tables were restricted to outcomes rated as critical and important by NTWC, study results for outcomes not considered critical or important were not included in the synthesis. The results for 2 prioritised conditions (rheumatoid arthritis, headache disorders) could not be determined, as no studies were found with outcomes that were considered critical or important for this review.

All included studies examined Tai Chi exercises delivered in a manner that was applicable to the Australian context based on the description, noting that Tai Chi can be practised anywhere and Tai Chi instruction in other countries was assumed to be sufficiently similar to Tai Chi instruction in Australia. Most studies evaluated group Tai Chi classes that were 45 to 60 minutes in duration, most commonly in the Yang style (generally simplified or abbreviated versions), with outcomes evaluated at the beginning and at the end of treatment. Session frequency varied across the studies but were most commonly between one and 4 sessions per week, usually lasting between 10 and 16 weeks after randomisation (or enrolment). A small proportion of studies provided longer-term follow-up data (up to 18-months). Across the included studies, Tai Chi sessions were generally conducted in small groups at tertiary institutions, medical, community or senior citizen centres. In some studies, patients were encouraged to maintain their practice at home with supplemental instruction in the form of videos (e.g. DVDs). The treatment provider was often not specified, but when reported, tended to be experienced and qualified instructors (Tai Chi master).

Studies were assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework. GRADE combines information to assess overall how certain systematic review authors can be that the estimates of the effect (reported across a study/s for each critical or important outcome) are correct. High certainty means the authors have a lot of confidence that the true effect is similar to the estimated effect. Moderate certainty means that the true effect is probably close to the estimated effect. Low certainty means the true effect might be markedly different from the estimated effect. Very low certainty means the true effect is probably markedly different from the estimated effect.

This review identified 17 conditions for which there was evidence about the effect of Tai Chi on an outcome considered critical or important by NTWC. The evidence provides:

Moderate certainty that Tai Chi probably results in:

- a moderate reduction in pain (6 studies, 524 participants) and a moderate reduction in stiffness (5 studies, 427 participants) in people with osteoarthritis
- a slight reduction in fear of falling in adults at high risk of falling (4 studies, 572 participants)
- a slight improvement in psychosocial wellbeing in adults with neurocognitive disorders (1 study, 74 participants)

Low certainty that Tai Chi may result in:

- a large increase in activities of daily living and psychosocial wellbeing in people recovering from acute cardiac events (1 study, 61 participants)
- a large decrease in pain in people recovering from acute cardiac events (1 study, 61 participants)
- a large improvement in functional mobility and a large improvement in health-related quality of life in people with heart failure (1 study, 30 participants)
- a moderate reduction in fatigue in cancer survivors (1 study, 30 participants)
- a moderate improvement in state and trait anxiety (1 study, 33 participants) and a moderate improvement in some aspects of health-related quality of life (2 study, 65 participants) and cardiovascular health (systolic blood pressure, SBP) (1 study, 33 participants) in people with anxiety disorder of living with symptoms of anxiety
- a moderate improvement in physical functioning in people with osteoarthritis (4 studies, 197 participants)
- a slight improvement in cardiorespiratory health in people recovering from acute cardiac events (1 study, 50 participants)
- a slight improvement in motor function (1 study, 28 participants) and a slight reduction in the number of falls (1 study, 58 participants) in people rehabilitating after stroke
- slight improvement in health-related quality of life in people with hypertensive heart disease (1 study, 113 participants)
- a slight reduction in disability/function (1 study, 77 participants) and a slight improvement in quality of life (physical) in people with neck pain (1 study, 160 participants)
- a slight reduction in the number of falls (1 study, 76 participants) and a slight improvement in motor aspects of experience of daily living (1 study, 20 participants) in people living with Parkinson's Disease
- a slight reduction in fatigue in people undergoing treatment for cancer (2 studies, 164 participants)
- a slight improvement in symptoms of anxiety in people living with an anxiety disorder (1 study, 32 participants)
- a slight improvement in perceived stress in people with symptoms of anxiety (1 study, 33 participants)

Moderate certainty that Tai Chi probably results in little (to no) change in:

- activities of daily living for people rehabilitating after stroke (2 studies, 123 participants)
- balance stability in adults at high risk of falling (1 study, 269 participants)
- pain for people with low back pain (4 studies, 404 participants)

Low certainty that Tai Chi may result in little (to no) change in:

- respiratory health (1 study, 50 participants) or the level of dyspnoea-related disability (1 study, 60 participants) for people living with chronic obstructive pulmonary disease (COPD)
- mobility (3 studies, 278 participants) or the number of people experiencing at least one or more falls (2 studies, 328 participants) in adults at high risk of falling
- perceived stress in people with hypertensive heart disease (1 study, 64 participants)
- knee-related quality of life in people with osteoarthritis (1 study, 32 participants)
- disability for people with low back pain (1 study, 160 participants)
- pain (2 studies, 96 participants) and psychosocial wellbeing (1 study, 77 participants) in people with neck pain

- pain in people with fibromyalgia (1 study, 31 participants)
- balance stability (2 studies, 109 participants) and motor function (5 studies, 178 participants) in people living with Parkinson's Disease
- sleep quality (1 study, 50 participants) and general health (heart rate variability, HRV) for people undergoing treatment for cancer (1 study, 114 participants)
- disease symptoms (improvement or severity) for people with depression (1 study, 38 participants)
- cardiovascular health (diastolic blood pressure, DBP) for people living with an anxiety disorder (1 study, 33 participants)
- balance stability for people with living with multiple sclerosis (1 study, 34 participants)
- neurocognitive function (2 studies, 145 participants) activities of daily living (1 study, 72 participants) or balance stability (1 study, 68 participants) in adults with neurocognitive disorders
- cardiorespiratory health for adults with coronary heart disease (1 study, 20 participants)

The evidence provides very low certainty of the effect of Tai Chi versus inactive control (no intervention, wait list or usual care) for 12 out of the 134 critical or important outcomes prioritised for analysis in this review.

Of the 134 outcomes prioritised as critical or important in this review 73 were not addressed by any studies, and therefore the effect of Tai Chi on these 73 outcomes is unknown.

A summary of harms of Tai Chi is not possible, as it was out of scope of this review to assess adverse outcomes related to the practice of Tai Chi.

Limitations

This review is limited to analysis of conditions prioritised by NTWC, who were guided by relevant patient and/or practitioner reported Australian survey data (where available) and expert advice from NTREAP during the prioritisation process, therefore this report may not cover all the reasons people practise Tai Chi. Importantly, we did not evaluate the effect of Tai Chi in healthy populations, and our strict eligibility criteria for defining at-risk populations did not allow for an assessment of the benefits of Tai Chi for health promotion.

The outcomes assessed in this review were limited to those deemed critical or important by NTWC for each priority condition. For 2 priority conditions (headache disorders, rheumatoid arthritis) there was no available evidence on specified outcomes, and most other conditions had evidence for only one to 4 critical or important outcomes.

The diverse range of prioritised conditions, combined with a small number of studies makes it challenging to draw strong conclusions about the effectiveness of Tai Chi. There is also a large amount of data which remains unpublished or untranslated, as well as a large number of ongoing studies. Results of these studies may or may not support the use of Tai Chi. Given the wide variety of active comparators, outcomes and conditions, an examination of the effectiveness of Tai Chi compared with other forms of exercise or other interventions was not conducted. It is unknown whether the results of these studies would affect the overall conclusions of this review.

Conclusions

The evidence provides moderate to low certainty that practising Tai Chi is more effective than not practising Tai Chi for some of the prioritised conditions and outcomes assessed in this review, including people with cancer fatigue, anxiety disorders, cognitive decline, recovery after stroke, rehabilitation after an acute cardiac event, Parkinson's disease, hypertensive heart disease, heart failure, osteoarthritis, neck pain, and fear of falling in people at high risk of falls. In some cases, the evidence also provides moderate to very low certainty that Tai Chi has little (to no) effect for some of the prioritised conditions and outcomes assessed in this review. There were 2 conditions and outcomes assessed in this review where the effect of Tai Chi is unknown.

The results of this review are generally consistent with systematic reviews of Tai Chi published up until June 2022 that focus on comparable priority populations (or conditions), which conclude that there is an absence of high certainty evidence that practising Tai Chi is more effective than not practising Tai Chi. More research is needed to reach a definitive conclusion on the effectiveness of Tai Chi for preventing and treating health conditions.

1 Background

In 2015, an Australian Government review of Tai Chi found very low quality evidence assessing its efficacy in treating any clinical condition (6, 7). The 2015 review was underpinned by an overview of systematic reviews (SRs) that focused solely on Tai Chi and were published in the English language between 2008 and June 2014. Randomised controlled trials (RCTs) that were reported within this review included SRs and assessed Tai Chi delivered to treat any clinical condition or health problem were included, with outcomes selected according to predefined criteria. This review is not limited by publication date and a broader range of study types were eligible for inclusion (inclusive of quasi-randomised studies). The updated review also included studies that assessed Tai Chi delivered for primary prevention. Similar to the 2015 review, eligible comparisons were Tai Chi versus control and Tai Chi versus other interventions. Studies not published in the English language were not translated, and databases in languages other than English were not searched.

1.1 Description of the condition

Tai Chi has been widely practised in China as an art form, religious ritual, relaxation technique and exercise for centuries. However, it was only in the early 1980s that research into the potential health benefits of Tai Chi began to surface (8), extending the practice to the greater community as a common recreational exercise. Tai Chi has been used for a variety of health-related benefits, including stress reduction (9), improved agility and balance (10), lower extremity strength (11), and posture control (12), as well as reduction of a variety of cardiovascular risk factors (13).

Given the breadth of the review and variety of potential conditions for which Tai Chi is used, a concise description of each condition or population addressed is provided before each result. A summary of the populations and conditions identified is provided in Section 4.1.5.

Tai Chi can be practised in a range of settings (see Section 1.2 Description of the intervention) and as such this review was not limited by setting.

1.2 Description of the intervention

Tai Chi is a traditional Chinese martial art that was developed in the 13th century (14). Consisting of a series of slow and rhythmic circular motions moving from one form to another, Tai Chi is based upon the assumption from Confucian and Buddhist philosophy, in which 2 opposing life forces, yin and yang, govern our health (15). From a Traditional Chinese Medicine perspective, this extends to free flow of internal energy within the body, termed ‘qi’ or ‘chi’. In focussing on the controlled breathing and circular body movements, Tai Chi facilitates the flow of ‘qi,’ harmonising a person’s yin and yang. Over the years, a variety of Tai Chi styles have been developed in which ‘Chen’, ‘Wu’, ‘Yang’, and ‘Sun’ are the most practised styles. Differentiation in the varying styles is dependent on the selected ‘forms’ or postures, the order of the movement sequence, pace of movement, emphasis on muscle work, and the angle of knee flexion during the practice (16). For example, in a classic Yang style Tai Chi, there are 108 forms, whereas the Wu style consists of 119 forms.

Despite the unique characteristics of each style, they are all based upon the same underlying principles involving the combination of deep breathing and relaxation with slow and gentle physical movements of a moderate intensity. Small variations in intensity are common but the peak heart rate and oxygen consumption achieved during Tai Chi practice is generally less than 60% and 55% of the age-predicted maximal heart and maximal oxygen consumption respectively (17).

Tai Chi can be practised at any time, without specialised equipment, and in any location where there is sufficient space. Most commonly Tai Chi is practised outdoors in parks or recreational areas with an accredited Tai Chi instructor providing supervised exercise and teaching mindful movement. It is also commonly taught through media such as DVDs. It can be practised by anyone, regardless of age or level of fitness, and is usually taught and practised in groups. Classes or exercise sessions can be adapted to provide gentle strength, flexibility and balance training, tailored to provide individual problem or condition specific Tai Chi exercise variations. After being taught the Tai Chi principles and completing a series of supervised tailored exercise sessions individuals may also practise Tai Chi at home, following a prescribed homework exercise program.

The intervention classes typically range from 60 to 90 minutes in length and vary in the expertise of the instructor, the extent to which a program is tailored to the individual (e.g., general fitness or individual programs such as Seated Tai Chi or Tai Chi for the elderly), size (small to large groups) and setting (gymnasium, community parks or in allied health practices such as common rooms in hospitals). The duration of the practice is also dependent on the complexity and number of Tai Chi forms performed. In a Yang style, each cycle may last from 5 minutes (for 'Simplified Yang style 24-forms') to around 20 to 30 minutes (for 'Classical Yang style 108-forms'). The cycle is usually repeated until the desired practise duration is obtained.

In Australia there is one main industry body that supports Tai Chi practitioners in their professional practice, the Tai Chi Association of Australia (TCAA). While the training of Tai Chi professionals varies, accredited member instructors typically hold recognised qualifications or deemed as a Tai Chi 'master'. The professional bodies also aim to regulate the quality and scope of Tai Chi practise, through provision of codes of conduct, codes of ethics and provision of continuing education.

1.3 How the intervention might work

Numerous physical benefits of Tai Chi have been suggested and are thought to arise in part due to the regular practice of exercise, which can enhance cardiopulmonary fitness and lead to stress reduction. Recognised as an exercise of moderate intensity, Tai Chi combines deep diaphragmatic breathing and relaxation with slow and gentle movements, while maintaining a range of postures. Tai Chi is performed most often in a semi squat position, whereby each posture varies in terms of base support (single- or double-leg stance), shifting of body weight, and types of muscle work (isometric or isotonic), as well as the patterns of upper and lower limb movement (16). For example, the form titled 'Waving hands in the cloud' involves waving the arms up and down alternately in circular forms while side stepping and shifting weight of the lower limbs concurrently. The form called 'Pushing the mountain' involves stepping forward, while at the same time pushing the arms forward. Tai Chi is characterised by slow and deliberate foot placements, and when practised correctly, the movements of Tai Chi flow imperceptibly from one into another.

In regard to the metabolic demands, Tai Chi is approximately equivalent to walking at a speed of 6 kilometres per hour (9), with an average increase in heart rate of 50% observed in a short-form style (18). In addition to the health-promoting benefits of exercise, Tai Chi is described as a total 'mind-body' exercise, utilising a 'top-down' method with emphasis on cognition, breathing and visualisation (19).

Tai Chi is believed to encourage movement, improve motor control, and facilitate a return to functional activities, which is why it is increasingly incorporated into physical therapy rehabilitation programs. In older adults, the practice of Tai Chi is used for falls prevention as it is thought to reduce the risk of falls as well as improve cardiorespiratory and musculoskeletal function and posture control capacity. The integration of mind and body balanced with breath control using modified Tai Chi is also thought to improve quality of life in people with certain conditions and has been suggested to be more effective than other physical therapies on improving physical function and depression in people with low back pain (20).

1.4 Why it is important to do this review

In Australia, natural therapies, including Tai Chi, are most often used in conjunction with conventional medicine and other strategies for maintaining good health and wellness. Tai Chi is a popular form of exercise in Australia, with a 2017 survey estimating that more than 127 000 Australians currently participate in Tai Chi (21). For these reasons, it is important to synthesise the evidence for the effectiveness of Tai Chi, to enable consumers, health care providers and policy makers to make informed decisions about care.

The 2015 Australian Government review identified 37 SRs containing evidence from 117 unique RCTs involving a total of 8852 participants across sixteen clinical conditions. The authors proposed that, compared with control, there is (a) very low certainty evidence to suggest that Tai Chi may have some beneficial health effects in a number of conditions for a limited number of outcomes including older people (muscle strength), heart disease (quality of life), hypertension (SBP, DBP), and osteoarthritis (physical function); and (b) very low certainty evidence that Tai Chi may have no effects on selected outcomes in people who are older (falls) and people with heart disease (HRV, exercise capacity) compared to a control.

Compared to other comparators, the 2015 review suggested that there is very low- certainty evidence that Tai Chi may have beneficial effects relative to other active comparators in a limited number of conditions and for a limited number of outcomes including hypertension (SBP, DBP), osteoporosis (bone mineral density) and type 2 diabetes (glycaemic control, fasting blood glucose, total cholesterol). It was also suggested that there was very low-certainty evidence that Tai Chi may have beneficial effect on selected outcomes in people with osteoarthritis (pain, physical function) relative to active comparators.

Overall, the health effects of Tai Chi were uncertain (6). This was primarily due to the methodological limitations of the primary studies, which included small sample sizes, short follow-up periods and inconsistent outcome reporting. The overall poor quality of the included SRs meant that the magnitude and clinical significance of any potential health benefits are uncertain.

2 Objectives

To conduct a systematic review of RCTs (and quasi RCTs) to evaluate the effectiveness of Tai Chi in individuals with a described injury, disease, medical condition, or preclinical condition, including disease prevention in at-risk individuals.

The intent was to evaluate the evidence representative of the populations and conditions commonly seen by Tai Chi instructors in Australia, the intervention(s) commonly used by the instructor, and outcomes that align with the reasons why people use Tai Chi and/or instructors administer Tai Chi.

The review was to be supplemented with NRSIs for certain populations, settings or outcomes when a NRSI study design was more appropriate or feasible, in line with Cochrane recommendations (22). No such search was required as available RCT evidence was judged to suitably cover the priority populations.

Table 1 lists the conditions identified and considered in this review and specifies whether studies were identified that assessed Tai Chi versus the main comparator of interest, inactive control.

Prioritised populations (no hierarchy) are listed below:

- Neoplasms (cancer)
- Depression
- Anxiety
- Neurocognitive (dementia and mild cognitive impairment)
- Rehabilitation after acute cerebrovascular stroke
- Parkinson's disease
- Multiple sclerosis
- Headache disorders
- Rehabilitation after acute cardiac event
- Hypertensive heart disease
- Coronary heart disease
- Heart failure
- Rehabilitation due to chronic obstructive pulmonary disease
- Osteoarthritis
- Rheumatoid arthritis
- Low back pain
- Neck pain
- Fibromyalgia
- Prevention of falls in those at high risk

3 Methods

Methods reported in this systematic review are based on that described in the *Cochrane Handbook for Systematic Reviews of Interventions* (23) and relevant sections in the *JBI Manual for Evidence Synthesis* (24, 25). Covidence (www.covidence.org), a web-based platform for producing SRs, was used for screening citations and recording decisions made. Covidence is compatible with EndNote and Microsoft Excel, which were used for managing citations and data extraction, respectively. Where appropriate, Review Manager 5.4 (26) was used for the main analyses and GRADEpro GDT software (www.gradepro.org) was used to record decisions and derive an overall assessment of the certainty of evidence for each outcome guided by GRADE methodology (5).

Eligible studies were assigned to an appropriate *International Classification of Disease* (ICD-11) category based on the primary clinical condition reported in the study, such that each study only contributed data to one population (see Appendix A5.4). Populations and up to 7 critical or important outcomes were prioritised to inform the data synthesis for the systematic review on the effect of Tai Chi for preventing and treating any health condition. Throughout the population and outcome prioritisation exercise, the NTWC remained blinded to the screening results (i.e. number of studies identified) or characteristics of included studies (e.g. study design, size, quality) to prevent any influence on decision-making (see Appendix A6). For prioritised conditions, risk of bias was assessed, appropriate data extracted into data extraction tables, and the results summarised into appropriate categories according to identified populations and conditions and comparators.

Summary of Findings tables were developed for studies that compared Tai Chi to control (main comparison) and which reported on outcomes rated as critical or important by the NTWC. Summary of Findings tables included up to 7 critical and important outcomes prioritised by NTWC who were guided by the GRADE framework (see Appendix A6.2 and Appendix B4).

The final approved review protocol was registered on the international prospective register of SRs (PROSPERO: CRD42020200130).

Further details on the methods and approach used to conduct the evidence evaluation are provide in Appendix A and Appendix B of the Technical Report, which outline the following:

- Appendix A1 search methods
- Appendix A2 search strategy
- Appendix A3 search results
- Appendix A4 eligibility criteria (types of studies, types of participants, types of interventions, types of outcome measures)
- Appendix A5 selection of studies (inclusion decisions)
- Appendix A6 population and outcome prioritisation process
- Appendix A7 summary screening results
- Appendix B1 risk of bias process
- Appendix B2 data extraction processes
- Appendix B3 data analysis and synthesis
- Appendix B4 summary of findings and certainty of evidence and the development of evidence statements

4 Results

4.1 Description of studies

4.1.1 Flow of studies

The literature was searched on 6 and 7 August 2020 to identify relevant studies published from database inception to the literature search date. The results of the literature search and the application of the study selection criteria are provided in Appendix A1 – A5 and Appendix C1 and C2.

A PRISMA flow summarising the screening results is provided in Figure 1. The PRISMA flow diagram shows the number of studies at each stage of search and screening process, including: the initial search; studies considered irrelevant based on the title and/or abstract; studies found not to be relevant when reviewed at full text; studies which met the eligibility criteria for inclusion in the review and the number of studies which were in considered in the analysis for prioritised conditions.

The search retrieved 439 citations corresponding to 204 RCTs that were eligible for inclusion. Of the 87 citations received through the Department's public call for evidence, 10 studies met the eligibility criteria for this review, all of which were already identified in the literature search (see **Appendix C2**). There are 159 studies (179 citations) awaiting classification and 86 studies (102 citations) recorded as ongoing.

4.1.2 Excluded studies

There were 547 citations screened at full text that were excluded for not meeting the reviews eligibility criteria. Of these, 147 had an intervention out of scope (e.g. unable to assess Tai Chi independent of other interventions), 122 had a publication type out of scope (e.g. opinion pieces), 112 were in a population out of scope (e.g. healthy population not at risk), 105 had a study design out of scope (e.g. systematic review, no comparator group), 28 had a comparator out of scope (e.g. studies compared different intensity or forms of Tai Chi), and 5 had an outcome out of scope (e.g. patient experience, cost). One other citation was excluded because the study had been retracted.

Lastly, 14 studies (28 citations) were excluded that enrolled a mixed population of participants (i.e. included both eligible and non-eligible populations). These studies did not provide suitable data for inclusion in the evidence synthesis because separate data for the eligible population was not reported. For transparency, these studies are listed separately in **Appendix C1** (Table C.2).

As per Cochrane guidelines, details of citations that were potentially eligible based on the title or abstract but after examination of the full text article were not, are presented in **Appendix C1**. Note that some studies may have been out of scope for more than one reason, but only one reason is listed for each (based on the prespecified hierarchy for inclusion).

4.1.3 Studies awaiting classification

Completed studies identified as potentially eligible for inclusion that could not be retrieved, were not translated, or did not provide complete or adequate data sufficient to make a judgement about eligibility are listed in the *Characteristics of studies awaiting classification* tables (see **Appendix C4**). This includes 46 conference proceedings/abstracts with incomplete information about the study (**Appendix C4.1**), 103 studies published in languages other than English (**Appendix C4.2**) that are probably eligible for inclusion (pending translation into English), 7 studies that were not able to be retrieved (**Appendix C4.3**), and 3 studies that were published after the literature search date (**Appendix C4.5**).

An additional 8 citations were unable to be translated or interpreted at the title/abstract stage (see **Appendix C4.4**).

Among the 159 studies awaiting classification, 89[1] were conducted in a priority population with 61[2] of these comparing Tai Chi with an inactive control (no intervention, wait list or usual activities). The studies appeared to be comparable to those included in the evidence synthesis in terms of sample size, study duration, outcomes measured. Among those published in a language other than English, many were from similar (non-English) countries (i.e. China, Korea, Thailand) to those identified and included in the review.

4.1.4 Ongoing studies

Ongoing studies that did not have published results at the time of the search (irrespective of the commencement date) are listed in the *Characteristics of ongoing studies* table (see **Appendix C5, Table C.12**). There were 22 studies 'not yet recruiting', 23 studies currently 'recruiting', and 4 studies listed as 'active but not recruiting'. Three studies had completed recruitment, but study data were not yet available, 25 studies had completed data analysis, but results were not yet published, and one study has preliminary results available on the trial registry site (but had not been through peer review). Two studies had been terminated due to slow enrolment and the status of 7 studies were unknown.

Among the 86 studies ongoing at the time of the search, 56 were conducted in a priority population with 24 of these comparing Tai Chi with an inactive control (no intervention, wait list or usual activities). Within each condition, the ongoing studies appeared to be comparable to those included in the evidence synthesis in terms of sample size, study duration and outcomes measured. Study settings were also comparable, with many ongoing studies found on Clinical trial registries of countries already identified and included in the review (i.e. China, Korea, Iran, Thailand).

4.1.5 Included studies

There were 191 RCTs identified as eligible for inclusion in the review. After prioritisation of the populations considered most relevant to the practice of Tai Chi in Australia, 129 RCTs were considered in the evidence evaluation.

For the main comparison of Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) 65 studies were considered for synthesis. Those that included NTWC prioritised critical and important outcome domains and measures, were included in the final analysis. The prioritised outcome domains are highlighted in a blue box in **Appendix F1**.

Studies that compared Tai Chi versus other active comparators (63 RCTs) or Tai Chi versus placebo/sham (1 RCT) are included in qualitative descriptions in the report, and results are listed in **Appendix F2**.

There were 62 studies that met the prespecified eligibility criteria for the review but were not included in the evidence evaluation either due to time and resource constraints (26 studies)[3] or they were conducted in populations (or conditions) not prioritised for analysis or synthesis by NTWC (36 studies) (see **Appendix A6.1**). These studies are listed in an inventory titled *Citation details of studies from low and non-priority populations* (see **Appendix C3, Table C.3**).

[1] 53 studies were in a language other than English.

[2] 39 studies were in a language other than English.

[3] 26 studies were conducted in populations (or conditions) that were ranked lower in priority by the NTWC than the included conditions.

An overview of the conditions identified and included in this review is provided in **Table 1**. Descriptions of the included studies, including an overview of the PICO criteria, a summary of the risk of bias assessment and additional information relating to the data synthesis for the main comparison can be found in **Appendix D**.

Figure 1 Literature screening results: Tai Chi

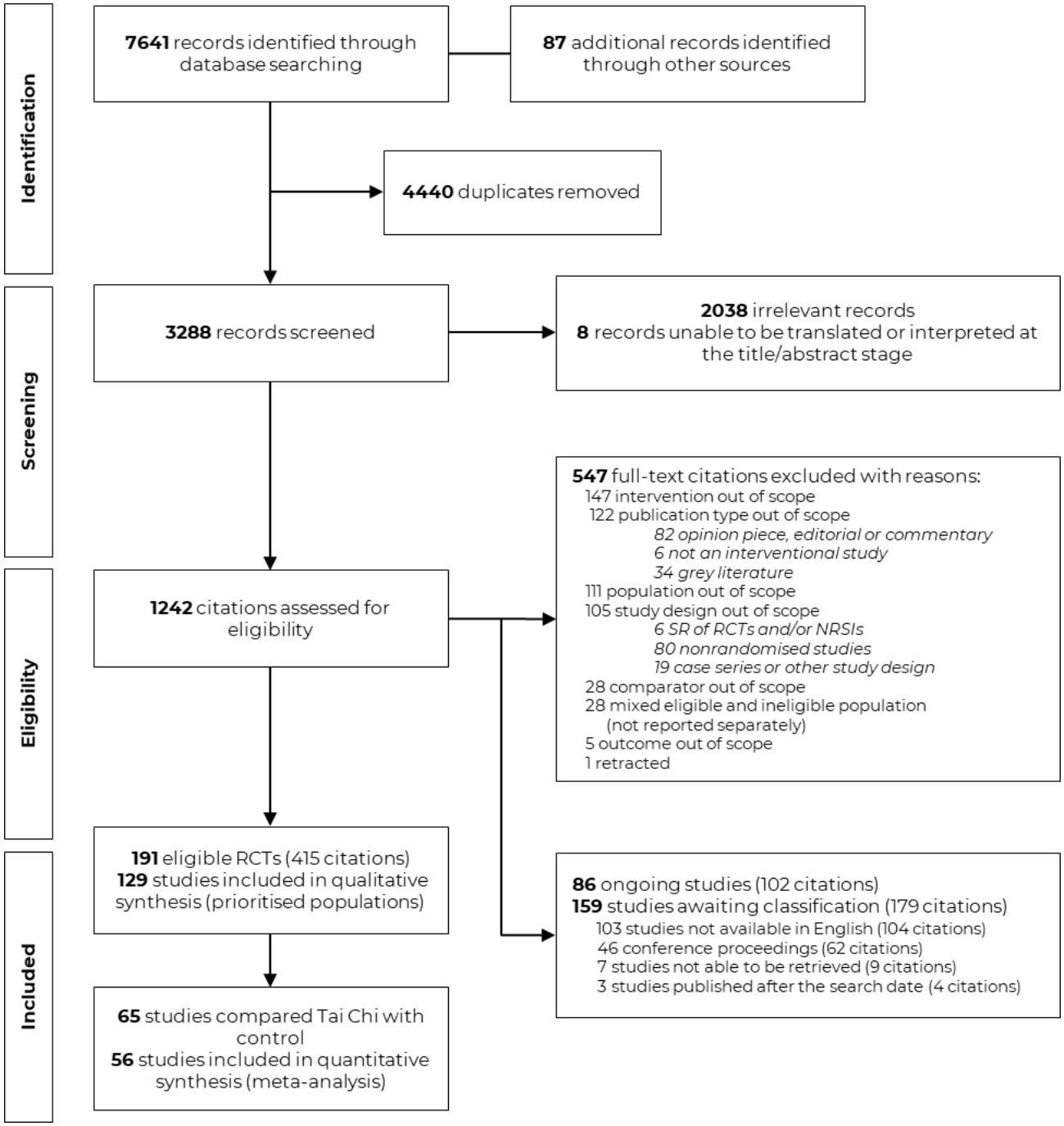


Table 1 List of conditions and population groups identified and considered in this review

ICD-11 [a]	POPULATION	# RCTs OR quasi-RCTs	Included as a priority population	Included in main comparison
01 Certain infectious and parasitic diseases				
	People living with HIV/with AIDS	2	No	--
02 Neoplasms				
	Cancer (survivors)	7	Yes	Yes
	Cancer (undergoing treatment)	5	Yes	Yes
04 Diseases of the immune system				
	Systemic Sclerosis	1	No	--
05 Endocrine, nutritional and metabolic diseases				
	Diabetes, type 2	9	No	--
	Metabolic syndrome	1	No	--
	Obesity (adults, adolescents)	6	No	--
06 Mental and behavioural disorders				
	Mood disorders, Depression (or dysthymia)	4	Yes	Yes
	Anxiety or fear-related, Generalised Anxiety Disorder	1	Yes	Yes
	Symptoms of anxiety	2	Yes	Yes
	Neurocognitive, Dementia	5	Yes	Yes
	Neurocognitive, Mild cognitive impairment	3	Yes	Yes
	Neurodevelopmental, intellectual disability (adolescents)	1	No	--
	Schizophrenia and related (chronic)	2	No	--
	Substance abuse, (alcohol, amphetamines, or opioids)	4	No	--
07 Sleep-wake disorders				
	Insomnia (chronic, primary, perimenopause)	3	No	--
	Obstructive sleep apnoea	1	No	--
	Sleep disturbance, daytime sleepiness	2	No	--
08 Diseases of the nervous system				
	Stroke recovery	9	Yes	Yes
	Parkinson's disease	11	Yes	Yes
	Multiple sclerosis (women)	1	Yes	Yes
	Headache disorders, tension-type	1	Yes	No
09 Disease of the visual system				
	Impaired vision (worse than 6/18 but equal to or better than 3/60)	1	No	--
10 Diseases of the ear or mastoid process				
	Vestibulopathy	1	No	--
11 Diseases of the circulatory system				
	Rehabilitation after acute event (myocardial infarction, percutaneous coronary intervention)	4	Yes	Yes
	Hypertension (includes pre/early)	7	Yes	Yes
	Coronary heart disease	3	Yes	Yes
	Heart failure, chronic (with/without preserved ejection fraction)	7	Yes	Yes

ICD-11 [a]	POPULATION	# RCTs OR quasi-RCTs	Included as a priority population	Included in main comparison
12 Diseases of the respiratory system				
	Chronic obstructive pulmonary disease	9	Yes	Yes
15 Diseases of the musculoskeletal system or connective tissue				
	Arthropathies, Chronic ankle instability (>6 months)	1	No	--
	Arthropathies, Osteoarthritis (hip or knee)	15 [b]	Yes	Yes
	Arthropathies, Rheumatoid arthritis	1	Yes	No [c]
	Osteopathies, Osteopenia or osteoporosis	4	No	--
	Soft tissue disorders, Sarcopenia	1	No	--
	Spinal conditions, Inflammatory spondyloarthritis (axial/ankylosing)	2	No	--
16 Diseases of the genitourinary system				
	Benign prostate hyperplasia	1	No	--
	Chronic kidney disease (with cardiovascular disease)	1	No	--
21 Symptoms, signs or clinical findings, not elsewhere classified				
	Low back pain, acute or chronic	6	Yes	Yes
	Neck pain, chronic (nonspecific, mechanical)	2	Yes	Yes
	Chronic widespread pain, Fibromyalgia	6	Yes	Yes
22 Injury, poisoning or certain other consequences of external causes				
	Anterior cruciate ligament injury (partial)	1	No	--
	Spinal cord injury	1	No	--
	Traumatic brain injury (with cognitive impairment)	1	No	--
24 Factors influencing health status or contact with health services				
	Employment conditions, Nurses at risk of musculoskeletal injury or reduced wellbeing	2	No	--
25 Prevention				
	01 Adults (60–80 yrs.) at risk of shingles	1	No	--
	04 Adults (40+ yrs.) at risk of obesity/metabolic syndrome	2	No	--
	11 Women with increased waist circumference and family history of cardiovascular disease	1	No	--
	11 Adults (55–70 yrs.) at high risk of ischaemic stroke	1	No	--
	15 Adults (>50 yrs.) at risk of osteopenia	4	No	--
	Adults (frail, in assisted living, using wheelchair) at risk of age-related physical or cognitive decline	4	No	--
	Adults (preclinically disabled, with dizziness/balance impairment/history of falls/fear of falling) at high risk of falls	20 [d]	Yes	Yes
	Adults (community, assisted living, nursing home) at risk of falls	13	Partial Yes [e]	No
	Grand Total	**204**	**129**	**115**

-- Not applicable

a. International Statistical Classification of Diseases and Related Health Problems 11th Revision (ICD-11)-WHO Version (2021)

b. Includes one study in people with OA rehabilitating after total knee arthroscopy and one study that includes people living with any type of arthritis.

c. No inactive comparator

d. Includes one study in people with distal symmetric polyneuropathy.

e. These studies enrolled mixed populations of eligible participants (with history of falls etc.) and noneligible participants (healthy, no risk factors) but did not provide suitable data for analysis of the eligible subgroup (See Appendix C3 Table C.4).

4.2 Neoplasms

4.2.1 Description of the conditions

4.2.1.1 Breast cancer

Breast cancer is the most common type of cancer for females, with an estimated 1 in 7 females being diagnosed before the age of 85 (27). In 2020, approximately 19 807 females and 167 males will be diagnosed with breast cancer, with about 2997 females and 33 males expected to die from the disease (28). Breast cancer is caused by abnormal growth of cells in the lobules, ducts and connective tissue (28). There are 5 stages of breast cancer, from 0 to IV (28). Stage 0 refers to preinvasive breast cancer. Treatment often involves breast surgery or radiotherapy to prevent invasive breast cancer developing. Stage I to Stage IIB (early) refers to early breast cancer. Stage IIB (advanced) to IV, refers to locally advanced breast cancer or metastatic breast cancer. Locally advanced or metastatic breast cancer usually involves a combination of treatments, including chemotherapy, breast surgery, radiotherapy or targeted and hormonal therapies (28).

There are many risk factors associated with breast cancer (such as age, genetic mutations, family history of breast or ovarian cancer) that are not modifiable (29). However, there are lifestyle factors that are associated with a decreased risk of breast cancer including physical activity and a diet with high vegetable intake, calcium and dairy consumption (29). Local and international guidelines (30-32) encourage physical therapy before, during and after treatment as exercise is believed to provide functional and psychological benefits, improve quality of life and reduce the risk of recurrence. Cancer Australia (32) and the Clinical Oncology Society of Australia (COSA) advise patients with cancer to undertake regular aerobic exercise and resistance exercise (strength training) that is tailored to the person's fitness, health and abilities.

4.2.1.2 Lung cancer

Lung cancer occurs when abnormal cells multiply uncontrollably inside the lungs. Approximately 12 200 people are diagnosed with lung cancer in Australia each year, with the average age at diagnosis being 72 years (33). Lung cancer is more common in men than in women. Primary lung cancer (i.e. cancer originating in the lungs) can spread to the lymph nodes, brain, bones, and other parts of the body (33). Non-small cell lung cancer (NSCLC) accounts for 85% of all lung cancers, while small cell lung cancer (SCLC) accounts for approximately 15% of all lung cancers. NSCLC can be classified as adenocarcinoma, squamous cell carcinoma, or large cell undifferentiated carcinoma.

Tobacco smoking is associated with 90% of lung cancers in men and 65% of lung cancers in women; however, about one in 5 (21%) people with lung cancer have never been smokers (33). Exposure to asbestos or radioactive gas also increases the risk of developing lung cancer (33). Treatment of early or locally advanced lung cancer is intended to be curative, while the goals of advanced lung cancer treatment are primarily to maintain quality of life, manage symptoms and slow down the spread of the cancer. Treatments include surgery, chemotherapy, radiation, targeted therapy or immunotherapy (33).

Symptoms of lung cancer include breathlessness, pain, difficulty sleeping, poor appetite and weight loss. Cancer Australia guidelines recommend that people with lung cancer learn relaxation or meditation techniques to help manage pain and difficulties sleeping, with gentle exercise (if recommended by doctor) though to help increase energy levels to combat fatigue (33).

4.2.1.3 Nasopharyngeal carcinoma

Nasopharyngeal cancer is a type of throat cancer. The nasopharynx is the highest part of the throat, located behind the nose and connecting the nasal cavity to the oropharynx (34). Risk factors associated with nasopharyngeal cancer are exposure to the Epstein-Barr virus, smoking, age greater than 40 years, male sex, and southern Chinese or southeast Asian ancestry (34).

Radiation therapy is the main treatment for nasopharyngeal cancer, and it can either be used definitively or palliatively (34). Definitive radiation therapy can be curative and may be combined with chemotherapy. Palliative radiation therapy is used to relieve symptoms such as pain, bleeding, and pressure symptoms from the tumour (34). Common side effects after treatment for throat cancers vary and include fatigue, mouth sores and dry mouth, changes to taste, smell and appetite, swallowing problems, malnutrition and weight loss and changes to breathing and speech (35). As with other types of cancer, Cancer Australia and COSA recognise that regular exercise should be prescribed to all cancer patients to help manage the effects of cancer and its treatment (36).

4.2.1.4 Solid tumours

Solid tumours are masses of abnormal cells that can develop in organs of the body such as the lungs (37). By contrast, liquid tumours occur in the blood, bone marrow, or lymph nodes (37). The most common types of solid cancer in women are breast, colorectal, melanoma, lung and uterine cancer (38). Prostate, colorectal, melanoma, lung and head and neck cancers are the most common types of solid cancer in men (38).

Treatment of solid cancers depends on the type of tumour and the stage at diagnosis. There are around 145 000 new cases of cancer per year, most of which are solid cancers (38). As with other types of cancer, Cancer Australia and COSA recognise that regular exercise should be prescribed to all cancer patients to help manage the effects of cancer and its treatment (36).

4.2.2 Description of studies

4.2.2.1 Cancer (survivors)

Twenty-six citations (39-64) corresponding to 6 RCTs (Campo 2013, Irwin 2014a, Larkey 2011, Mustian 2004a, Natma 2015, Wang 2013b) and one quasi-RCT (Galatino 2003) were identified in the literature. No additional studies were identified in the Department's public call for evidence. There were 5 studies awaiting classification and 10 ongoing studies. An overview of the PICO criteria of included studies is provided in Appendix D1.1.1.

Five studies (Campo 2013, Galantino 2003, Irwin 2014a, Larkey 2011, Mustian 2004) were conducted at various community or outpatient cancer centres in the United States. One study (Natma 2015) was conducted in a single centre in Thailand and one study (Wang 2013b) was carried out at single centre in China. Sample size ranged from 11 to 101 (total 358), with 6 studies enrolling breast cancer survivors (Campo 2013, Galatino 2003, Irwin 2014a, Larkey 2011, Mustian 2004a, Natma 2015) and 2 studies enrolling participants with non-small cell lung cancer (NSCLC) after surgery (Jiang 2020, Wang 2013b). In most studies, people who exercised regularly or had health conditions that could interfere with the ability to participate were excluded.

Among breast cancer survivors, a variety of enrolment criteria were specified. One study (Campo 2013) included women aged 55 years or above who had been treated for a solid tumour cancer (stages I to III) and had some physical function limitations. Most (83%) participants had breast cancer with the mean time since treatment being 5.3 and 8.5 years. Two studies (Galantino 2003, Larkey 2011) enrolled with women with self-reported cancer-related fatigue. In Galantino 2003, participants were aged between 40 and 59 years and had undergone adjuvant therapy in the previous year for stage II to IV breast cancer. In Larkey 2011, participants were aged between 45 and 75 years, postmenopausal, and were between 6 months and 5 years post primary treatment for stages 0 to III breast cancer. One study (Irwin 2014a) enrolled women who had been diagnosed with primary insomnia who were aged between 30 and 85 years and had completed treatment for breast cancer (stage not specified) at least 6 months prior to study entry. One study (Mustian 2004) enrolled women who had competed treatment (stages I to IIIb) between one week and 30 months prior and one study (Natma 2015) included women who had completed treatment (stages 0 to IIIb) at least one year prior.

Among people with NSCLC, one study (Wang 2013b) enrolled people who were at least 2 years post-lobectomy due to stage I to IIIb NSCLC.

Two studies (Natma 2015, Wang 2013b) compared a modified form of Tai Chi with an inactive control (no intervention or usual care). In Wang 2013b, all participants continued to receive routine nursing or medical care. The other 5 studies compared varying styles of Tai Chi with another intervention; being either a wellness education program that covered topics related to aging, including sleep quality, nutrition, and pain (Campo 2013), a low impact self-paced walking program (Galantino 2013), cognitive behavioural therapy specifically designed for participants with insomnia (Irwin 2014a), sham Qigong that included movements created to mimic the Qigong/Tai Chi exercises (Larkey 2011), or psychosocial support therapy that was guided by Spiegel's Supportive-Expressive Group Therapy model (Mustian 2004).

In all studies, Tai Chi sessions were typically 60 minutes in duration, but the exercise programs ranged in intensity from 3 times a week for 6 week (Galantino 2003), 12 weeks (Campo 2013, Mustian 2004) or 16 weeks (Wang was 2013b) down to once a week for 12 weeks (Larkey 2011, Natma 2015). In Irwin 2014a the Tai Chi classes were delivered weekly for 120 minutes over 12 weeks.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.2.4.1 Cancer (survivors)) (and Appendix F2).

Results from 4 RCTs (Campo 2013, Galantino 2003, Irwin 2014a, Mustian 2004) that examined Tai Chi versus an active comparator are presented in Appendix F2. Results from one RCT (Larkey 2011) that compared the effect of Tai Chi in breast cancer survivors with a sham intervention[4] are also presented in Appendix F2.

4.2.2.2 Cancer (on treatment)

Six citations (65-70) corresponding to 5 RCTs (Jiang 2020, McCain 2010, McQuade 2017, Zhang 2016, Zhou 2018) were identified in the literature. No additional studies were identified in the Department's public call for evidence. There are no studies awaiting classification and 3 ongoing trials. An overview of the PICO criteria of included studies is provided in Appendix D1.2.1.

[4] The systematic review protocol did not state how a sham control group would be considered in the evidence synthesis; therefore the study is not included alongside those that included a Control (no intervention, waitlist, usual care) group. This is the intended approach used for the review of Shiatsu (placebo/sham interventions to be considered separate).

Two RCTs (McCain 2010, McQuade 2017) were carried out in a multicentre setting in the United States, and 3 studies (Jiang 2020, Zhou 2018, Zhang 2016 were conducted in community settings in China. Sample sizes ranged from 76 to 145 (total 413 participants). The studies enrolled people receiving treatment for cancer including women with breast cancer (stages I to IIIa) who were receiving adjuvant chemotherapy (McCain 2010); men with prostate cancer (stages I to III) who were undergoing daily radiotherapy (McQuade 2017), people with lung cancer who were experiencing postoperative pain after completion of lobectomy (Jiang 2020) and who had received chemotherapy or radiotherapy more than 6 months prior to surgery, people with lung cancer (ECOG[5] status 0 to 3) receiving cisplatin-based chemotherapy (Zhang 2016); and people with nasopharyngeal carcinoma (stage III or IV) undergoing chemotherapy (Zhou 2018).

Four studies (Jiang 2020, McCain 2010, McQuade 2017, Zhou 2018) compared a modified form of Tai Chi with control (no intervention, waitlist, or usual care). The Tai Chi was typically based on a classical Yang style and was modified especially for cancer patients. In Jiang 2020, all participants continued to receive routine nursing or medical care. Two studies also included another intervention group, being either a wellness education program focused on spiritual growth (McCain 2010) or a low-impact exercise program that focused on light resistance training and stretching exercises (McQuade 2017). One study (Zhang 2016) compared Yang style Tai Chi to home- or community-based low-impact exercises.

The exercise programs ranged in duration and intensity. In one study (McCain 2010) Tai Chi was practised for 90 minutes a week for 10 weeks. Patients were given a DVD and printed instructional materials and encouraged to practice daily on their own. In Jiang 2020, DVD-guided Tai Chi was practised at home for 60 minutes a day over 3 months. In McQuade 201, sessions were 40 minutes in duration and were practised 3 times per week throughout radiotherapy with classes mostly conducted one-on-one or with one or 2 other patients. In Zhang 2016, the interventions were delivered starting on day 10 day of the 21-day chemotherapy cycle and practised for one hour every other day at the same time. In Zhou 2018, Tai Chi was practised for 60 minutes for 5 sessions per week, sometimes at home and sometimes in hospital.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.2.4.1, Cancer (on treatment)) (and Appendix F2). Results from the studies that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.2.3 Risk of Bias – per item

The risk of bias of included RCTs for people with cancer is illustrated in Figure 2 and Figure 3. A summary is provided in Appendix D1.1.2 (survivors) and Appendix D1.2.2 (on treatment).

One study (Larkey 2011) was judged to be at overall low risk of bias.

[5] Eastern Cooperative Oncology Group

Figure 2 **Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Cancer (survivors)**

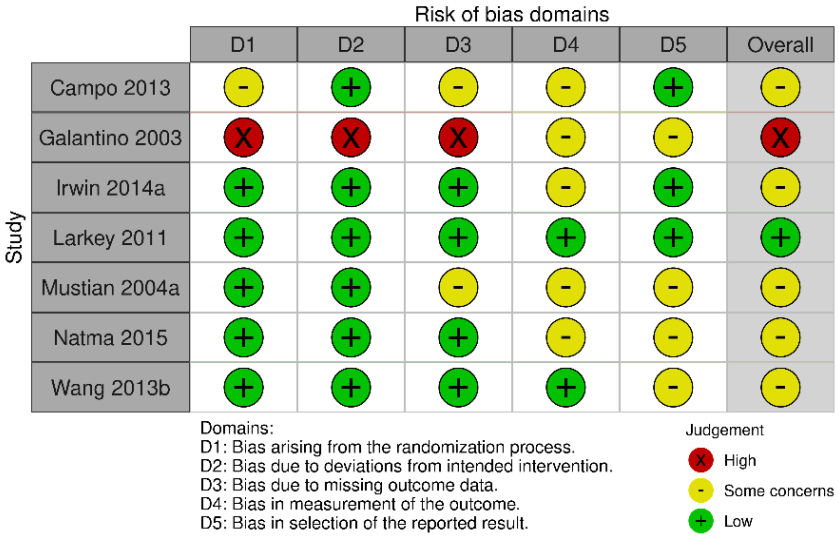
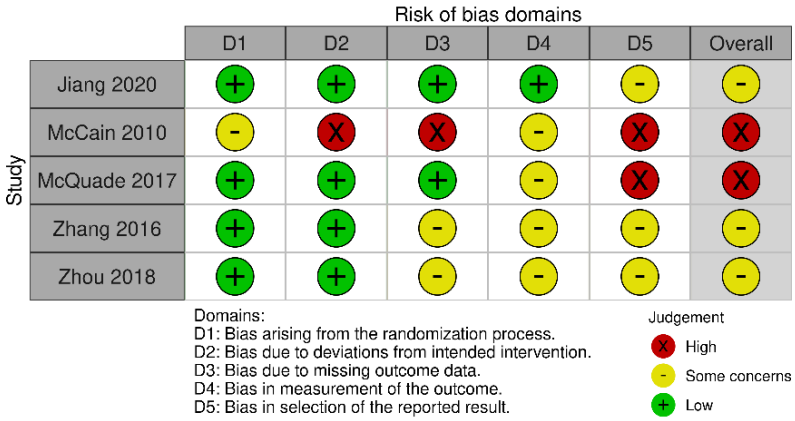


Figure 3 **Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Cancer (on treatment)**



4.2.4 Main comparison (vs control)

4.2.4.1 Summary of findings and evidence statements

4.2.4.1.1 Cancer (survivors)

Two RCTs were eligible for this comparison, with one RCT (Natma 2015) contributing data relevant to 2 outcomes. One RCT (Wang 2013b) did not report any outcome measures considered to be critical or important for decision making. There were 3 studies awaiting classification (total 102 participants) and 4 ongoing studies (complete, results not available) (total 258 participants) that compared Tai Chi with no intervention (or placebo) in cancer survivors that could have contributed data to these outcomes but there was limited information to make a judgement regarding the extent of missing data (see Appendix C6).

Tai Chi compared to Control (no intervention, waitlist or usual care) for Cancer (survivors)

Patient or population: Cancer (survivors)
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Quality of Life assessed with: FACT-B (higher is best) Scale from: 0 to 148 follow-up: 12 weeks	The mean HRQoL was **109.53**	**MD 7.19 points higher** (1.70 lower to 16.08 higher)	-	30 (1 RCT)	⊕◯◯◯ VERY LOW A,B,C,D,E	The evidence is very uncertain about the effect of Tai Chi on HRQoL in cancer survivors.**
Fatigue assessed with: Fatigue Symptom Inventory (higher is worse) Scale from: 0 to 144 follow-up: 12 weeks	The mean FSI score was **27.3**	**MD 16.03 points lower** (27.00 lower to 5.06 lower)	-	30 (1 RCT)	⊕⊕◯◯ LOW A,B,C,E,F	Tai Chi may result in a reduction in fatigue in cancer survivors. ***
Sleep quality – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on sleep quality in cancer survivors is unknown.
Psychosocial wellbeing – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on psychosocial wellbeing in cancer survivors is unknown.
Pain – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on pain in cancer survivors is unknown.
Aerobic capacity and endurance – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on aerobic capacity and endurance in cancer survivors is unknown.
Physical functioning – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on physical functioning in cancer survivors is unknown.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID has been defined as being between 7 to 8 points on total FACT-B score (71).
*** The MCID is unknown. #

In the absence of an MCID, effect estimates were considered on 3 levels: small (MD <10% of the scale), moderate (MD between 10% to 20% of the scale) or large (MD more than 20% of the scale).

CI: confidence interval; **HRQoL:** health-related quality of life; **FACT-B:** Functional Assessment of Cancer Therapy – Breast; **FSI:** fatigue symptom inventory; **MCID:** minimally clinical importance difference; **MD**: mean difference

Tai Chi compared to Control (no intervention, waitlist or usual care) for Cancer (survivors)

Patient or population: Cancer (survivors)
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

c. No serious indirectness. The available evidence is applicable to breast cancer survivors. Certainty of evidence not downgraded.

d. Very serious imprecision. Small study (fewer than 50 participants). Wide confidence interval (upper and lower bounds overlap with a large important difference and no important difference). Certainty of evidence downgraded 2 levels.

e. Publication bias suspected. Evidence is limited to a small number of small trials. There is a strong suspicion of nonreporting of results relating to *p* value or direction of effect (see Appendix C6). Certainty of evidence downgraded.

f. Serious imprecision. Small study (fewer than 50 participants). Wide confidence interval (lower bound overlaps with a small or no important difference). Certainty of evidence downgraded.

4.2.4.1.2 Cancer (on treatment)

Four RCTs were eligible for this comparison, with 3 studies (McQuade 2017, McCain 2010, Zhou 2018) contributing data relevant to 3 outcomes. One RCT (Jiang 2020,) did not report any outcome measures considered to be critical or important for decision making.

Tai Chi compared to Control (no intervention, waitlist or usual care) for Cancer (on treatment)

Patient or population: Cancer (on treatment)
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Quality of life, disease specific assessed with: EPIC (higher is better) Scale from: 0 to 100 follow up: after radio/chemotherapy	Data reported for 3 out of 4 domains (urinary, bowel, hormonal) with no difference between groups observed (see Figure 6). Scores for one domain (sexual function) were not reported.		-	50 (1 RCT)	⊕◯◯◯ VERY LOW A,B,C,D	The evidence is very uncertain about the effect of Tai Chi on HRQoL in men with prostate cancer undergoing daily radiotherapy.
Quality of life, disease specific assessed with: FACT-B (higher is better) Scale from: 0 to 144 follow up: after radio/chemotherapy	Authors report scores were not different between the groups, but no data were provided.		-	190 (1 RCT)	⊕◯◯◯ VERY LOW A,B,E,F	The evidence is very uncertain about the effect of Tai Chi on quality of life in women undergoing treatment for breast cancer.
Fatigue assessed with: MSFI-SF (scale from 24 to 96) OR BFI (scale from 0 to 10) (higher is worse) follow up: after radio/chemotherapy		**SMD 0.46 SD lower ^** (0.77 lower to 0.14 lower)	-	164 (2 RCTs)	⊕⊕◯◯ LOW D,G,H	Tai Chi may result in a slight reduction in fatigue in people undergoing treatment for cancer.
Sleep assessed with: PSQI (higher is worse) Scale from: 0 to 21 follow up: in last week of radiotherapy	The mean sleep score was **5.77 points**	**MD 0.61 points lower** (2.02 lower to 0.80 higher)	-	50 (1 RCT)	⊕⊕◯◯ LOW B,D,G,I	Tai Chi may result in little to no improvement in sleep quality for people undergoing treatment for cancer.**
Psychosocial wellbeing – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on psychosocial wellbeing in people undergoing treatment for cancer is unknown.
Pain – not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on pain in people undergoing treatment for cancer is unknown.
Physical functioning - not reported	-	-	-	(0 studies)	-	The effect of Tai Chi on physical functioning in people undergoing treatment for cancer is unknown.

Tai Chi compared to Control (no intervention, waitlist or usual care) for Cancer (on treatment)

Patient or population: Cancer (on treatment)
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
General health assessed with: Heart rate variability (LF/HF ratio) (higher is better) follow-up: after chemotherapy	The mean LF/HF ratio was **2.29** ms^2	**MD 0.24 ms^2 lower** (0.46 lower to 0.02 lower)	-	114 (1 RCT)	⨁⨁◯◯ Low [b,d,,g,h]	Tai Chi may result in little to no difference in general health (HRV) for people undergoing treatment for cancer. ***

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** MCID unknown. A score above 5 (in both groups) means sleep difficulties are not resolved.
*** MCID unknown. Healthy norms for HR variability (LV/HF) are reported be mean 2.8 (SD: 2.6) (range 1.1 to 11.6) (72).

^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (73).

BFI: brief fatigue inventory; **CI:** confidence interval; **EPIC:** Expanded Prostate Cancer Index; **FACT-B:** Functional Assessment of Cancer Therapy – Breast; **FACT-L:** Functional Assessment of Cancer Therapy – Lung; **HRQoL:** health related quality of life; **MCID:** minimal clinically important difference; **MD:** mean difference; **MSFI-SF:** Multidimensional Fatigue Symptom Inventory – short-form; **PSQI:** Pittsburgh Sleep Quality Index

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. One RCT at high risk of bias (100% weight). Serious concerns of bias related to selective reporting. Certainty of evidence downgraded.
b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
c. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with both an important and no important difference). Certainty of evidence downgraded.
d. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.
e. Serious imprecision. Certainty of evidence downgraded.
f. Publication bias suspected. There is a strong suspicion of nonreporting of results relating to *p* value or direction of effect (see Appendix C6). Certainty of evidence downgraded.
g. No serious risk of bias. Certainty of evidence not downgraded.
h. Serious imprecision. Wide confidence intervals (lower bounds overlap with no important difference). Certainty of evidence downgraded.
i. Serious imprecision. Wide confidence intervals (upper bound overlap with an important difference). Certainty of evidence downgraded.

4.2.4.2 Forest Plots

4.2.4.2.1 Cancer (survivors)

Outcome results for cancer survivors are presented in Figure 4 (health-related quality of life) and Figure 5 (fatigue).

Figure 4 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): cancer (survivors) – health-related quality of Life

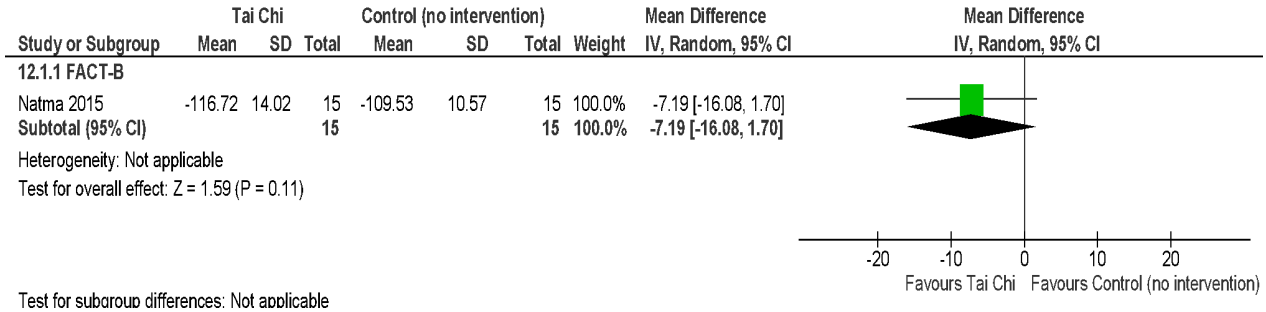
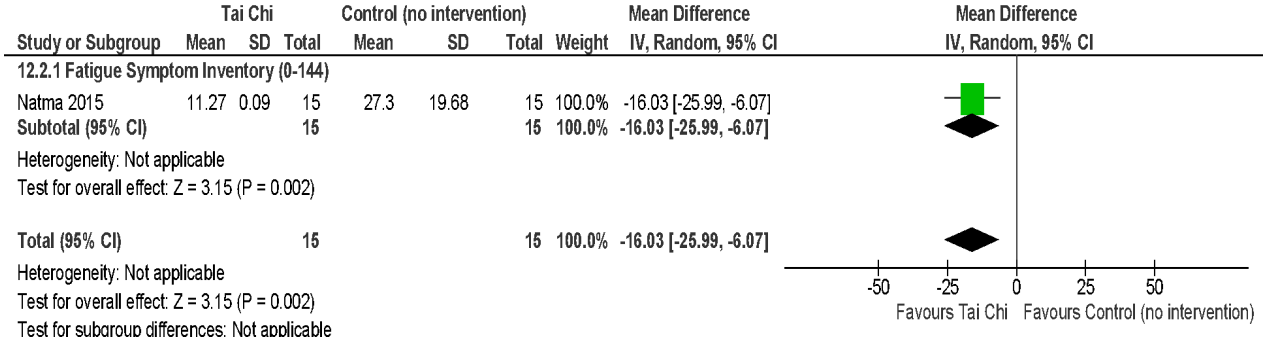


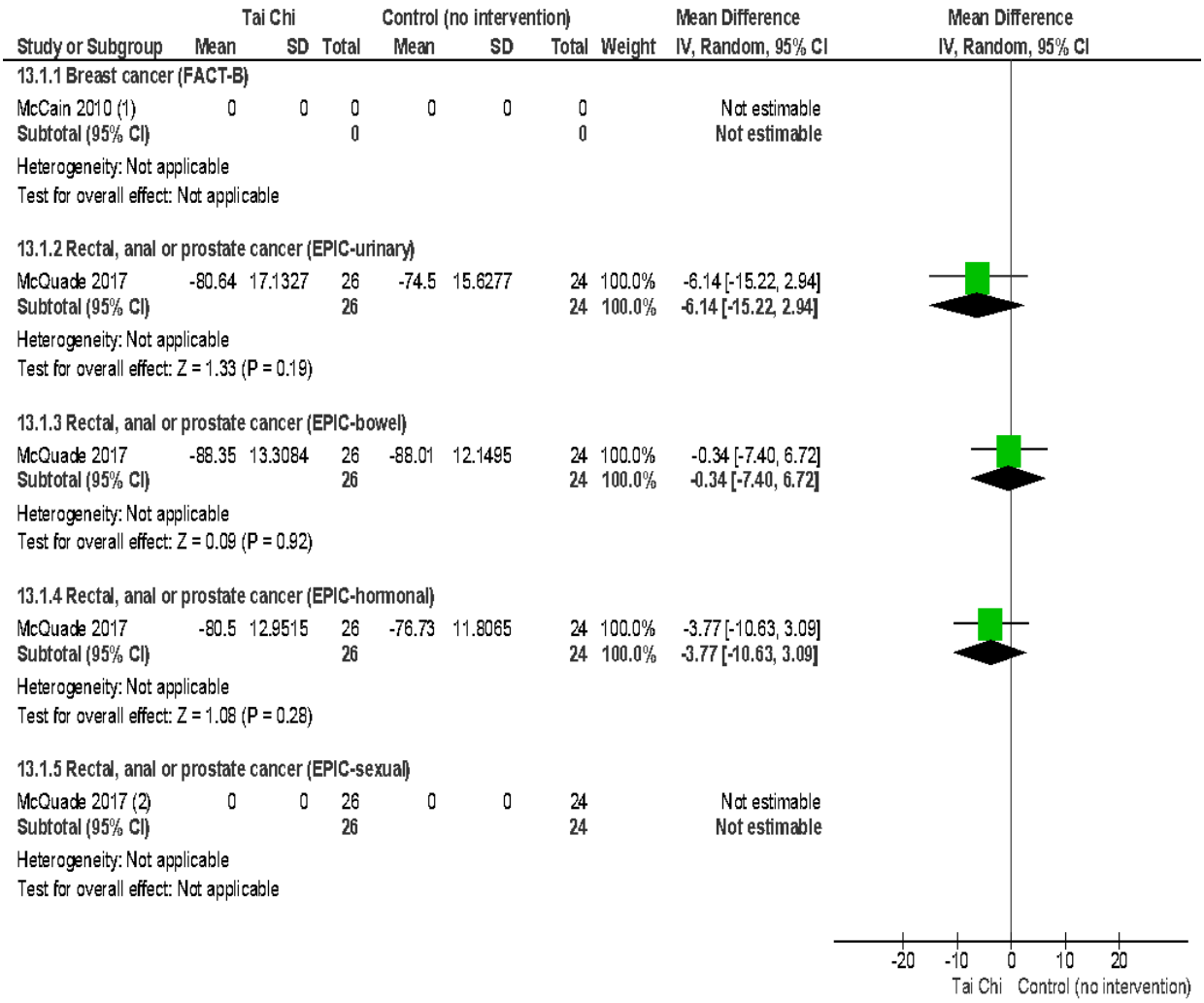
Figure 5 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): cancer (survivors) – fatigue



4.2.4.2.2 Cancer (on treatment)

Outcome results for people with cancer undergoing treatment are presented in Figure 6 (health-related quality of life), Figure 7 (fatigue), Figure 8 (sleep quality) and Figure 9 (general health).

Figure 6 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cancer, undergoing treatment – health-related quality of life



Footnotes

(1) Individual group data not reported, with authors noting the scores were not different between the groups. Total N=109.

(2) Data not reported by the study authors.

Figure 7 **Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cancer, undergoing treatment – fatigue**

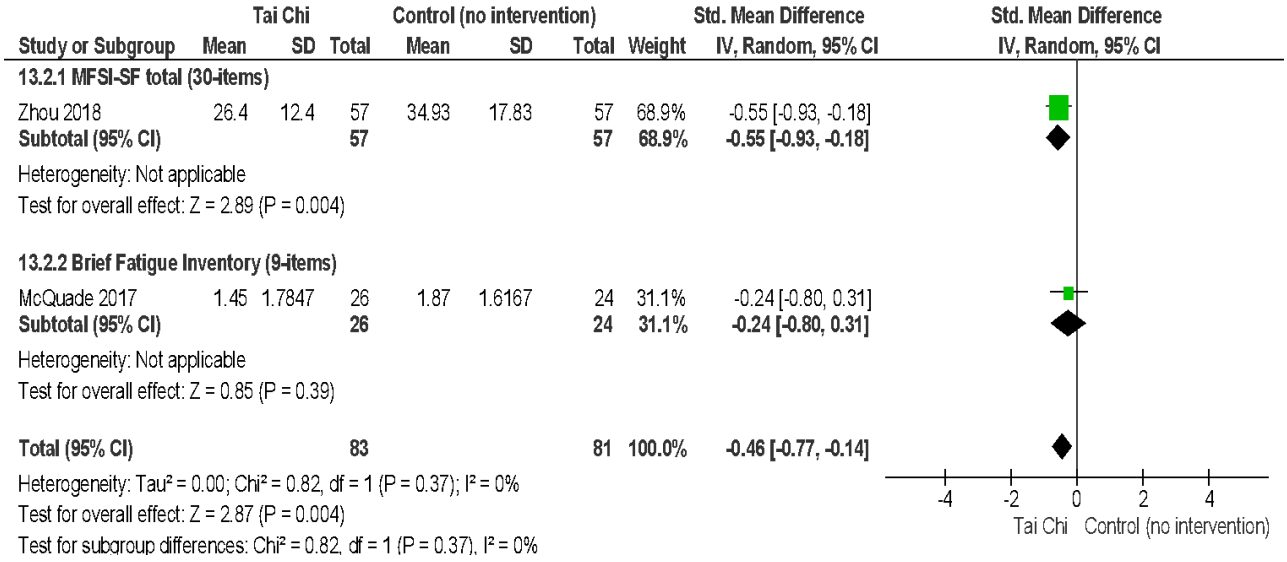


Figure 8 **Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cancer, undergoing treatment – sleep quality**

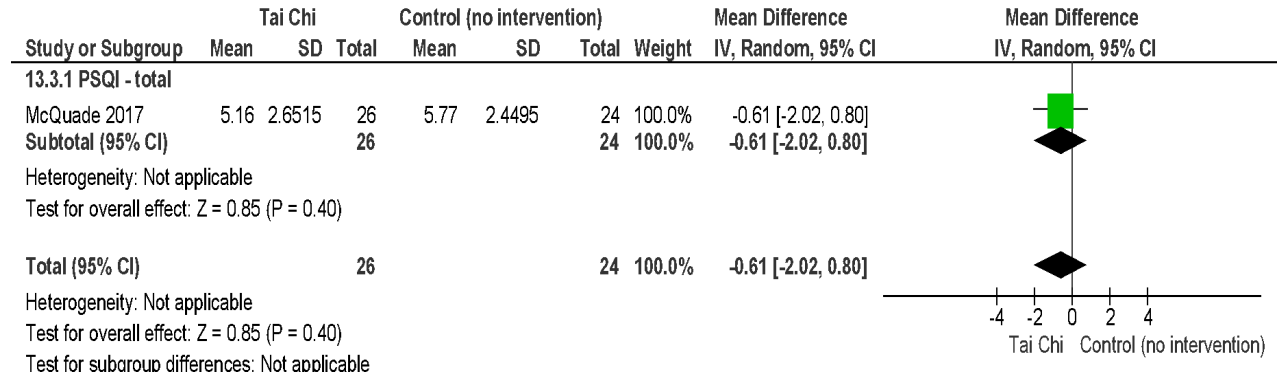
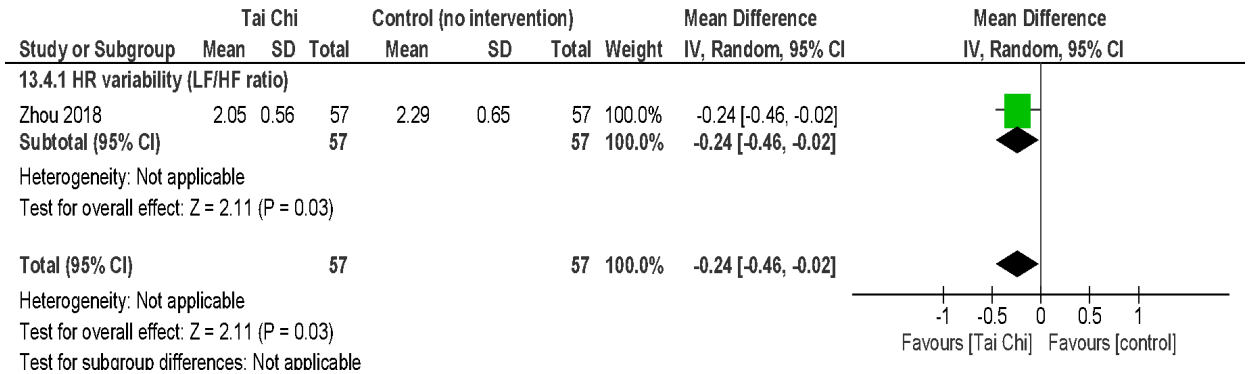


Figure 9 **Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cancer, undergoing treatment – general health**



4.3 Depression

4.3.1 Description of the condition

Depression is a highly prevalent mood disorder having the third highest burden of all diseases in Australia (74). It affects 1 in every 16 Australians (75) and more than 300 million people worldwide (76). In Australia, females are more likely than males to experience depression (75). While it is common to feel sad, moody, or low from time to time, depression is characterised by such feelings that occur more intensely and for longer periods of time, sometimes without any apparent reason. People experiencing depression will often report symptoms of low mood, loss of interest or pleasure in most activities, sleep disturbances, changes in appetite or unintentional changes of weight, decreased energy, either slowed or agitated movement, decreased concentration and, in some cases, feelings of guilt, worthlessness and thoughts of suicide (77). Depressive symptoms can become chronic, leading to substantial impairment in an individual's ability to function in everyday life (78).

There are several different types of depressive disorders which are characterised by the specific symptoms experienced by the person as well as the severity of the symptoms (mild, moderate, or severe). Major depressive disorder is the most commonly diagnosed depressive disorder in Australia (79), however; several other types including bipolar disorder, cyclothymia, dysthymia (or persistent depressive disorder) and seasonal affective disorder are also recognised within the Australian healthcare context. There are a variety of social, psychological and biological factors that contribute to depression, with people who have experienced adverse life events at higher risk of developing depression (75).

There are many known and effective treatments for depression that are highly dependent on the severity and pattern of depressive episodes. Traditional treatments offered by health-care providers include psychological treatments such as behavioural activation, cognitive behavioural therapy and interpersonal psychotherapy, and/or antidepressant medication (76). In additional to traditional therapy, prevention programmes have been shown to reduce depression. Community approaches such as school-based programmes for children and adolescents as well as exercise programmes for older persons can be highly effective in depression prevention (76).

4.3.2 Description of studies

Seven citations (80-86) corresponding to 3 RCTs (Lavretsky 2010, Liu 2018a, Yeung 2012) and one quasi-RCT (Chou 2004) were identified in the literature. There was one ongoing study, and 5 studies awaiting classification[6]. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies in provided in Appendix D2.1.1.

Three of the 4 studies (Lavretsky 2010, Liu 2018a, Yeung 2012) were carried out in multicentre settings in either the United States (Lavretsky 2010, Yeung 2012) or China (Liu 2018a). One study (Chou 2004) did not report the setting of the trial but was carried out in Hong Kong. Sample sizes ranges from 14 to 112 (total 235), with all studies enrolling adults with depressive mood disorder. One study (Chou 2004) also included participants with dysthymia. In all trials, participants were middle-aged (mean age ranged between 55 and 70 years) and included both males and females but were predominately female (mean 65%). One study (Chou 2004) did not report the mean age of included participants but only participants over the age of 60 were enrolled.

[6] Includes one study in teenagers with no defined 'mental illness'

Three studies (Chou 2004, Liu 2018a, Yeung 2012) compared a Yang style form of Tai Chi with no intervention in participants with depression. Liu 2018b instructed the control group to maintain their usual activities. The remaining study (Lavretsky 2010) compared Tai Chi with a wellness education control. In all studies, the Tai Chi session were typically 45 to 120 minutes in duration, but the treatment programmes ranged in intensity from 3 times a week for 24 weeks (Liu 2018a) or 12 weeks (Chou 2004), to twice a week for 12 weeks (Yeung 2012) down to once a week for 10 weeks (Lavretsky 2010).

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.3.4.1) (and Appendix F2).

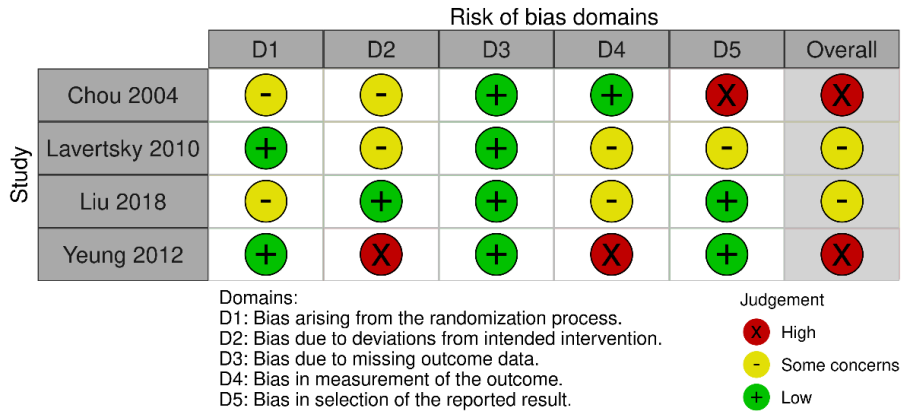
Results for one RCT (Lavertsky 2010) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.3.3 Risk of Bias summary

The risk of bias of included RCTs for depression is summarised in Figure 10. Details are provided in Appendix D2.1.2.

No studies were judged to be at overall low risk of bias.

Figure 10 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Depression



4.3.4 Main comparison (vs control)

Three RCTs (Chou 2004, Liu 2018a, Yeung 2012) were eligible for this comparison and contributed data relevant to 2 outcomes. There were 4 studies awaiting classification that were published in a language other than English (total 235 participants) that compared Tai Chi with no intervention in participants with depression that could have contributed data to the critical or important outcomes however there was limited information to make a judgement regarding the extent of missing data (see Appendix C6).

4.3.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for depression

Patient or population: Depression
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Symptoms of depression assessed with: CES-D, HDRS or GDS (higher is worse) Scale from: 0 to 60, 0 to 54 and 0 to 30 follow-up: range 12 weeks to 24 weeks	-	SMD **1.35 SD lower ^** (3.05 lower to 0.35 higher)	-	112 (3 RCTs)	⊕◯◯◯ VERY LOW [A,B,C]	The evidence is very uncertain about the effect of Tai Chi on depressive symptoms in people with depression.
Psychosocial wellbeing (anxiety) - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on anxiety in people with depression is unknown.
Disease symptoms - Improvement assessed with: Clinical Global Impression scale (lower is best) Scale from: 0 to 7 follow-up: 12 weeks	The mean change from baseline for improvement was **3.5** points	MD **0.5 lower** (1.17 lower to 0.17 higher)	-	38 (1 RCT)	⊕⊕◯◯ LOW [C,D,E,F]	Tai Chi may result in little to no difference in disease symptoms (improvement) for people with depression.
Disease symptoms – severity assessed with: Clinical Global Impression scale (higher is best) Scale from: 0 to 7 follow-up: 12 weeks	The mean change from baseline for severity was **0.67** points	MD **0.33 higher** (0.43 lower to 1.09 higher)	-	38 (1 RCT)	⊕⊕◯◯ LOW [C,D,E,F]	Tai Chi may result in little to no difference in disease symptoms (severity) for people with depression.
HRQoL - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on HRQoL in people with depression is unknown.
Cognitive function - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on cognitive function in people with depression is unknown.

Tai Chi compared to Control (no intervention, waitlist, usual care) for depression

Patient or population: Depression
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Activities of daily living - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on activities of daily living in people with depression is unknown.
Sleep - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on sleep in people with depression is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (73).

CES-D: Center for Epidemiological Studies Depression Scale; **CI:** confidence interval; **GDS**: Geriatric Depression Scale; **HDRS:** Hamilton Depression Rating Scale; **HRQoL:** health-related quality of life; **MD:** mean difference; **SMD:** standardised mean difference

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Two RCTs (64.6% weight) at high risk of bias that influence the results. Certainty of evidence downgraded.

b. Serious inconsistency not able to be explained. Significant statistical heterogeneity (I^2 = 92%). Minimal overlap in point estimates or confidence intervals. Certainty of evidence downgraded.

c. Serious imprecision. Wide confidence intervals (upper and lower bound overlap with both a large important difference and no difference). Certainty of evidence downgraded.

d. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

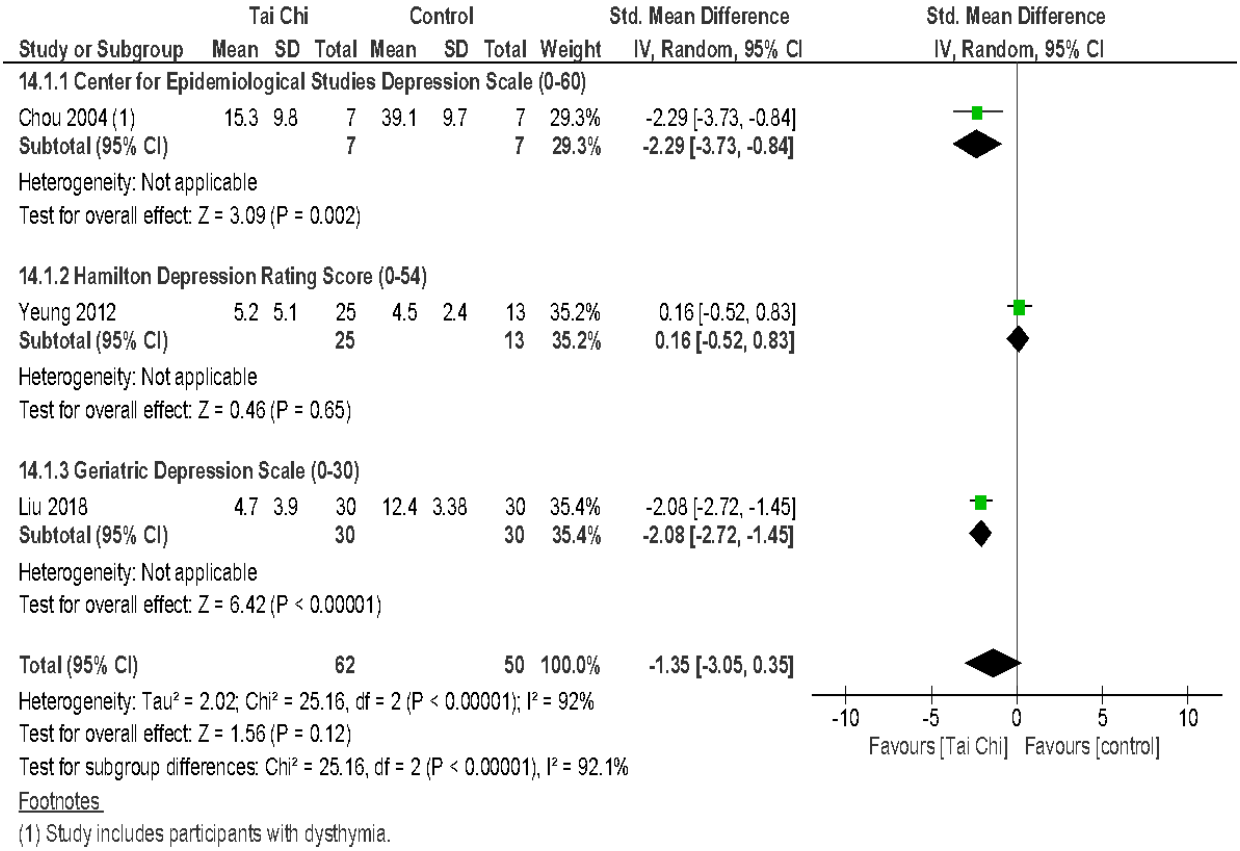
e. Publication bias suspected. Evidence is limited to a small number of small trials. There is a strong suspicion of nonreporting of results relating to *p* value or direction of effect (see Appendix C6). Certainty of evidence downgraded.

f. No serious risk of bias. Certainty of evidence not downgraded.

4.3.4.2 Forest plots

Outcomes results for people with depression are presented in Figure 11 (symptoms of depression) and Figure 12 (symptoms improvement and severity).

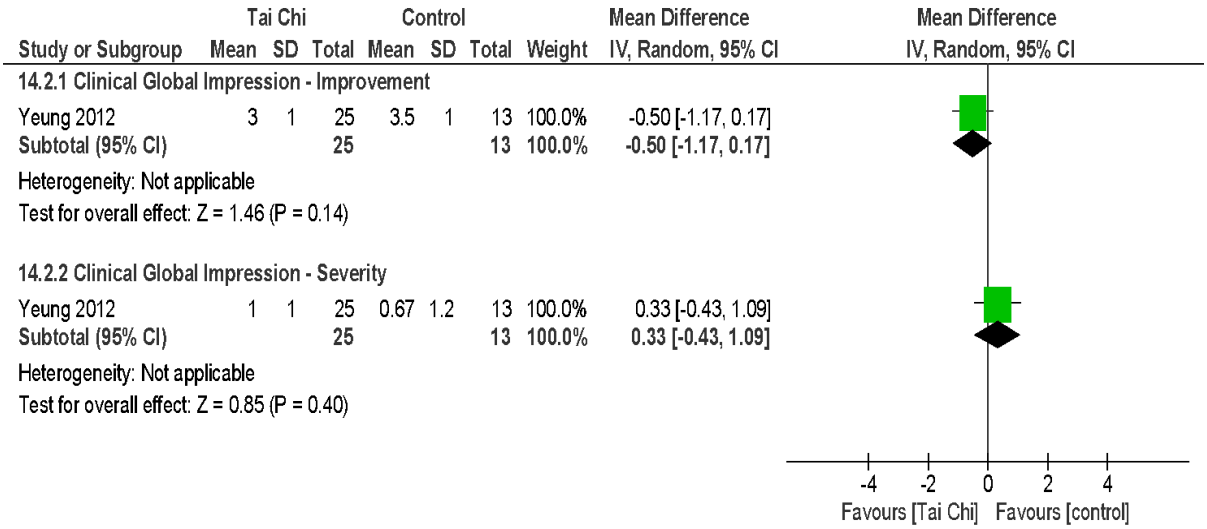
Figure 11 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Depression – symptoms of depression



Footnotes

(1) Study includes participants with dysthymia.

Figure 12 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Depression – disease symptoms



4.4 Anxiety

4.4.1 Description of the condition

Anxiety is the most common mental health condition in Australia and the sixth largest contributor to burden of disease, with one in 4 people experiencing anxiety at some stage in their life (87, 88). While it is normal to feel anxious or stressed in certain situations, those with an anxiety disorder experience these symptoms more frequently and persistently without an obvious cause. These feelings of anxiety can impact their quality of life and day-to-day functioning (87) and can also have significant direct and indirect economic consequences (89). It is not uncommon for anxiety disorders to become chronic, with the 12-month prevalence rate estimated at 17% and a lifetime prevalence rate of close to 25% (90).

There are different types of anxiety presenting with different symptoms, including generalised anxiety disorder, social anxiety, specific phobias and panic disorders. Each type of anxiety disorder has its own features, however there are some common symptoms including excessive fear or worrying, panic attacks, racing heart, tightening of the chest, shortness of breath and avoidance of situations that cause anxiety.

Treatments for anxiety focus on controlling symptoms to minimise their impact on daily life. This can include psychological treatments such as Cognitive Behavioural Therapy, medical treatments such as antidepressants, or an anxiety management strategy (87). A shift towards natural and holistic forms of therapy to assist pharmacological approaches or act as an alternative in a variety of anxiety-related conditions has seen increasing support from scientific evidence, clinical experience, and community attitudes. Meditation in the treatment of stress and related disorders is one such therapy that has the expectation of cognitive-behavioural benefits (91). This in turn can be extended to meditative forms of exercise such as Yoga and Tai Chi.

4.4.2 Description of studies

Six citations (92-97) corresponding to 2 RCTs (Caldwell 2015, Zheng 2018) and one quasi-RCT (Song 2014a) were identified in the literature. There were no ongoing studies and 2 studies awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D2.2.1.

Two studies were carried out at single centres in either the United States (Caldwell 2015) or Australia (Zheng 2018). One study (Song 2014a) was carried out in a multicentre setting in China. Sample sizes ranged from 32 to 75 (total 158 participants), with studies enrolling adults with generalised anxiety disorder (Song 2014a) or symptoms of anxiety (Caldwell 2015, Zheng 2018). In both Caldwell 2015 and Zheng 2018, participants were young adults (mean age ranged between 21 and 34 years) and predominately female. Song 2014a did not report the mean age of included participants but only participants aged between 60 and 75 years were enrolled.

Two studies (Song 2014a, Zheng 2018) compared a modified form of Tai Chi with no intervention. All participants in Song 2014a continued to receive standard medical care (paroxetine) and Zheng 2018 included a third intervention arm, being a gym-based aerobic exercise program. One study (Caldwell 2015) compared Chen Style Tai Chi with an education control or an enhanced Tai Chi program that included a DVD programme used for home practice. In all trials the Tai Chi sessions were 60 minutes in duration, but the programmes ranged in intensity from twice a day for 45 days (Song 2014a), 5 days a week for 12 weeks (Zheng 2018), down to twice a week for 10 weeks (Caldwell 2015).

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.4.4.1) (and Appendix F2).

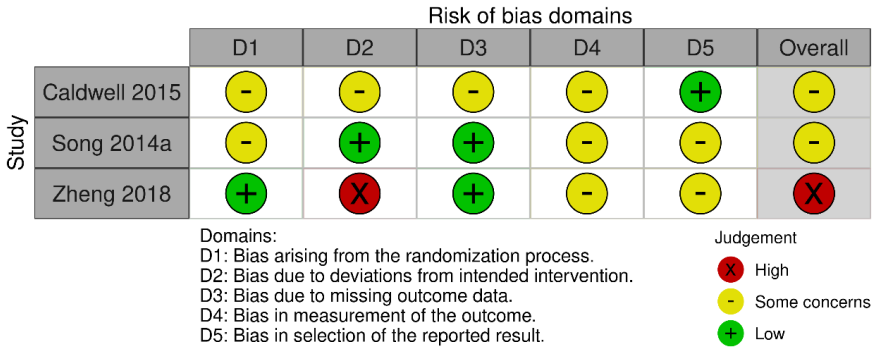
Results of the 2 RCTs (Caldwell 2015, Zheng 2018) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.4.3 Risk of Bias – per item

The risk of bias of included RCTs for anxiety is summarised in Figure 13. Details are provided in Appendix D2.2.2.

No studies were judged to be at overall low risk of bias.

Figure 13 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Anxiety



4.4.4 Main comparison (vs control)

Two RCTs (Song 2014a, Zheng 2018) were eligible for this comparison and contributed data relevant to 4 outcomes. There were 2 studies awaiting classification (total 120 participants) that compared Tai Chi with no intervention in participants with symptoms of depression and/or anxiety that could have contributed data to these outcomes but there was limited information to make a judgement regarding the extend of missing data (see Appendix C6).

4.4.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for Anxiety

Patient or population: Anxiety
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Anxiety severity assessed with: HAM-A (14-items) (higher is worse) Scale from: 0 to 56 follow-up: 45 days	The mean HAM-A score was **14.5** points	MD **3.8 lower** (6.79 lower to 0.81 lower)	-	32 (1 RCT)	⊕⊕◯◯ LOW A,B,C,D,E	Tai Chi may result in a slight improvement in symptoms of anxiety in people living with an anxiety disorder.**
Anxiety severity assessed with: STAI-state (20-items) (higher is worse) Scale from: 20 to 80 follow-up: 12 weeks	The mean State-anxiety score was **50** points	MD **10.53 lower** (11.67 lower to 9.03 lower)	-	33 (1 RCT)	⊕⊕◯◯ LOW B,E,F,G	Tai Chi may result in an improvement in state anxiety in people with symptoms of anxiety.**

Tai Chi compared to Control (no intervention, waitlist, usual care) for Anxiety

Patient or population: Anxiety
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Anxiety severity assessed with: STAI-trait (20-items) (higher is worse) Scale from: 20 to 80 follow-up: 12 weeks	The mean trait-anxiety score was **52.56** points	MD **7.44 lower** (8.32 lower to 6.56 lower)	-	33 (1 RCT)	⨁⨁◯◯ LOW [B,E,F,G]	Tai Chi may result in an improvement in trait anxiety in people with symptoms of anxiety.**
Psychosocial wellbeing assessed with: 14-item Perceived Stress Scale (higher is worse) Scale from: 0 to 56 follow-up: 12 weeks	The mean perceived stress score was **31.25** points	MD **4.6 lower** (5.4 lower to 3.8 lower)	-	33 (1 RCT)	⨁⨁◯◯ LOW [B,E,F,G]	Tai Chi may result in slight improvement in perceived stress in people with symptoms of anxiety.**
HRQoL assessed with: SF-36 (higher is best) Scale from: 0 to 100 follow-up range: 12 weeks	An effect favouring Tai Chi was observed for 6 out of 8 domains related to physical function, bodily pain, vitality, role-social, role-emotional and mental health. An effect against Tai Chi for general health perceptions. No difference between groups for role-physical. (see Figure 16).		-	33 (1 RCT)	⨁⨁◯◯ LOW [B,E,F,G]	Tai Chi may improve some aspects of HRQoL in people with symptoms of anxiety.***
HRQoL assessed with: GQOLI-74 (higher is best) Scale from: 0 to 100 follow-up range: 12 weeks	An effect favouring Tai Chi was observed for 3 out of 5 domains related to psychological and social function. No important difference was observed for material function and general life quality. (see Figure 17).		-	32 (1 RCT)	⨁⨁◯◯ LOW [A,B,C,D,E]	Tai Chi may improve some aspects of HRQoL in people living with an anxiety disorder.**
Functional capacity - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on functional capacity in people with anxiety is unknown.
Sleep – not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on sleep in people with anxiety is unknown.

Tai Chi compared to Control (no intervention, waitlist, usual care) for Anxiety

Patient or population: Anxiety
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Cardiovascular health assessed with: SBP (the closer to 120 mmHg, the more stable the function) follow-up: 12 weeks	The mean SBP was **109.6** mmHg	MD **10.3 mmHg higher** (11.14 higher to 9.46 higher)	-	33 (1 RCT)	⊕⊕◯◯ LOW [B,E,F,G]	Tai Chi may result in improvement in cardiovascular health (SBP) for people living with anxiety.***
Cardiovascular health assessed with: DBP (the closer to 80 mmHg, the more stable the function) follow-up: 12 weeks	The mean DBP was **73.95** mmHg	MD **0.07 mmHg higher** (0.78 higher to 0.64 lower)	-	33 (1 RCT)	⊕⊕◯◯ LOW [B,E,F,G]	Tai Chi may result in a little to no difference in cardiovascular health (DBP) for people living with anxiety.***

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID is unknown.#
*** The MCID is assumed to be between 2 to 4 points in the general population (98).
*** The closer the score to 120/80 mmHg, the more stable the cardiorespiratory health.

In the absence of an MCID, effect estimates were considered on 3 levels: small (MD 10% or less of the scale), moderate (MD between 10% to 20% of the scale) or large (MD more than 20% of the scale).

CI: confidence interval; **HRQoL:** health-related quality of life; **MCID:** minimal clinically important difference; **MD:** mean difference; **SMD:** standardised mean difference

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

c. No serious indirectness. The evidence is generalisable to the Australian healthcare context with some caveats. The study was conducted in China among older adults with Generalized Anxiety Disorder and may not be directly applicable to all Australians living with symptoms of anxiety but could be sensibly applied. Certainty of evidence not downgraded.

d. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with both a large and no important difference). Certainty of evidence downgraded.

e. Publication bias suspected. The evidence is limited to a small number of small trials. There is a strong suspicion of nonreporting of results relating to *p* value or direction of effect (see Appendix C6). Certainty of evidence downgraded.

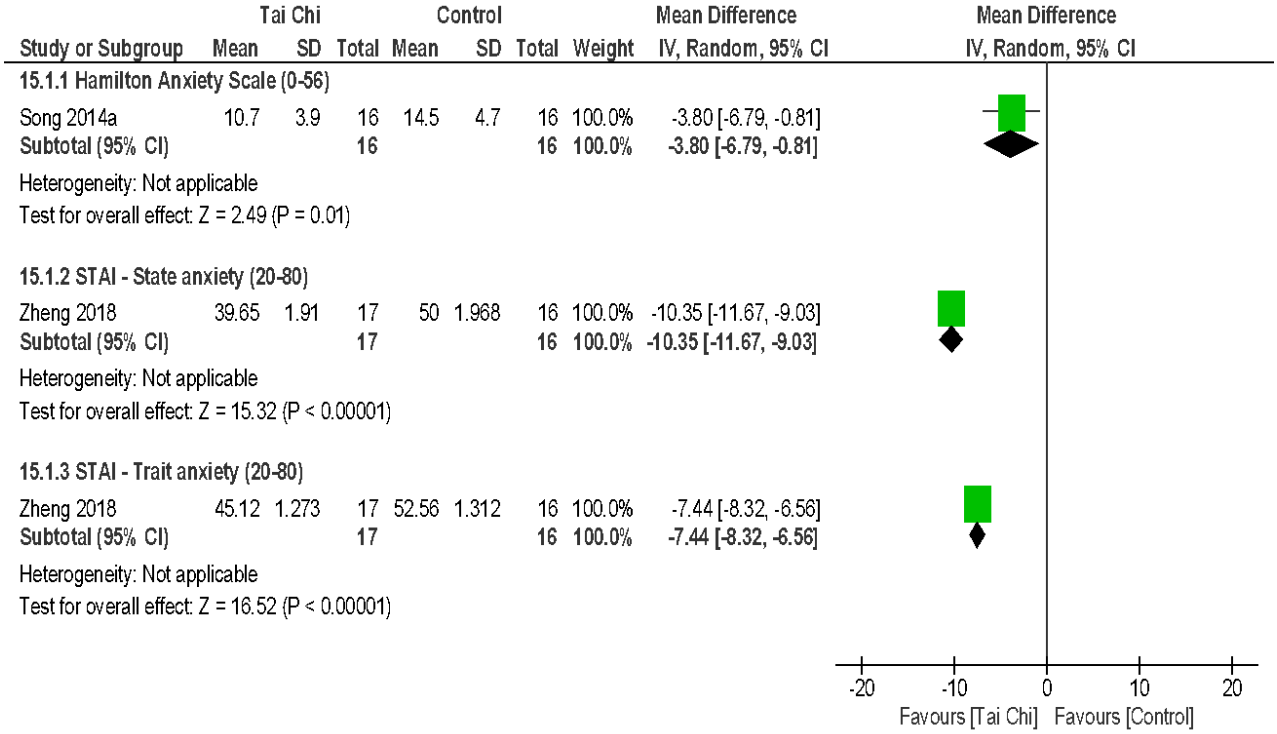
f. Serious risk of bias. One study (100%) at high risk of bias related to deviation from the intended interventions and baseline imbalances. Certainty of evidence downgraded.

g. No serious imprecision. Certainty of evidence not downgraded.

4.4.4.2 Forest Plots

Outcome results for people with anxiety are presented in Figure 14 (anxiety symptoms)), Figure 15 (perceived stress), Figure 16 (health-related quality of life [SF-36]) Figure 17 (health-related quality of life [GQOLI-74] and Figure 18 (cardiovascular health).

Figure 14 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Anxiety – symptoms of anxiety



Note: Data were not pooled as each instrument measures different aspects of anxiety (see Appendix D2.2.3.1)

Figure 15 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Anxiety – psychosocial wellbeing

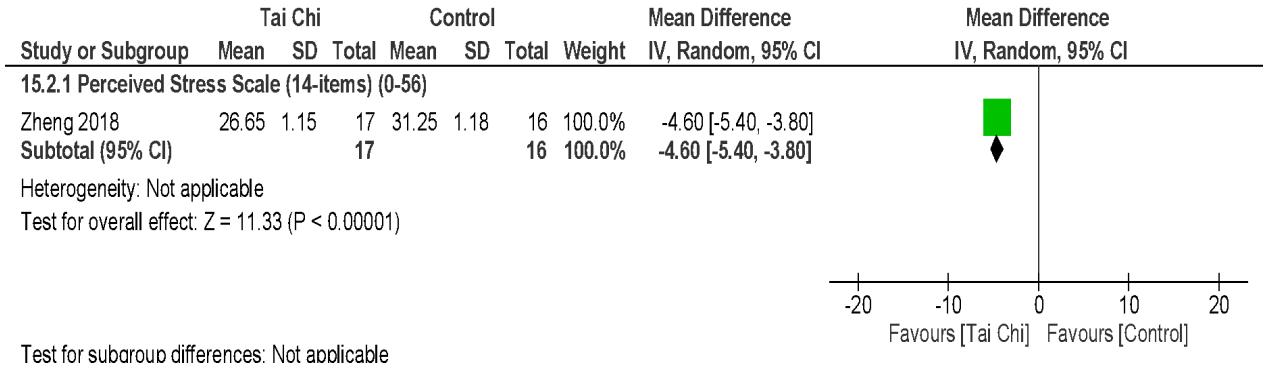


Figure 16 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Anxiety – health-related quality of life (SF-36)

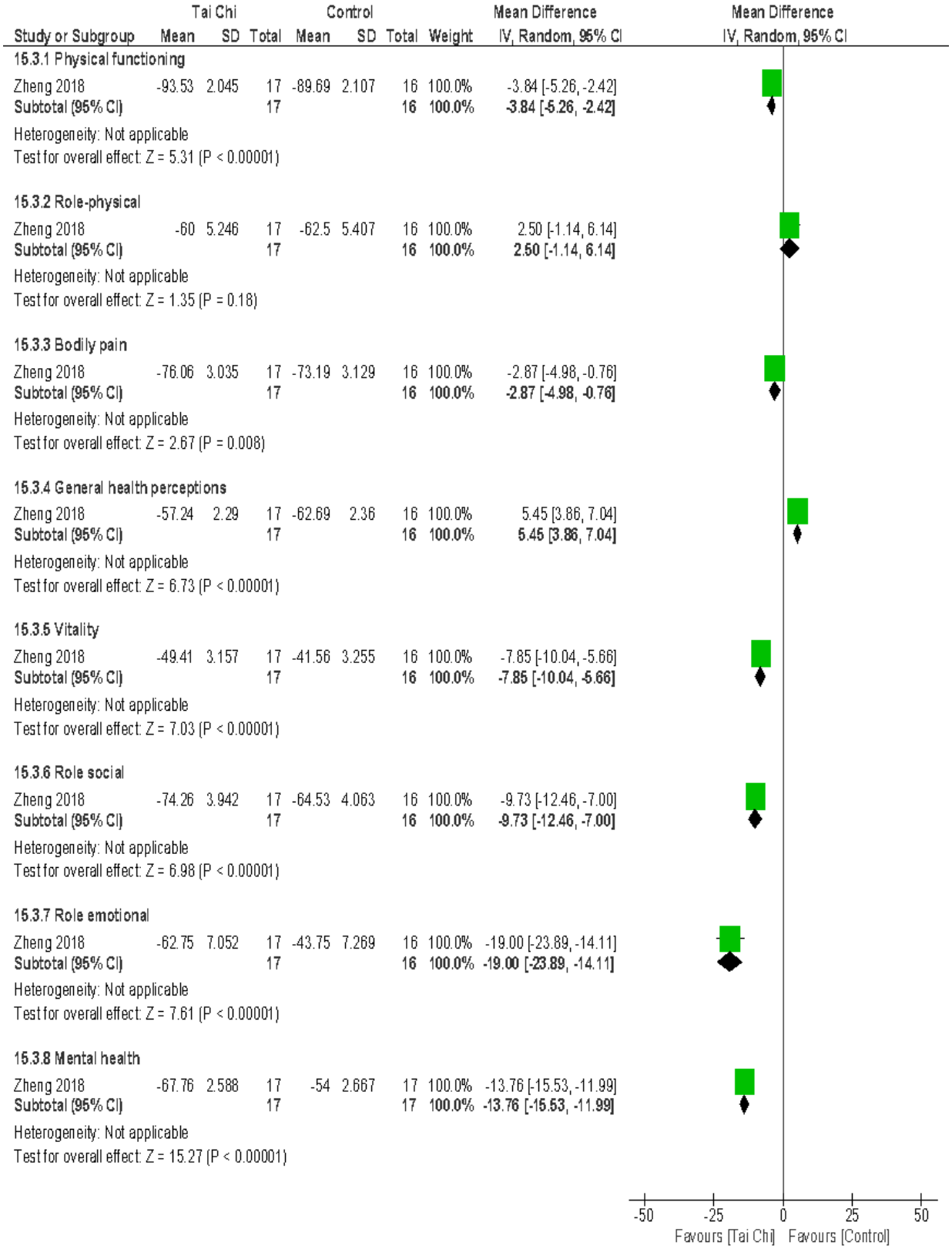


Figure 17 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Anxiety – health-related quality of life (GQOLI-74)

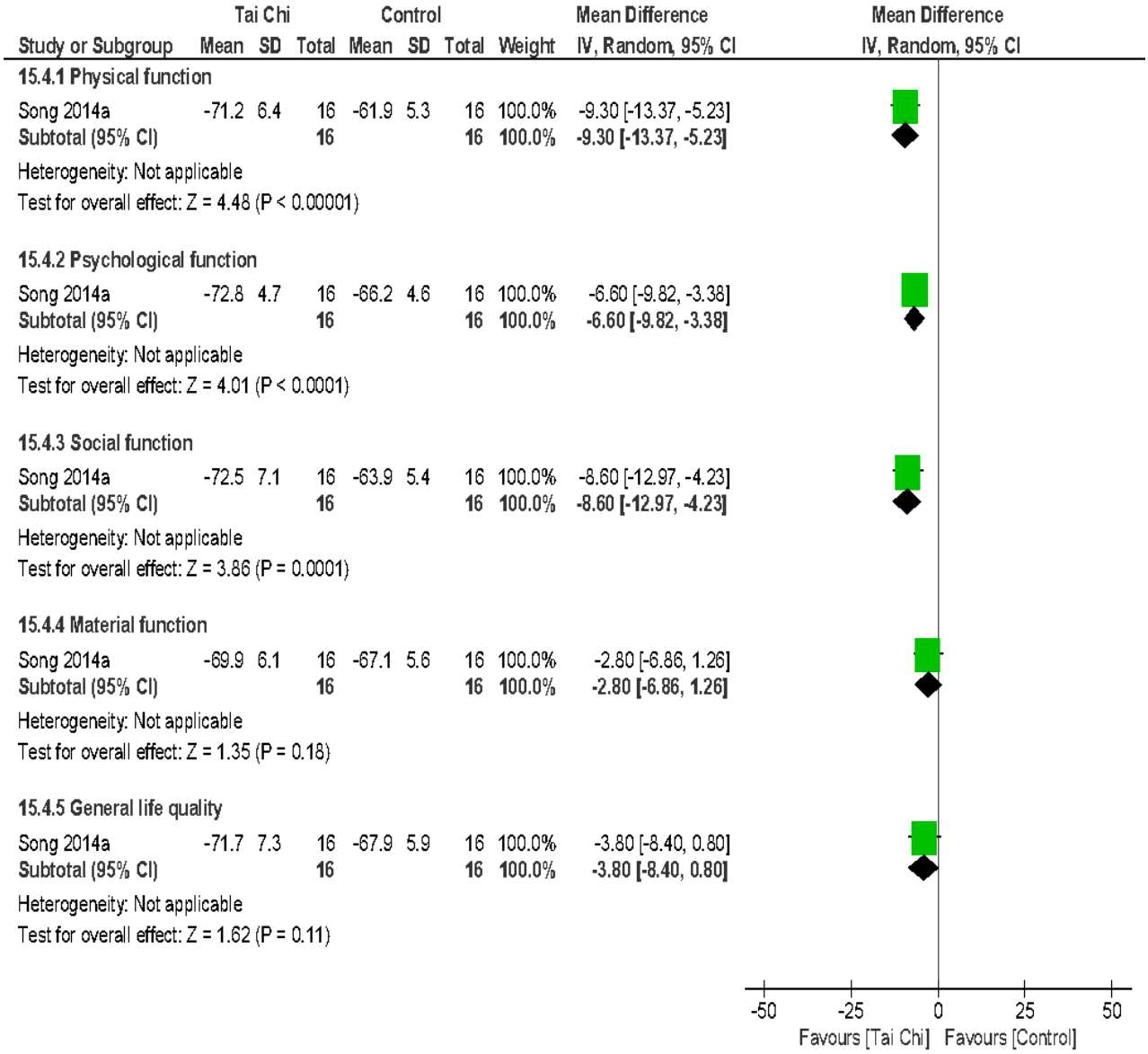
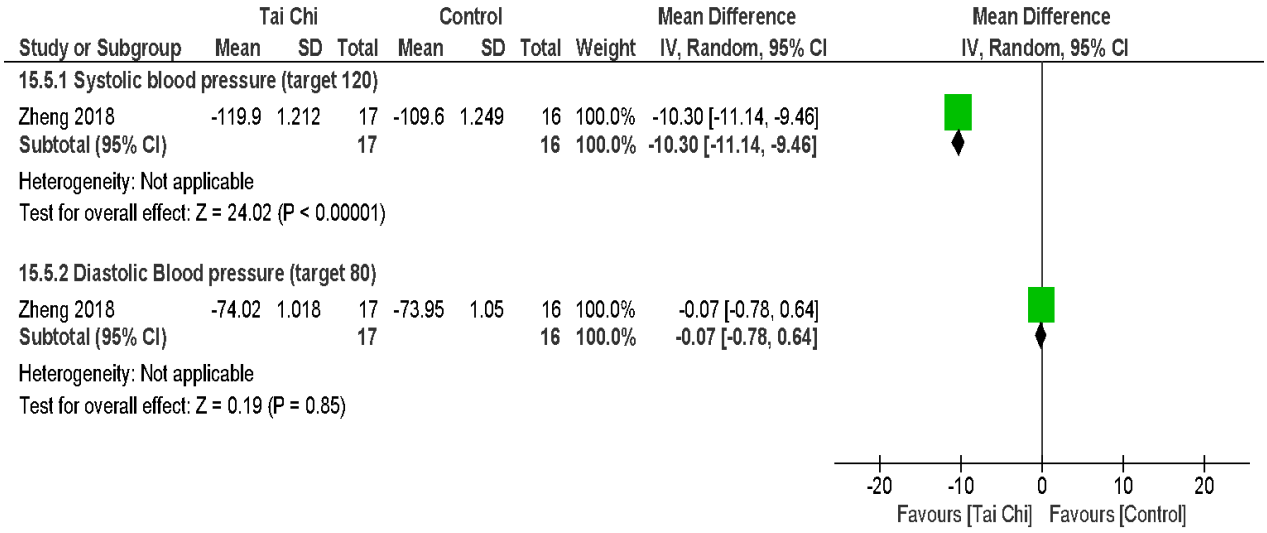


Figure 18 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Anxiety – cardiovascular health



4.5 Neurocognitive

4.5.1 Description of the conditions

4.5.1.1 Dementia

Dementia is the collective name for a variety of progressively degenerative brain syndromes that affect memory, thinking, behaviour, emotions, and social functioning. As the condition progresses, affected persons become increasingly dependent on care from others in many activities of daily life, including feeding, bathing and taking medication. As one of the principal causes of disability, disease and decreased quality of life among older adults, dementia is identified as one of the biggest global health challenges, expected to affect up to 135 million adults worldwide by 2050 (99). Within Australia, an estimated 472 000 people were living with dementia in 2021 (100) and it represents the second leading cause of death nationwide (101). This equates to a significant burden on the Australian economy with an average cost of AUD$35 550 per person with dementia (102).

Commonly referred to as a neurocognitive disorder (103), there are several different subtypes of dementia that are characterised by their underlying brain pathology. The most common subtypes include dementia due to Alzheimer's disease, vascular dementia, dementia with Lewy bodies and frontotemporal dementia. Alzheimer's disease is the most common. Research has shown that in people with Alzheimer's disease, mild cognitive impairment categorises the symptomatic pre-dementia phase, and presents an opportunity of introducing interventions that aim to prevent or postpone the onset of dementia (104). Delaying the progression to dementia would significantly reduce the number of people living with dementia, increasing their quality of life and in turn the associated costs to society in general.

People diagnosed with dementia often have unique needs, as they tend to be older and present with symptoms of memory loss and personality changes (77). Due to the limited benefit of pharmacological treatments in reducing functional decline as well as their potential side effects, best practice guidelines recommend a first approach of behavioural and psychological intervention (105, 106). Exercise programs with older adults have been shown to improve cognitive function - among the potential protective lifestyle factors identified for treating the symptoms of dementia or delaying its progression (107).

4.5.1.2 Mild cognitive impairment

Mild cognitive impairment (MCI) is characterised by the intermediate symptomatology between the cognitive changes of ageing and full developed symptoms of dementia, especially those associated with Alzheimer's disease. The diagnostic criteria for people with MCI are defined by: (1) memory complaint, (2) normal activities of daily living (ADL), (3) normal general cognitive functioning, (4) abnormal memory for age and (5) patient not meeting the criteria for dementia (108). Although MCI is not sufficiently severe to meaningfully impair daily functioning, individuals with MCI have significantly more memory problems than would be expected from someone at a similar age. Individuals with MCI are also 3 to 5 times more likely to develop dementia than healthy individuals of the same age, with an Australian study finding about 15% of people with MCI progressed to dementia each year (109).

Approximately 14% of the Australian population between 60 to 64 years of age live with MCI (110). The economic cost of MCI in Australia is not clear, however, the estimated cost of dementia in Australia in 2008 was approximately AUD$5.4 billion. These costs are likely to rise to become approximately 1% of GDP within the next 2 decades (102) and are estimated to be larger than any other health condition by 2060 (102).

The aetiology of MCI is not entirely attributable to normal aging, and the development of MCI may be precipitated by having a specific form of gene known as APOE ε4 (111). Other medical conditions and lifestyle factors such as diabetes, smoking, depression, lack of physical activity and low education level have also been linked to increased risk for the development of MCI, although a significant proportion of MCI cases can occur without an attributable cause (112).

There are no established therapies for MCI. Activity-based interventions and pharmacotherapies are emerging as candidate treatments for delaying or preventing disease progression or the development of comorbidities, such as mobility decline and falls (113, 114). Tai Chi has been proposed as an intervention, suggested to be particularly beneficial to older adults with MCI as it incorporates physical and mental activity (115).

4.5.2 Description of studies

Twenty-one citations (115-135) corresponding to 4 RCTs (Liu 2018b, Lyu 2018, Nyman 2018, Sungkarat 2017), one quasi-RCT (Fogarty 2016) and 3 cluster RCTs (Cheng 2012, Cheng 2014, Lam 2011) were identified in the literature. There were 4 ongoing studies, and 3 studies awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D2.3.1.

Two studies were carried out in single centre settings in China (Cheng 2012) or Thailand (Sungkarat 2017). Six studies were carried out in multicentre settings in either China (Cheng 2014, Lyu 2018), Canada (Fogarty 2016), Hong Kong (Lam 2011, Liu 2018b) or the United Kingdom (Nyman 2018). Sample sizes ranged from 26 to 548 (total 999 participants), with all studies enrolling older adults with neurocognitive disorders. Five studies (Cheng 2012, Cheng 2014, Liu 2018b, Lyu 2018, Nyman 2018) enrolled participants diagnosed with dementia, in which 3 studies (Cheng 2012, Cheng 2014, Lyu 2018) included people with dementia with CDR[7] scores of less than 2.0. Two studies (Liu 2018b, Nyman 2018) also included the participants' caregivers. Three studies (Fogarty 2016, Lam 2011, Sungkarat 2017) included participants with amnestic type mild cognitive impairment, with participants in Lam 2011 having a CDR score of 0.5. In all studies focused on dementia, the mean age of participants ranged between 80 and 82 years and included both males and females. In 4 out of 5 studies, between 65% to 70% of participant were female, with one study (Nyman 2018) including 43% female participants. In contrast, the studies comprising people with MCI, the mean age of participants between 68 and 77 years. Two out of 3 studies enrolled between 73% and 93% female participants. Fogarty 2016 included equal numbers of males and females.

Three studies (Liu 2018b, Lyu 2018, Nyman 2018) compared a modified form of Tai Chi with no intervention. Two of the 3 studies asked participants to carry out their usual activities and care. Liu 2018b examined the effect of a Yang style form of Tai Chi, and Lyu 2018 implemented a Cognition Protecting form of Tai Chi and Nyman 2018 conducted Therapeutic Tai Chi which focused on positive emotion. One study (Fogarty 2016) compared a memory intervention program coupled with a modified form of Tai Chi against the memory intervention program alone.

Two studies compared Yang style Tai Chi with an active control of either stretching and toning exercise (Lam 2011) or an education advice programme (Sungkarat 2017). Two studies (Cheng 2012, Cheng 2014) compared a Yang style form of Seated Tai Chi with Majong or an attention control that included handcrafts and beading.

[7] The Clinical Dementia Rating (CDR) is based on a scale of 0–3: no dementia (CDR = 0), questionable dementia (CDR = 0.5), MCI (CDR = 1), moderate cognitive impairment (CDR = 2), and severe cognitive impairment (CDR = 3).

In all studies the Tai Chi sessions were typically 30 to 90 minutes in duration, but the treatment programmes ranged in intensity from: 3 times a week for 12 months (Lam 2011), 10 months (Lyu 2019), 15 weeks (Sungkarat 2017), or 12 weeks (Cheng 2012, Cheng 2014); twice a week for 16 weeks (Liu 2018b) or 10 weeks (Fogarty 2016); down to once a week for 20 weeks (Nyman 2018). Nyman 2018 also included a 20 minute per day home practice and Sungkarat 2017 commenced with 3 weeks centre-based classes before moving to home-based intervention for the remaining 12 weeks.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.5.4.1 and Appendix F2).

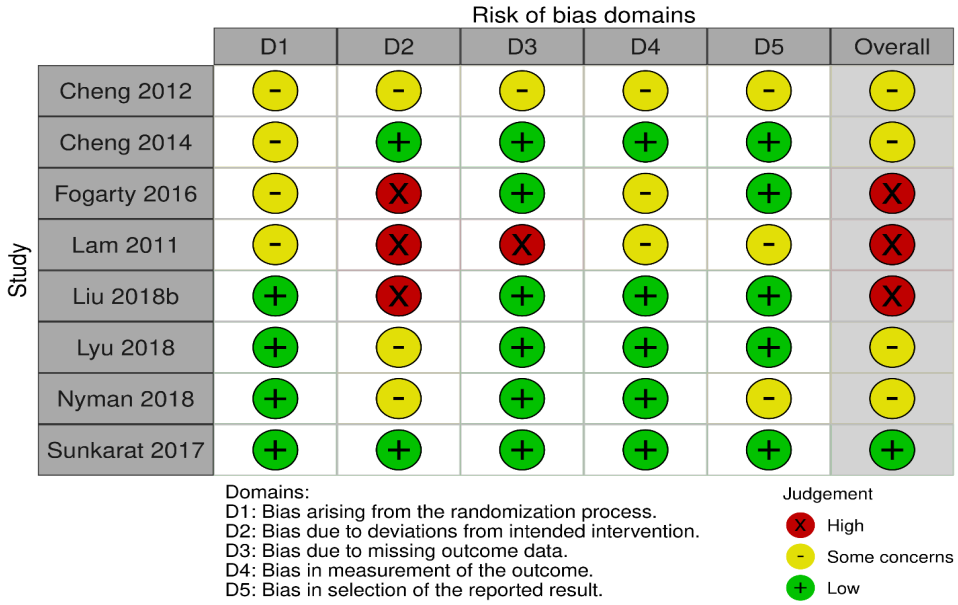
Three cluster RCTs (Cheng 2012, Cheng 2014, Lam 2011) examined Tai Chi versus an active comparator, of which results are presented in Appendix F2.

4.5.3 Risk of Bias – per item

The risk of bias of included RCTs for neurocognitive impairment is summarised in Figure 19. Details are provided in Appendix D2.3.2.

One study (Sungkarat 2017) was judged to be at overall low risk of bias.

Figure 19 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Neurocognitive disorders



4.5.4 Main comparison (vs control)

Five RCTs were eligible for this comparison, with 2 studies (Lyu 2018, Nyman 2018) contributing data to 4 outcomes. There was one study awaiting classification (full text unable to be retrieved) (total 150 participants) that could have contributed data to these outcomes but there was no information to make a judgment regarding the extent of missing data (see Appendix C6).

4.5.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist or usual care) for Neurocognitive disorders

Patient or population: Neurocognitive disorders
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Neurocognitive function assessed with: MoCA or Mini-ACE (higher is best) Scale from: 0 to 30 follow-up: range 6 months to 10 months	-	SMD **0.27 SD higher ^** (0.60 higher to 0.05 lower)	-	145 (2 RCTs)	⊕⊕◯◯ LOW [A,B,C,D,E]	Tai Chi may result in little to no difference in neurocognitive function in adults with neurocognitive disorders.**
Activities of daily living assessed with: Barthel ADL index (higher is best) Scale from: 0 to 100 follow-up: 10 months	The mean activities of daily living index was **92.55**	MD **1.57 higher** (7.24 higher to 4.10 lower)	-	72 (1 RCT)	⊕⊕◯◯ LOW [A,C,D,E,F]	Tai Chi may result in little to no difference in activities of daily living in adults with neurocognitive disorders.***
Quality of life assessed with: SF-36 Scale from: 0 to 100 Follow-up: 22 weeks	The authors did not provide data but reported that there was no important difference observed between groups for any of the SF-36 domains.		-	48 (1 RCT)	-	The effect of Tai Chi on quality of life in adults with neurocognitive disorders is not known.*
Balance/falls risk assessed with: Berg balance scale (higher is best) Scale from: 0 to 56 follow-up: 6 months	The mean balance/falls risk was **44.7**	MD **0.10 higher** (3.21 higher to 3.01 lower)	-	68 (1 RCT)	⊕⊕◯◯ LOW [A,C,D,E,F]	Tai Chi may result in little to no difference in balance stability in adults with neurocognitive disorders.****
Psychosocial wellbeing assessed with: Geriatric Depression Scale (higher is worse) Scale from: 0 to 30 follow-up: 10 months	The mean depression score was **5.37** points	MD **2.93 lower** (3.62 lower to 2.24 lower)	-	74 (1 RCT)	⊕⊕⊕◯ MODERATE [A,C,E,F,G]	Tai Chi may result in a slight increase in psychosocial wellbeing in adults with neurocognitive disorders.*****
Sleep - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on sleep in adults with neurocognitive disorders is not known.

Tai Chi compared to Control (no intervention, waitlist or usual care) for Neurocognitive disorders

Patient or population: Neurocognitive disorders
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
General health - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on general health in adults with neurocognitive disorders is not known.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** Participants in both groups remain below the cut-offs considered normal for both the MoCA and the Mini-ACE.
*** An MCID of 1.85 points has been proposed to be clinically meaningful for stroke patients (136).
**** A score of less than 45 indicates individuals continue to be at greater risk of falling (137).
***** MCID is unknown.#

^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (73).
# In the absence of an MCID, effect estimates were considered on 3 levels: small (MD 10% or less of the scale), moderate (MD between 10% to 20% of the scale) or large (MD more than 20% of the scale).

ADL: activities of daily living; **CI:** confidence interval; **MCID:** minimal clinically important difference; **MD:** mean difference; **MoCA:** Montreal Cognitive Assessment; **MMSE:** Mini Mental State Examination; **Mini-ACE:** Mini-Addenbrooke Cognitive Exam; **RCT:** randomised controlled trial; **SMD:** standardised mean difference

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

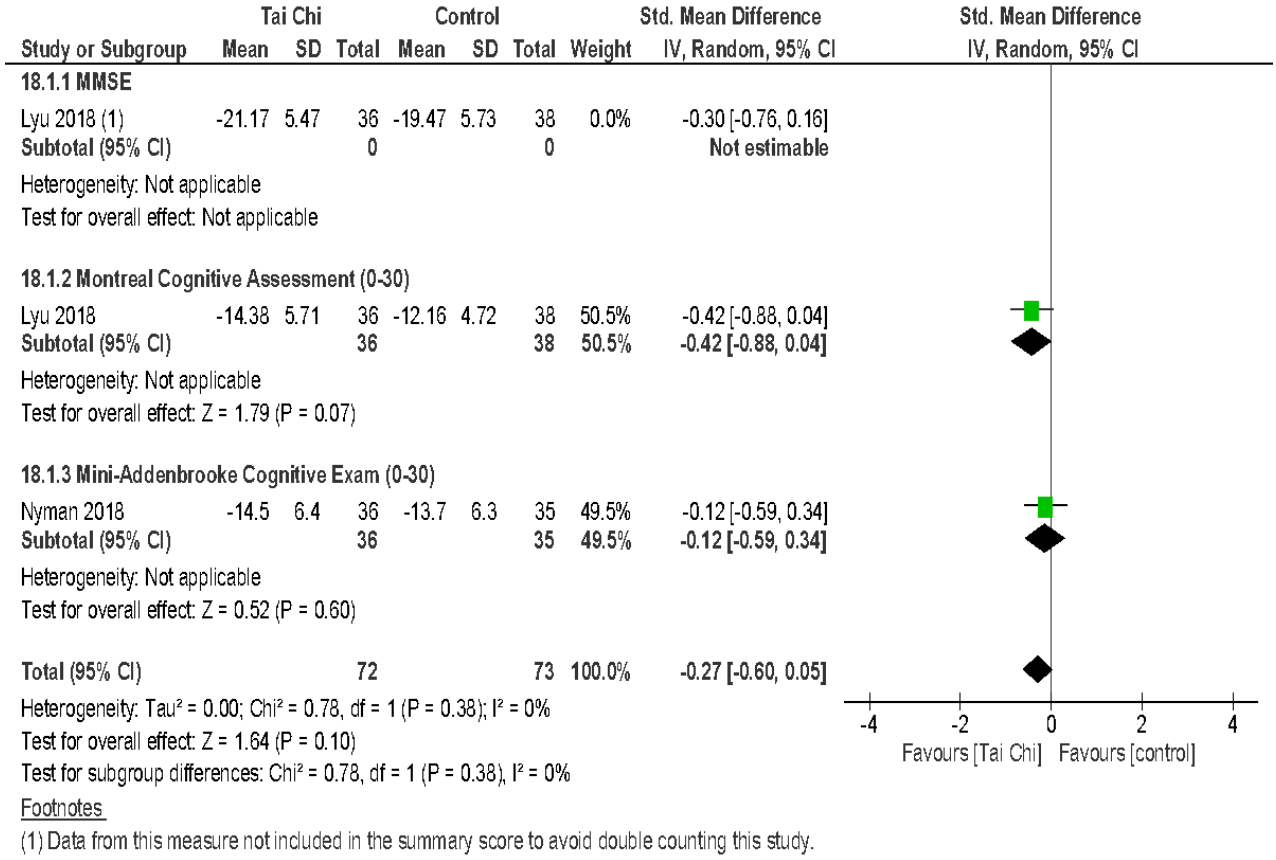
Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.
b. No serious inconsistency. Certainty of evidence not downgraded.
c. No serious indirectness. Available evidence is directly generalisable to the Australian healthcare context with few caveats. Certainty of evidence not downgraded.
d. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with both an important and no important difference). Certainty of evidence downgraded.
e. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.
f. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
g. No serious imprecision. Certainty of evidence not downgraded.

4.5.4.2 Forest Plots

Outcome results relating to people with neurocognitive disorders are presented in Figure 20 (neurocognitive function), Figure 21 (activities of daily living), Figure 22 (balance stability) and Figure 23 (psychosocial wellbeing).

Figure 20 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Neurocognitive disorders – neurocognitive function



Footnotes

(1) Data from this measure not included in the summary score to avoid double counting this study.

Figure 21 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Neurocognitive disorders – Activities of daily living

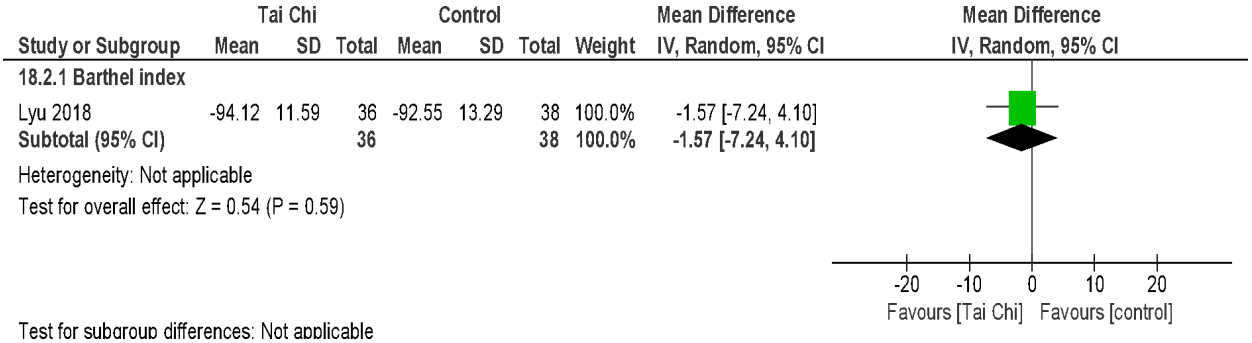


Figure 22 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Neurocognitive disorders – Falls/balance

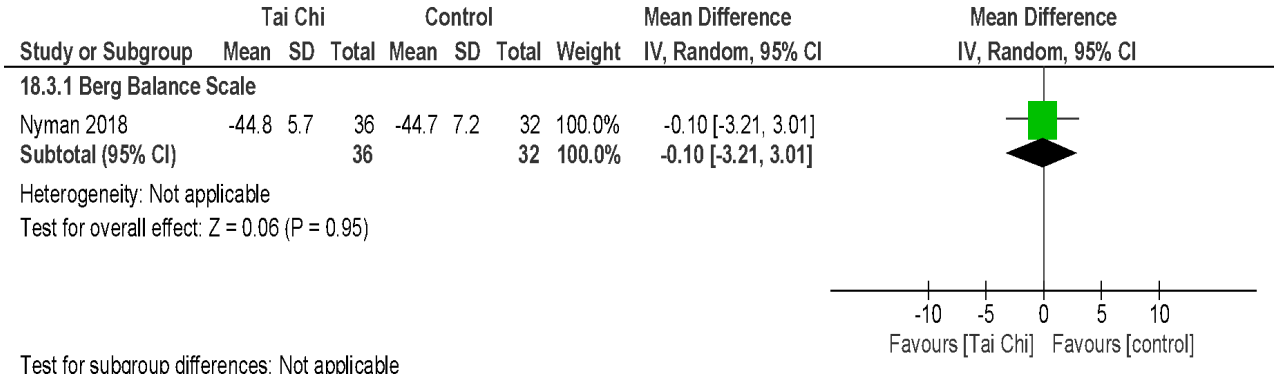
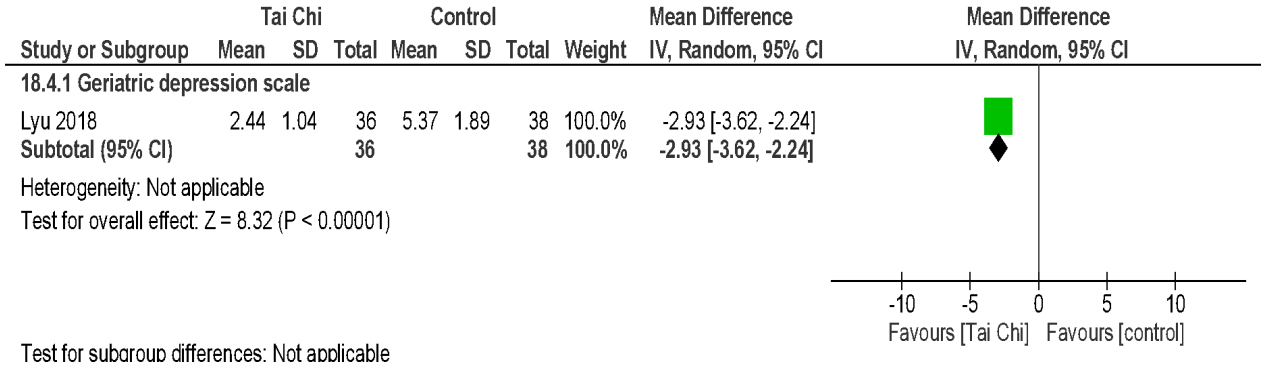


Figure 23 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Neurocognitive disorders – Psychosocial wellbeing



4.6 Rehabilitation after acute cerebrovascular stroke

4.6.1 Description of the condition

Stroke occurs when blood supply to the brain either suddenly becomes blocked (ischaemic stroke) or a blood vessel ruptures and begins to bleed (haemorrhagic stroke) (138). In Australia, there were more than 100 stroke events every day in 2017 and stroke accounted for 5.3% of all deaths in 2018 (138). Every stroke is different depending on where in the brain stroke occurs and the severity. As a result of stroke, part of the brain may die which can lead to the impairment of various function, including partial paralysis and difficulties with speech, swallowing, vision and thinking (139).

Patients with chronic stroke are hospitalised during the acute or sub-acute phase and go on to receive rehabilitation treatment in the months following (140). Australian Clinical Guidelines for Stroke Management (141) suggest holistic rehabilitation beginning the first day after stroke with the aim of maximising the participation of the person with stroke in the community. An important part of the rehabilitation process is improving muscle strength and coordination. Tai Chi training is thought to be effective for the recovery of physical functions including balance, strength and flexibility in various age groups (142). The method can be adapted to the persons abilities and needs and has been suggested to be a valuable part of rehabilitation for persons following stroke (142).

4.6.2 Description of studies

Eighteen citations (143-160) corresponding to 5 RCTs (Au-Yeung 2007, Chan 2018, Huang 2019, Taylor-Piliae 2013, Tao 2015) and 4 quasi-RCTs (Chan 2017a, Hart 2004, Kim 2015, Wang 2010) were identified in the literature. There were 4 ongoing studies and 8 studies awaiting classification (including one study that could not be retrieved, one conference abstract and 6 studies published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D3.1.1.

Two of the 9 studies were carried out in single centre settings in either China (Huang 2019) or South Korea (Kim 2015) and one study (Au-Yeung 2007) was carried out across multiple community centres in Hong Kong. The remaining studies were conducted in the community in either Hong Kong (Chan 2017a, Chan 2018), United States (Taylor-Piliae 2013), Japan (Wang 2010) or China (Tao 2015). Chan 2017a and Chan 2018 also included home practice as part of the intervention. Hart 2004 did not provide any information on the setting of the trial, but it was conducted in Israel. The sample size ranged from 24 to 250 participants (total 708) and included adults recovering from stroke. One study (Huang 2019) also included participants with a fear of falling and Wang 2010 included elderly participants with cerebral vascular disorder. In all studies, both female and male participants were recruited, and the mean age ranged from 53.4 to 76.5 years. In all studies, participants with any neurological or muscular impairment that would interfere with study participation were excluded.

Two of the 9 studies compared a Yang style short-form of Tai Chi with no intervention or a waitlist control (Huang 2019, Kim 2015). The intervention in Huang 2019 focused on footwork and included body weight support. Both studies included conventional physiotherapy as a co-intervention. Three of the studies were three-armed, comparing a waitlisted or usual care control with either conventional physical exercise (Chan 2017a, Chan 2018) or a SilverSneakers exercise program (Taylor-Piliae 2013). The remaining 4 studies with an active control group compared Sun Style short-form Tai Chi (Au-Yeung 2007), Tai Chi Chaun (Hart 2004), Yang style short-form Tai Chi (Wang 2010) or Yun Shou Tai Chi (Tao 2015) with various active control including low impact exercise (breathing and stretching), conventional rehabilitation exercises including walking and resistance training and balance rehabilitation.

In all studies, the Tai Chi sessions were typically 60 minutes in duration lasting for 6 (Kim 2015), 12 (Au-Yeung 2007, Chan 2017a, Hart 2004, Huang 2019, Taylor-Piliae 2013, Wang 2010, Tao 2015) or 13 weeks (Chan 2018) but the intensity varied from one session per week (Au-Yeung 2007, Wang 2010) to 2 (Chan 2017a, Hart 2004, Kim 2015), 3 (Chan 2018, Huang 2019, Taylor-Piliae 2013) or 5 sessions per week (Tao 2015). Chan 2017a and Chan 2018 also included a 30-minute home practice per week and Au-Yeung 2007 a 3-hour home practice per week.

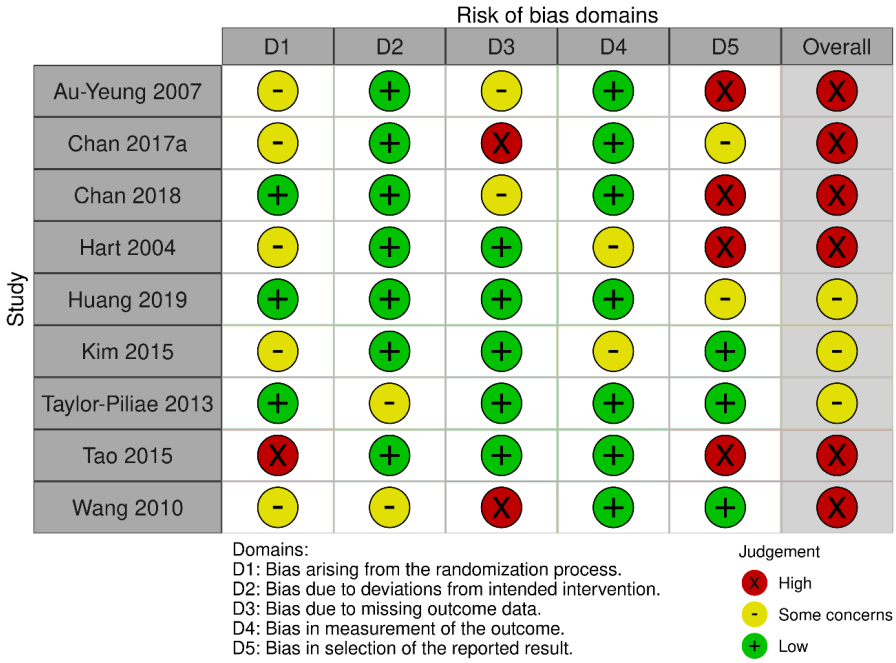
Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.6.4.1) (and Appendix F2). Results for the 3 studies (Hart 2004, Taylor-Piliae 2013, Tao 2015) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.6.3 Risk of Bias – per item

The risk of bias of included RCTs for stroke rehabilitation is summarised in Figure 24. Details are provided in Appendix D3.1.2.

No studies were judged to be at overall low risk of bias.

Figure 24 Risk of bias summary: review authors' judgements about each risk of bias item for each study: Stroke Rehabilitation



4.6.4 Main comparison (vs control)

Two RCTs (Huang 2018, Taylor-Piliae 2013) and one quasi-RCT (Kim 2015) were eligible for this comparison and contributed data to 3 outcomes. The remaining 2 RCTs did not report any outcome measures considered to be critical or important for decision-making.

There were 2 studies awaiting classification and 2 ongoing studies (total 125+ participants) that compared Tai Chi with no intervention in people rehabilitating after an acute cerebrovascular event that could have contributed data to some of these outcomes, but there was limited information to make a judgment regarding the extent of missing data (see Appendix C6).

4.6.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, usual care) for stroke rehabilitation

Patient or population: Stroke rehabilitation
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Balance assessed with: Berg Balance Scale - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on balance stability in people rehabilitating after stroke is unknown.
Activities of daily living assessed with: SF-36 Physical Component score (higher is best) Scale: 0 to 100 follow-up: 12 weeks	Two studies reporting little to no between group difference for combined PCS score or individual domain scores (see Figure 25)		-	123 (2 RCTs)	⊕⊕⊕◯ MODERATE [A]	Tai Chi probably results in little to no difference in activities of daily living for people rehabilitating after stroke.**
Aerobic capacity and endurance assessed with: 6-minute walk test	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on aerobic capacity and endurance in people rehabilitating after stroke is unknown.
Motor function assessed with: Fugl-Meyer Test (higher is best) Scale: 0 to 100 follow-up: 12 weeks	The mean motor function was **25.5**	MD **3.81 higher** (6.12 higher to 1.5 higher)	-	28 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in a slight improvement in motor function in people rehabilitating after stroke.***
Number of Falls assessed with: Patient reported falls follow-up: 12 weeks	**536 per 1000** person days	**166 per 1000** person days (70 to 396)	**RR 0.31** (0.13 to 0.74)	58 (1 RCT)	⊕⊕◯◯ LOW [B,D,E]	Tai Chi may result in a slight reduction in the number of falls in people rehabilitating after stroke.^
HRQoL, disease specific assessed with: SS-QoL - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on HRQoL in people rehabilitating after strokes is unknown.
Cognitive Function assessed with: MMSE (or other) - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on cognitive function in people rehabilitating after strokes is unknown.

Tai Chi compared to Control (no intervention, usual care) for stroke rehabilitation

Patient or population: Stroke rehabilitation
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID for the SF-36 PCS in patients with stroke is estimated to be 1.8 to 3.0 points (161).
*** The MCID for the FM-LE in chronic stoke has not been established but is suggested to be based on 10% of the total score (i.e. 3.4 points) (162).#

^ A 25% relative reduction was considered important (i.e. RR < 0.75).
# Effect estimates were considered on 3 levels: small (MD <10% of the scale), moderate (MD between 10% to 20% of the scale), or large (MD more than 20% of the scale)

CI: confidence interval; **HRQoL:** health related quality of life; **MCID:** minimal clinically important difference; **MD:** mean difference; **SF-36:** 36-item short form survey; **RCT:** randomised controlled trial; **RR:** risk ratio

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with large and no important difference). Certainty of evidence downgraded.
b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
c. Study was conducted in China with evidence not directly generalisable to the Australian healthcare context but could be sensibly applied. Certainty of evidence not downgraded.
d. Publication bias suspected. The evidence is limited to a small number of small trials. Certainty of evidence downgraded.

4.6.4.2 Forest plots

Outcome results related to people rehabilitating after stroke are presented in Figure 25 (activities of daily living), Figure 26 (motor function) and Figure 27 (number of falls).

Figure 25 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Stroke rehabilitation – Activities of daily living

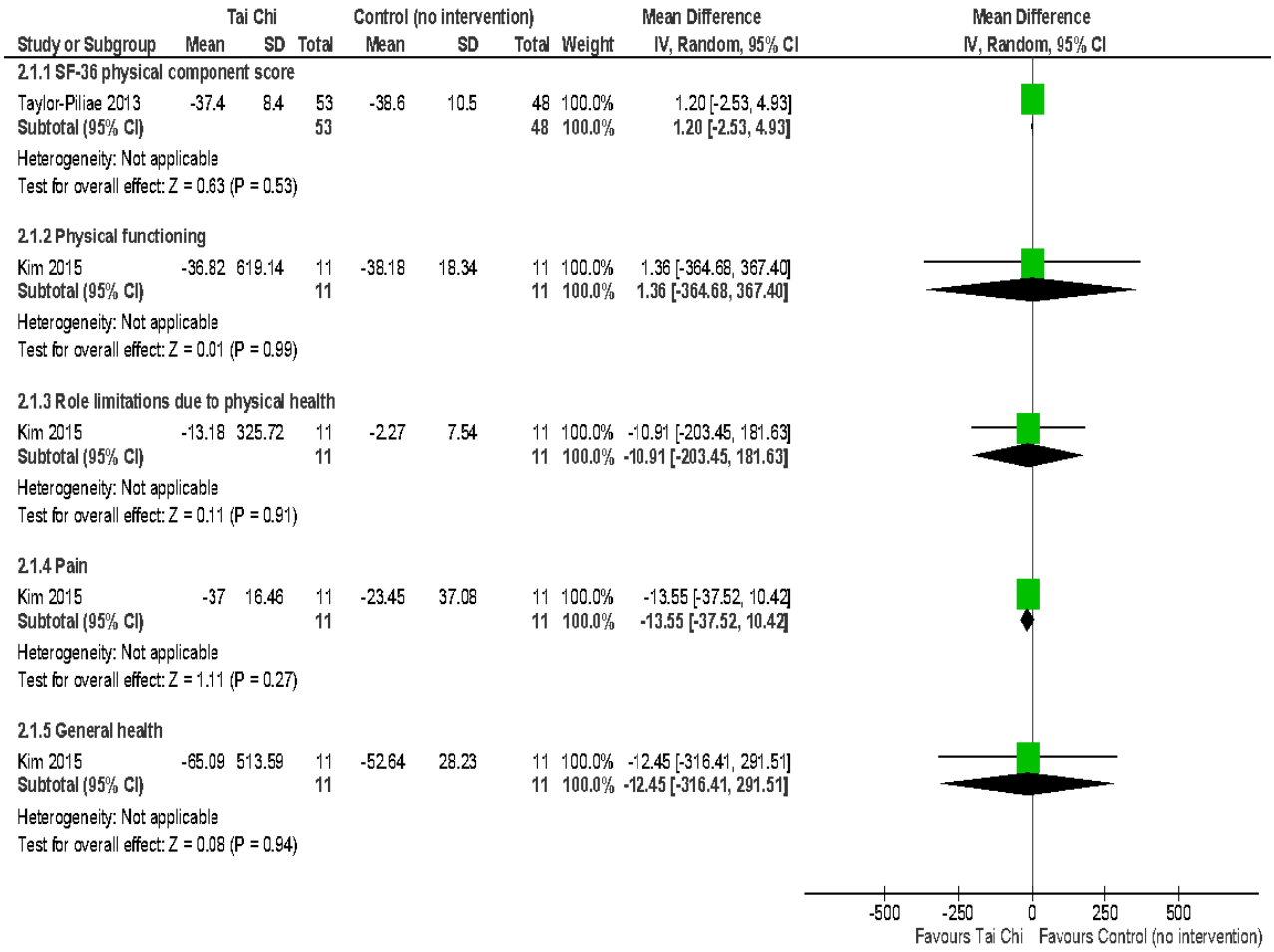


Figure 26 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Stroke rehabilitation – Motor function

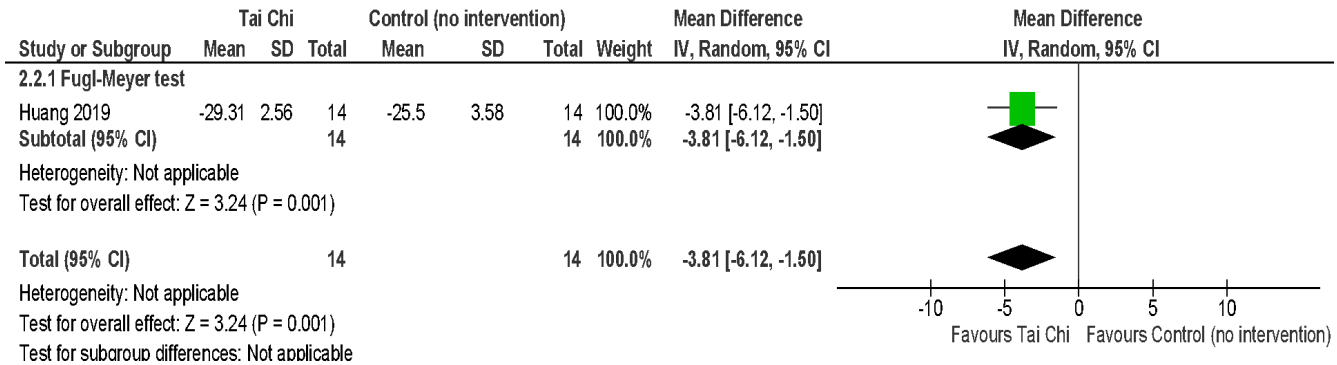
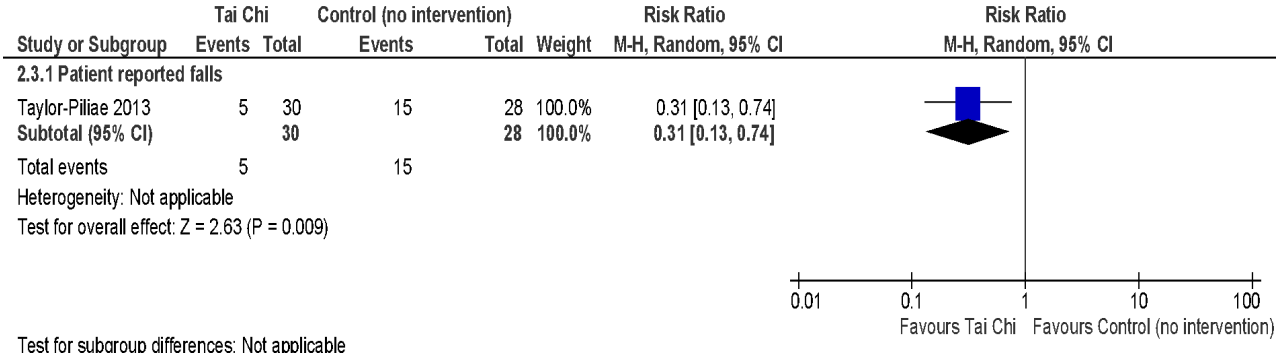


Figure 27 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Stroke rehabilitation – Number of falls



4.7 Parkinson's disease

4.7.1 Description of the condition

Parkinson's disease is a complex neurodegenerative disease characterised by death of dopaminergic neurons. As the disease progresses affected people face increasing levels of disability caused by motor (tremor, stiffness, slowness and imbalance) and nonmotor symptoms affecting many organ systems (163). Parkinson's disease is one of the most common neurodegenerative diseases, with estimates ranging between 84 000 and 212 000 people living with Parkinson's disease in Australia (164, 165). Approximately 18% of affected persons are of working age, with the majority diagnosed after the age of 65. A dramatic rise in number of people living with PD is expected as the Australian population ages (164).

Traditionally, treatment of Parkinson's disease involves pharmacologic approaches (typically with levodopa with or without other medications). However, even with optimal pharmacologic management, people living with PD experience progressive disability. For this reason, there has been growing support for addition of nonpharmacologic approaches to PD management including exercise, such as Tai Chi, and physical, occupational and speech therapies (163, 166).

4.7.2 Description of studies

There were 24 citations (167-186) corresponding to 8 RCTs (Gao 2009, Hackney 2008, Hackney 2009, Khuzema 2020, Li 2012, Poier 2019, Vergara-Diaz 2017, Zhang 2015b) and 3 quasi-RCTs (Amano 2013, Choi 2013, Nocera 2013) identified in the literature. There were 5 ongoing studies and 5 studies awaiting classification (including 3 studies published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D3.2.1.

Three of the 11 studies were carried out in single centre settings in either the United States (Amano 2013, Li 2012) or Korea (Choi 2013). Choi 2013 also incorporated a home-based setting. The remaining 8 studies were carried out across multiple community-based settings in either China (Gao 2009, Zhang 2015b), the United States (Hackney 2008, Hackney 2009, Nocera 2013, Vergara-Diaz 2017), Germany (Poier 2019) or India (Khuzema 2020). Khuzema 2020 was a home-based only trial. Sample sizes ranged between 21 and 195 participants (total 601), with all studies enrolling participants with Parkinson's disease. Eight of the 11 studies included participants with Parkinson's disease characterised as idiopathic (Amano 2013, Choi 2013, Gao 2009, Hackney 2008, Hackney 2009, Nocera 2013, Vergara-Diaz 2017, Zhang 2015b). There were no limits on sex specified in the studies; however, a majority of trials enrolled a greater proportion of men. All included studies enrolled adults over the age of 40 years (mean age between 63.85 and 70.33 years) and excluded participants with history or evidence of neurological impairment other than Parkinson's disease (e.g. dementia, stroke).

Seven of the 11 studies (Amano 2013, Choi 2013, Gao 2009, Hackney 2008, Hackney 2009, Nocera 2013, Vergara-Diaz 2017) compared a modified form of Tai Chi with no intervention or usual care control. Two of the 7 studies also included an active control. Hackney 2009 included 2 additional intervention arms of either Waltz/Foxtrot or Tango. Amano 2013 was divided into 2 separate projects with the first project comparing Yang style Tai Chi with Qi Gong meditation and the second project comparing Yang style Tai Chi to no intervention. The remaining 4 studies compared modified forms of Tai Chi to a variety of active controls including Yoga or conventional balance exercise programs (Khuzema 2020), stretch and resistance training or low-intensity exercise (Li 2012), Tango Argentino (Poier 2019) and multimodal exercise training (Zhang 2015b).

In all studies, the Tai Chi sessions were typically 60 minutes in duration but ranged in intensity from 5 times a week for 8 weeks (Khuzema 2020), 3 times a week for 12 (Gao 2009) or 16 weeks (Nocera 2013), twice a week for 12 (Choi 2013, Zhang 2015b), 13 (Hackney 2008, Hackney 2009) or 24 weeks (Li 2012, Vergara-Diaz 2017) down to once a week for 10 weeks (Poier 2019). Choi 2013 also included one home-based practice per week for the 12 weeks. Amano 2013 ranged in intensity with 2, 60-minute sessions for 16 weeks in project 1 and 3, 60-minute sessions for 16 weeks in project 2.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.7.4.1 and Appendix F2).

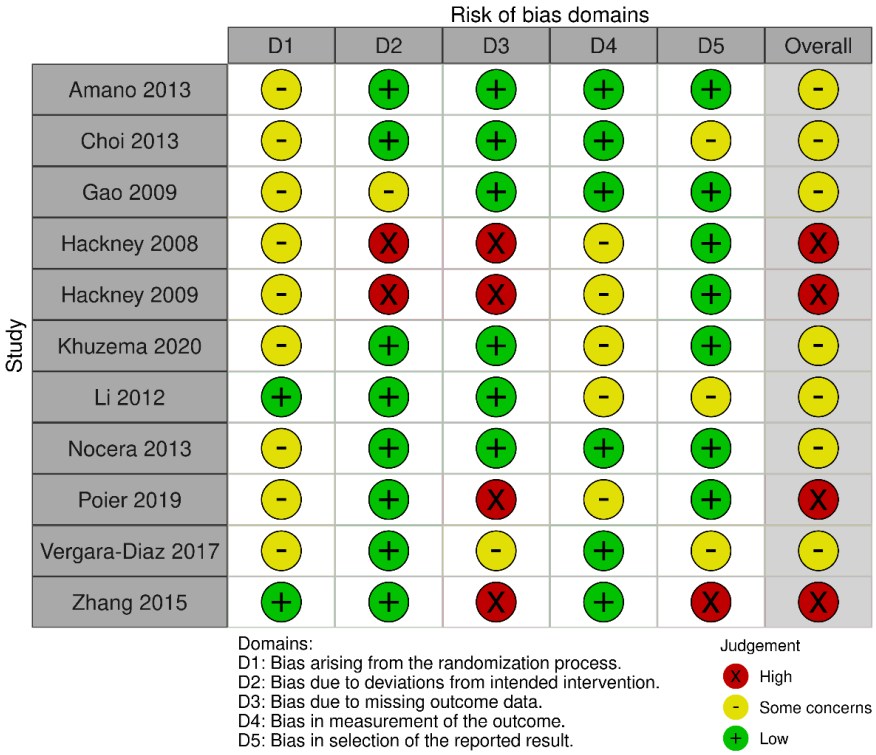
Results from the RCTs (Amano 2013, Hackney 2009, Khuzema 2020, Li 2012, Poier 2019, Zhang 2015) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.7.3 Risk of Bias – per item

The risk of bias of included RCTs for Parkinson's disease is summarised in Figure 28. Details are provided in Appendix D3.2.2.

No studies were judged to be at overall low risk of bias.

Figure 28 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Parkinson's disease



4.7.4 Main comparison (vs control)

Seven RCTs (Amano 2013, Choi 2013, Gao 2009, Hackney 2008, Vergara-Diaz 2017, Hackney 2009, Nocera 2013) were eligible for this comparison and contributed data relevant to 5 outcomes. There were 4 studies awaiting classification (total 187 participants) that compared Tai Chi with no intervention in people living with Parkinson's disease that could have contributed data to these outcomes (see Appendix C6).

4.7.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for Parkinson's disease

Patient or population: Parkinson's disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Balance assessed with: Berg Balance Scale (higher is best) Scale from: 0 to 56 follow-up: range 8 weeks to 13 weeks	The mean score ranged from **46.4 to not reported**	MD **3.80** (5.41 lower to 2.20 lower)	-	109 (2 RCTs)	⊕⊕◯◯ LOW [A,B,C,G]	Tai Chi may result in little to no improvement in balance stability for people living with Parkinson's Disease.**
Motor function assessed with: UPDRS-III (higher is worse) Scale from: 0 to 132 follow-up: range 10 weeks to 6 months	The mean score ranged from **16.44 to 28.72**	MD **1.73 lower** (5.40 lower to 1.95 higher)	-	178 (5 RCTs)	⊕⊕◯◯ LOW [C,D,E]	Tai Chi may result in little to no difference in motor function in people living with Parkinson's Disease.***
Number of Falls assessed with: Self-reported (higher is worse) follow-up: 6 months	The mean number of falls was **0.64**	MD **0.34 lower** (0.65 lower to 0.03 lower)	-	76 (1 RCT)	⊕⊕◯◯ LOW [C,F,G]	Tai Chi may result in a slight reduction in the average number of falls for people living with Parkinson's Disease.****
Quality of life assessed with: PDQ-39 (higher is worse) Scale from: 0 to 100 follow-up: range 10 weeks to 6 months	-	SMD **0.76 SD higher ^** (1.03 lower to 2.55 higher)	-	76 (3 RCTs)	⊕◯◯◯ VERY LOW [C,G,H,I]	The evidence is very uncertain about the effect of Tai Chi on health-related quality of life in people living with Parkinson's Disease.*****
Disease severity assessed with: UPDRS-II (higher is worse) Scale from: 0 to 52 follow up: 12 weeks	The mean score was **8.22** points	MD **2.40 lower** (5.53 lower to 0.73 higher)	-	20 (1 RCT)	⊕⊕◯◯ LOW [F,G,J]	Tai Chi may result in a slight improvement in motor aspects of daily living in people living with Parkinson's Disease.******
Cognitive function - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on cognitive function in people living with Parkinson's Disease is unknown.

Tai Chi compared to Control (no intervention, waitlist, usual care) for Parkinson's disease

Patient or population: Parkinson's disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Disability - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disability in people living with Parkinson's Disease is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** MCID for improvement in balance stability in people living with Parkinson's Disease is 5 points (187).
*** The MCID for Motor function assessed with UPDRS-III is estimated to be 5 points (188).
**** A 25% (IQR 20-25%) relative reduction in falls rate would be clinically meaningful (189).
***** The MCID for PDQ-39 is –4.72 (improvement) and +4.22 (worsening) (190).
****** The MCID for Disease severity assessed with UPDRS-II is estimated to be +1.8 for improvement (191).

^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (73).

CI: confidence interval; **MCID:** minimal clinically important difference; **MD:** mean difference; **PDQ:** Parkinson's Disease Questionnaire; **SMD:** standardised mean difference; **UPDRS:** Unified Parkinson's Disease Rating Score

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. One study at high risk of bias (83.4% weight) that did not seriously influence the results. Certainty of evidence not downgraded.

b. No serious inconsistency. Certainty of evidence not downgraded.

c. Serious imprecision. Wide confidence intervals (upper bound overlaps with an important difference). Certainty of evidence downgraded.

d. No serious risk of bias. One study at high risk of bias (24.8% weight) that does not seriously influence the result. In a sensitivity analysis, the effect was smaller when the study at high risk of bias was removed, but both point estimates were below the threshold for an important effect (5 points). Certainty of evidence not downgraded.

e. Serious inconsistency. Significant statistical heterogeneity (I^2 = 57%) with important differences in the observed effect and minimal overall of confidence intervals. Certainty of evidence downgraded.

f. Single study. Heterogeneity not assessed. Certainty of evidence not downgraded.

g. Publication bias suspected. Probable missing data related to non-reporting of results. Certainty of evidence downgraded.

h. Serious risk of bias. One study at high risk of bias (32.6% weight) that influences the results. In a sensitivity analysis, the effect was smaller when the study at high risk of bias was removed, but the overall conclusion did not change (no important difference between groups). Certainty of evidence downgraded.

i. Serious inconsistency. Significant statistical heterogeneity (I^2 = 91%) with no overlap in confidence intervals. Certainty of evidence downgraded.

j. Serious imprecision. Wide confidence intervals (lower bound overlaps with no important difference). Certainty of evidence downgraded.

4.7.4.2 Forest plots

Outcomes relating to people living with Parkinson's Disease are presented in Figure 29 (balance), Figure 30 (motor function), Figure 31 (number of falls), Figure 32 (quality of life) and Figure 33 (disease severity).

Figure 29 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Parkinson's disease – balance

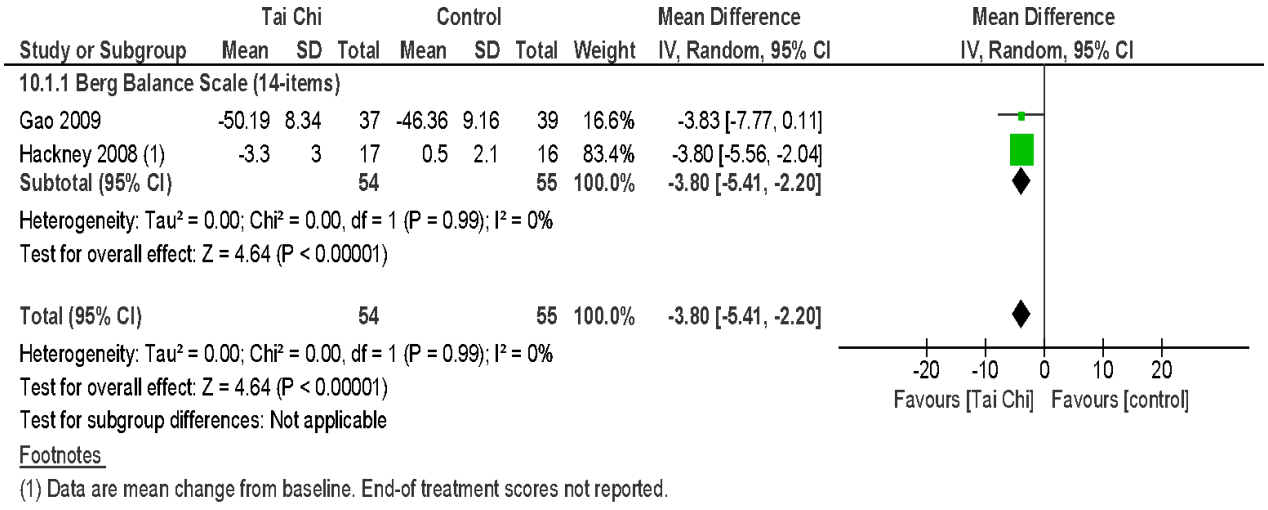


Figure 30 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Parkinson's disease – motor function

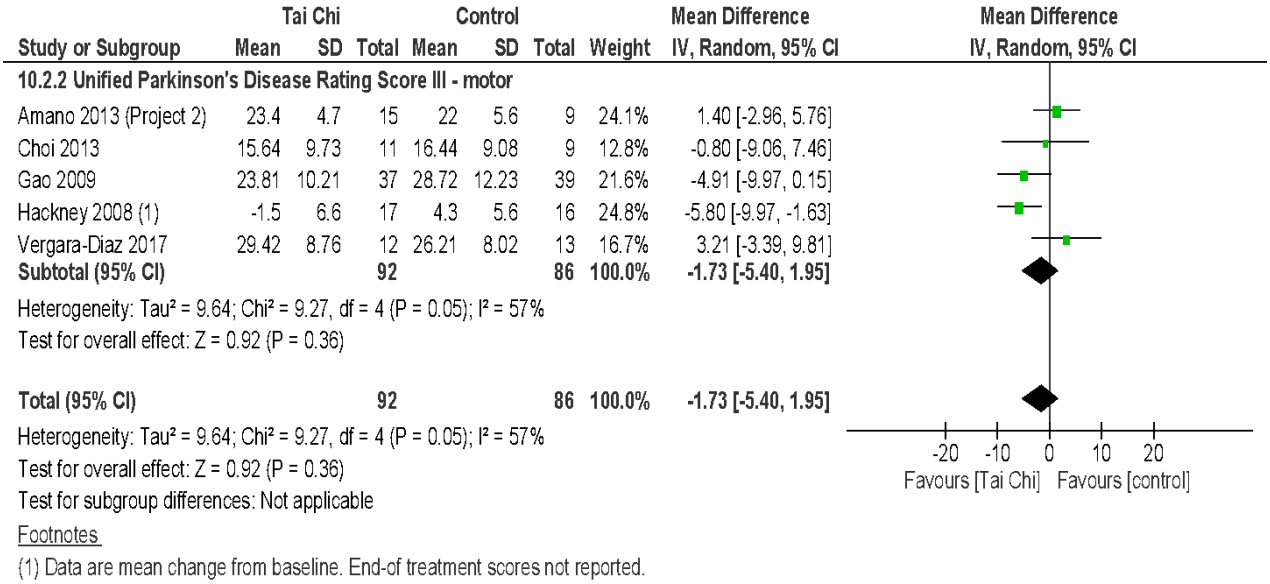


Figure 31 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Parkinson's disease – average number of falls

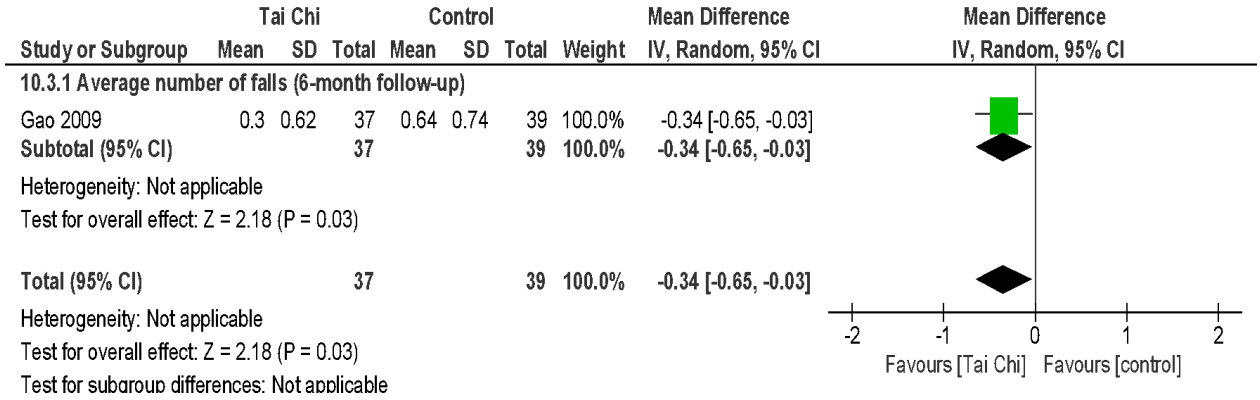


Figure 32 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Parkinson's disease – quality of life

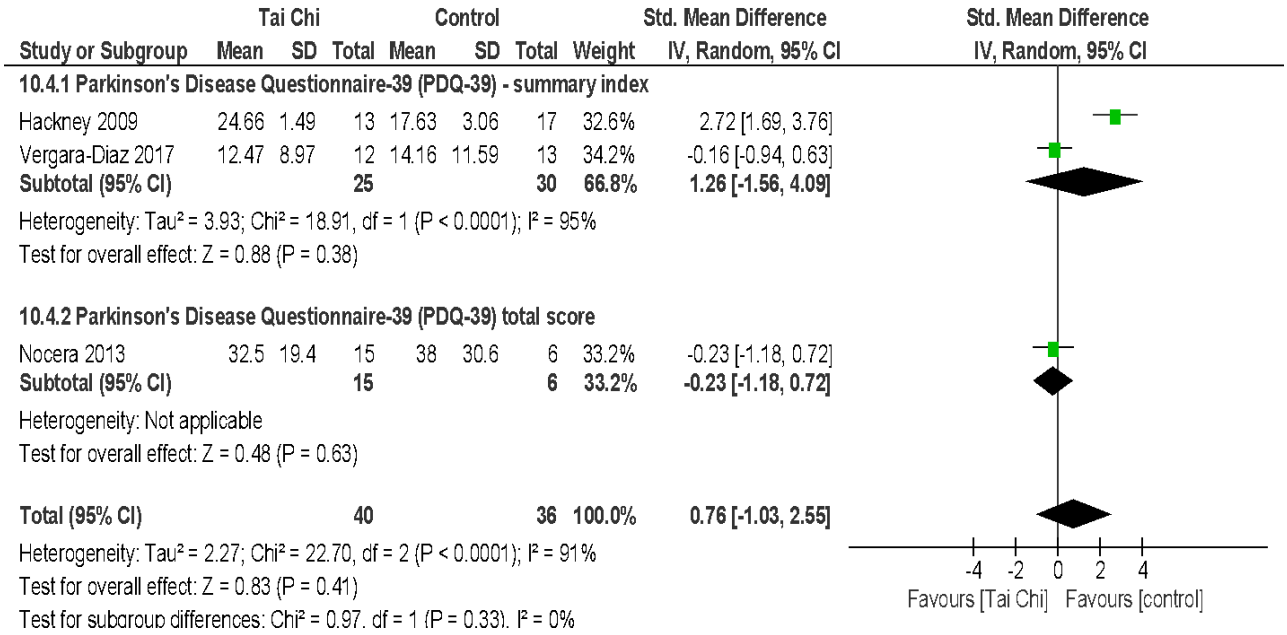
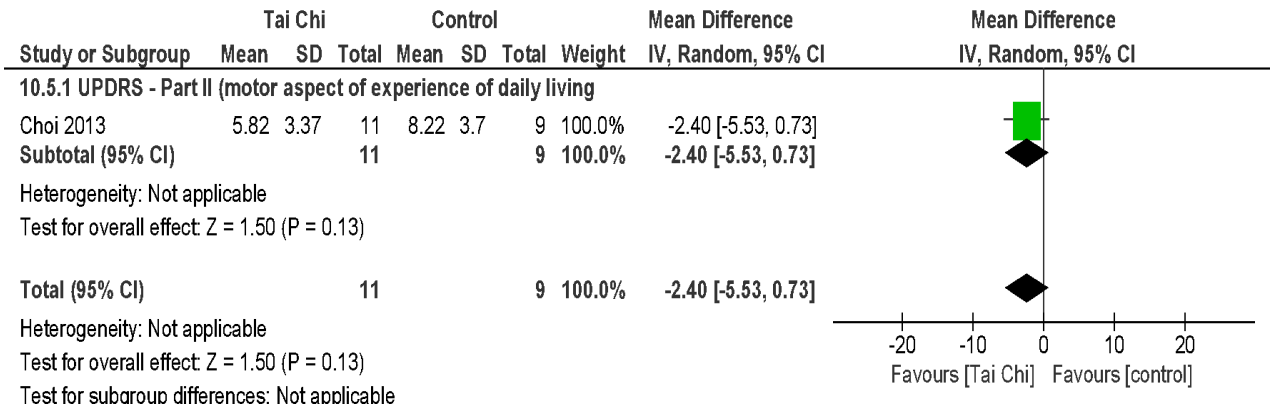


Figure 33 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Parkinson's disease – disease severity



4.8 Multiple sclerosis

4.8.1 Description of the condition

Multiple sclerosis (MS) is a chronic inflammatory, demyelinating and neurodegenerative disease of the central nervous system. A distinctive feature of MS is accumulation of demyelinating plaques in the brain and spinal cord (192, 193). MS symptoms are heterogenous depending on which part of the central nervous system is affected, but can include combination of motor control issues, fatigue, neurological and neuropsychological symptoms and incontinence. Most people experience relapsing-remitting MS, characterised by neurological episodes known as relapses, which are reversible but leave behind accumulated neurological and clinical disability. Over time, the disease progresses to secondary progressive disease. Approximately 5% to 15% of people with MS have a progressive form of disease from onset (192, 193).

MS is the most common nontraumatic disease of the central nervous system in young adults. In Australia, over 25 000 people are living with MS (194). Most people are diagnosed between the ages of 20 and 40 years of age, with 3 out of every 4 diagnosed persons likely to be women (194). The quality of life of people with MS in Australia is estimated to be 31% less than that of the general population with reduced life-quality driven mostly by MS-related pain, extreme fatigue, and impact on independent living (related to factors such as balance impairment, dizziness, visual disturbances), mental health and relationships (194).

MS is typically treated with disease modifying therapeutics (DMTs) that act on the immune system to decrease the frequency of relapse and avoid disease progression. In Australia, approximately two-thirds of people with MS are prescribed DMTs, with treatment options more limited for people with the progressive form of disease (194). Use of DMTs is associated with higher QoL but they also contribute the largest economic burden for people living with MS (194). Modifiable lifestyle factors that can slow MS disease progression and prevent or improve associated disabilities are also recommended (195-197), as they provide a mechanism for people with MS to take control and potentially minimise the impact of MS on their lives (198). This includes interventions that focus on falls prevention (199), improvements in diet or gut health (200), and interventions that enhance physical activity (201).

4.8.2 Description of studies

Three citations (202-204) corresponding to one quasi-RCT (Azimzadeh 2013) were identified in the literature. There were no ongoing studies and 2 studies awaiting classification (one conference abstract and one study published in a language other than English (206)). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D3.3.1.

One study (Azimzadeh 2013) was carried out in a community-based setting in Iran, enrolling women with multiple sclerosis aged 20 to 60 years (mean age between 40.5 years). Participants experiencing acute and severe recurrences of disease, at any stage of pregnancy, or were involved in any other exercise were excluded.

Azimzadeh 2013 assessed the effectiveness of a 6-form Yang style Tai Chi with no intervention. The 45 to 60-minute Tai Chi sessions were provided by a certified instructor 2 times a week for 12 weeks. Participants were also encouraged to practise at home. Women in both the Tai Chi group and control group maintained their usual care of psychological classes and physical therapy.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings tables (see 4.8.4.1) (and Appendix F2).

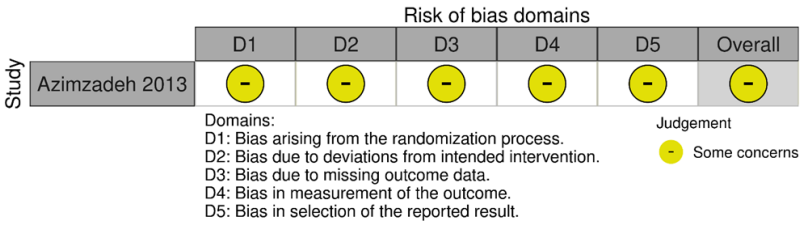
There were no studies that compared Tai Chi with an active comparator.

4.8.3 Risk of Bias – per item

The risk of bias of included RCTs for multiple sclerosis is summarised in Figure 34. Details are provided in Appendix D3.3.2.

Some concerns of bias were raised about each domain in Azimzadeh 2013.

Figure 34 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Multiple sclerosis



4.8.4 Main comparison (vs control)

One study (Azimzadeh 2013) was eligible for this comparison and contributed data to one outcome. There was one study awaiting classification (72 participants) that was published in a language other than English that could have contributed data to these outcomes (see Appendix C6).

4.8.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for Multiple sclerosis

Patient or population: Multiple sclerosis
Setting: Community
Intervention: Tai Chi
Comparison: Control

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Activities of daily living - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on activities of daily living in people living with multiple sclerosis is unknown.
Balance assessed with: Berg Balance Scale (higher is best) Scale from: 0 to 56 follow-up: 12 weeks	The mean balance score was **53.61**	MD **0.33 higher** (1.14 lower to 1.80 higher)	-	34 (1 RCT)	⨁⨁◯◯ LOW A,B,C,D,E	Tai Chi may result in little to no improvement in balance stability for people living with multiple sclerosis.**
Quality of life - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on quality of life in people living with multiple sclerosis is unknown.

Tai Chi compared to Control (no intervention, waitlist, usual care) for Multiple sclerosis

Patient or population: Multiple sclerosis
Setting: Community
Intervention: Tai Chi
Comparison: Control

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Fatigue - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on fatigue in people living with multiple sclerosis is unknown.
Disability - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disability in people living with multiple sclerosis is unknown.
General health - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on general health in people living with multiple sclerosis is unknown.
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on psychosocial wellbeing in people living with multiple sclerosis is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

** The MCID for change on the Berg Balance Scale is estimated to be between 2 to 3 points (205).

CI: confidence interval; **MD:** mean difference; **MCID**: minimal clinically important difference

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

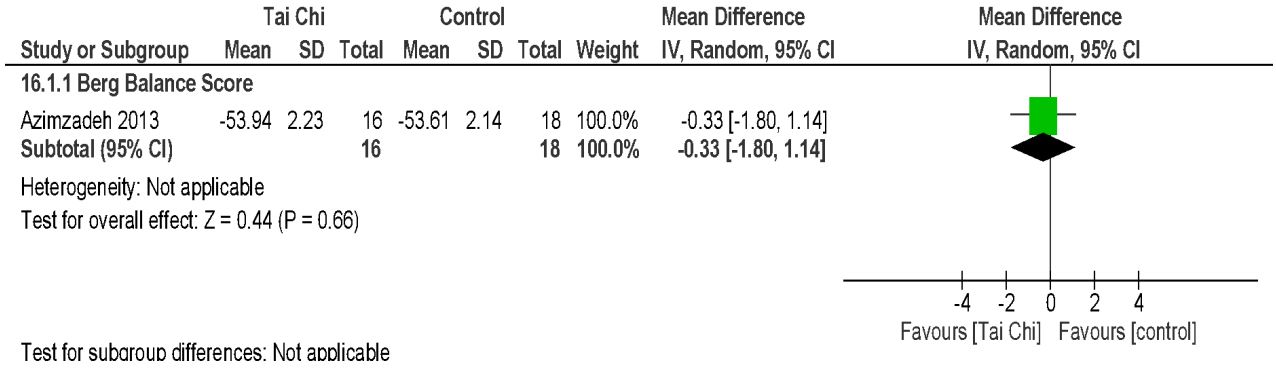
Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.
b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
c. No serious indirectness. The evidence is generalisable to the Australian healthcare context with some caveats but could be sensibly applied. The available evidence is in women only, with the study conducted in Iran. Certainty of evidence not downgraded.
d. Serious imprecision. Small study (34 participants) with wide confidence intervals (lower bounds overlap with no important difference). Certainty of evidence downgraded.
e. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.

4.8.4.2 Forest Plots

Outcome results relating to people with multiple sclerosis are presented in Figure 35 (balance).

Figure 35 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Multiple sclerosis – balance



4.9 Headache disorders

4.9.1 Description of the conditions

Tension-type headaches are a type of headache disorder characterised by a dull aching pain throughout the whole head, a feeling or tightness around the head, tightness or tenderness of scalp, neck and shoulder muscles, mild sensitivity to light and noise, nausea, trouble concentrating, depression and anxiety (206, 207). Migraines are characterised by moderate to severe headache lasting between 4 to 72 hours that are accompanied by varied symptoms including nausea, vomiting or photophobia (sensitivity to light) (208). While it is unknown exactly what causes headaches and migraines, episodes are thought to be triggered by diet, stress, sleep, posture and hormonal influences among others (206, 208). International studies show that 36% of men and 42% of women experience tension-type headaches, which translates to around 7 million Australians (207). Migraines are estimated to affect over 4.9 million Australians (208). Onset usually begins in teenage years, with prevalence declining after a person is in their forties.

Effective management of headaches and migraines includes both acute and preventative treatments to reduce the frequency of attacks. Treatments include pain relief medication, avoiding trigger factors, exercise, and relaxation techniques (206, 208). Non-pharmaceutical treatment options include a variety of complementary and alternative medicines such as aromatherapy, deep breathing, hypnotherapy, biofeedback, yoga, Tai Chi, and neck and shoulder massage (207, 208).

4.9.2 Description of studies

One citation (209) corresponding to one quasi-RCT (Abbott 2007) was identified in the literature. There were no ongoing studies and one study awaiting classification (212). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D3.4.1.

Abbott 2007 was carried out in a community setting in the United States and included 47 participants with tension-type headache aged 20 to 65 (mean age 44 years). Participants with previous experience of Tai Chi or Qi Gong, significant comorbid illness, or any additional conditions that might interfere with completion of the study were excluded.

One study (Abbot 2007) compared a Yang style Tai Chi with a waitlisted control. The sessions were taught to participants by a qualified Tai Chi instructor in one hour, twice weekly sessions for 15 weeks. The waitlist control did not receive any intervention until after the 15 weeks.

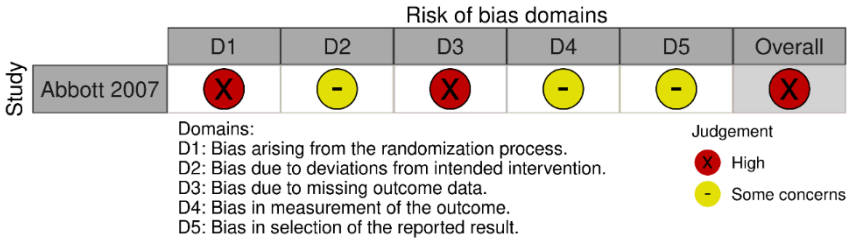
Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are not provided because Abbott 2007 did not provide any usable data. There were no studies that compared Tai Chi with an active comparator (see Appendix F2).

4.9.3 Risk of Bias – per item

The risk of bias of included RCTs for headache disorders is summarised in Figure 36. Details are provided in Appendix D3.4.2.

No studies were judged to be at overall low risk of bias.

Figure 36 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Headache disorders



4.9.4 Main comparison (vs control)

One study (Abbott 2007) was eligible for this comparison but did not provide any usable data for inclusion in the summary of findings tables for any of the critical or important outcomes for in people with headache disorders. There was one study awaiting classification (conference abstract) conducted in women with episodic migraine (82 participants) that could have contributed data to these outcomes, but there was no information to make a judgement about the missing data (see Appendix C6).

4.9.4.1 Summary of findings and evidence statements

There were no studies found for outcomes selected *a priori* as critical or important, thus the effect of Tai Chi compared with control on these outcomes in people with headache disorders is unknown.

The following outcomes were selected (in order of importance):

- disease severity (frequency)
- treatment response rate (reduction in headache frequency)
- psychosocial wellbeing
- quality of life
- physical health

4.10 Rehabilitation after acute cardiac event

4.10.1 Description of the condition

Cardiovascular disease (CVD) is the leading cause of death and morbidity in Australia (210). Cardiac rehabilitation is an evidence-based, secondary prevention that is critical for supporting cardiovascular health and recovery in persons with CVD or following cardiovascular events including acute myocardial infarction and percutaneous coronary intervention (stent) (210, 211).

Cardiac rehabilitation is defined by the World Health Organization (212) as "the coordinated sum of activities required to influence favourably the underlying cause of cardiovascular disease, as well as to provide the best possible physical, mental and social conditions, so that the patients may, by their own efforts, preserve or resume optimal functioning in their community and through improved health behaviour, slow or reverse progression of disease". Cardiac rehabilitation programs are led by health professionals, providing support, tailored exercise and education to participants. Participation in cardiac rehabilitation programs is reported to reduce cardiovascular mortality, hospital readmissions and improve quality of life (210, 212). Globally and in Australia, referrals and attendance to cardiac rehabilitation programs remain low (210, 213). Geographical inaccessibility and transportation are a major barrier as many programs are provided in large urban centres (212). Home-based cardiac rehabilitation programs are a potential solution.

Across international guidelines, aerobic endurance training is routinely recommended for cardiac rehabilitation, with intensity progressing from moderate to vigorous (213). Resistance training is also recommended (213). In Australia, five core components underpinning cardiac rehabilitation services have been outlined (212, 214) and include exercise to support recovery, as well as long-term maintenance, lifestyle and behaviour modifications. This includes diet and nutrition strategies that are associated with better cardiovascular outcomes (212, 215), such a reduction in dietary salt intake than can improve blood pressure (216). Mind-body practices that may improve elements of cardiovascular health includes Tai Chi (217), with meditation and stress reduction practices associated with reduced blood pressure (218) and improve psychosocial wellbeing (219).

4.10.2 Description of studies

Six citations (220-223) corresponding to 3 RCTs (Liu 2020, Nery 2015, Zhang 2020b) and one quasi-RCT (Channer 1996) were identified in the literature. There were 5 studies awaiting classification, including 3 studies published in a language other than English. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D4.1.1.

One study (Nery 2015) was carried out in an outpatient setting in Brazil. Three studies were carried out in the United Kingdom (Channer 1996) and China (Liu 2020, Zhang 2020b) but did not provide setting details. Channer 1996 and Nery 2015 included adult participants after acute myocardial infarction who were available and able to participate in exercise. Participants were excluded if they had heart failure or angina. Liu 2020 included adults aged under 70 years with a percutaneous coronary intervention (stent) as well as one of various presentations including anxiety or depression, coronary or left main artherosclerosing lesions and luminal stenosis over 50%, history of acute myocardial infarction, or abnormal ECG. Zhang 2020b also included participants (aged 45 to 75 years) who underwent percutaneous coronary intervention but was limited to narrow stent implant only.

Two studies (Liu 2020, Zhang 2020b) compared Tai Chi to no intervention (control). Both studies included a co-intervention where participants received either standard medical care that included routine treatment, health education and a daily antidepressant prescription (Liu 2020), or participants received traditional Chinese medicine (Zhang 2020b). One study (Channer 1996) compared Tai Chi to a cardiac support group or aerobic exercise. The cardiac support group included one-hour weekly sessions where participants discussed practical issues. No formal exercise was performed; however, participants were advised to resume normal activities. One study (Nery 2015) compared a Beijing style of Tai Chi with a stretching exercise intervention. Beta blocker medication and general orientation on health and management of cardiovascular risk factors and psychologic support were also provided to all participants.

In all studies, Tai Chi sessions averaged 60 minutes but ranged in intensity from once a day for 3 months (Zhang 2020b), to twice a day for 42 to 52 weeks (Liu 2020), or 3 times a week for twelve weeks (Nery 2015). In one study (Channer 1996) participants practised twice a week for 3 weeks and then weekly for 5 weeks. Channer 1996 also encouraged participants to continue with home-based practice.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see Section 4.10.4.1).

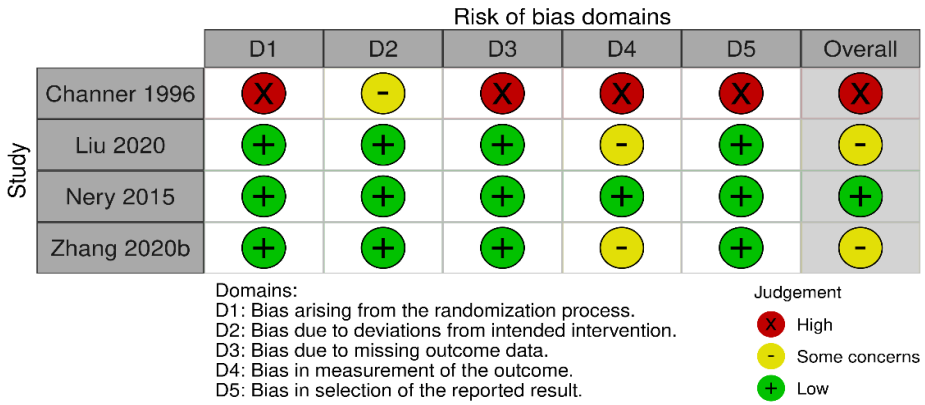
Results for the 2 studies (Channer 1996, Nery 2015) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.10.3 Risk of Bias – per item

The risk of bias of included RCTs for cardiac rehabilitation is summarised in Figure 37. Details are provided in Appendix D4.1.2.

One study (Nery 2015) was judged to be at overall low risk of bias.

Figure 37 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Acute cardiac event rehabilitation



4.10.4 Main comparison (vs control)

Two RCTs (Liu 2020, Zhang 2020b) were eligible for this comparison and contributed data relevant to 5 outcomes. There were 2 studies not published in English (total 150+ participants) that compared Tai Chi with no intervention in people rehabilitating after an acute cardiac event that could have contributed data, but the studies did not appear to measure these outcomes (see Appendix C6).

4.10.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, usual care) for acute cardiac rehabilitation

Patient or population: Acute cardiac rehabilitation

Setting: Community

Intervention: Tai Chi

Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Cardiorespiratory health assessed with: SBP (closer to 120 mm Hg is best) follow-up: 3 months	The systolic blood pressure was **139.06 mm Hg**	MD **12.74 mm Hg lower** (21.17 lower to 4.31 lower)	-	50 (1 RCT)	⊕⊕◯◯ LOW [A,B,C]	Tai Chi may result in a slight improvement in cardiorespiratory health in people recovering from acute cardiac events.**
Aerobic capacity – not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on aerobic capacity in people recovering from acute cardiac events is unknown.
Activities of daily living assessed with: SF-36 physical functioning (higher is best) Scale from: 0 to 100 follow-up: 10 weeks	The mean SF-36 physical functioning score was **72.3**	MD **14.3 point higher** (10.34 higher to 18.26 higher)	-	61 (1 RCT)	⊕⊕◯◯ LOW [A,C,D]	Tai Chi may result in a large increase in activities of daily living in people recovering from acute cardiac events.***
Stress assessed with: PSS-14 14 (higher is worse) Scale from: 0 to 56 follow-up: 10 weeks	The mean stress score was **46**	MD **6 points lower** (10.34 lower to 1.66 lower)	-	61 (1 RCT)	⊕◯◯◯ VERY LOW [A,C,D,E]	The evidence is very uncertain about the effect of Tai Chi results on stress in people recovering from acute cardiac events.****
HRQoL – not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on HRQoL in people recovering from acute cardiac events is unknown.
Psychosocial wellbeing assessed with: SF-36 – mental health (higher is best) Scale from: 0 to 100 follow-up: 10 weeks	The mean psychosocial wellbeing was **70.3**	MD **14.9 points higher** (10.84 higher to 18.97 higher)	-	61 (1 RCT)	⊕⊕◯◯ LOW [A,C,D]	Tai Chi may result in a large increase in psychosocial wellbeing in people recovering from acute cardiac events.*****

Tai Chi compared to Control (no intervention, usual care) for acute cardiac rehabilitation

Patient or population: Acute cardiac rehabilitation
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Pain assessed with: SF-36 – bodily pain (higher is best) Scale from: 0 -to100 follow-up: 10 weeks	The mean pain score was **72.5**	MD **14.3 points higher** (10.26 higher to 18.34 higher)	-	61 (1 RCT)	⊕⊕◯◯ LOW [A,C,D]	Tai Chi may result in a large decrease in pain in people recovering from acute cardiac events.*****

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The closer the score to 120 mm Hg the more stable the cardiorespiratory health.
*** An MCID of 8-10 points for the SF-36 physical functioning score is considered significant for adults with chronic fatigue syndrome (224).
**** The MCID in people recovering from acute cardiac events is unknown. #
***** The MCID in people recovering from acute cardiac events is unknown but is reported to be around 2 to 4 points for individual domain scores in the general population (98).

In the absence of an MCID, effect estimates were considered on 3 levels: small (MD 10% or less of the scale), moderate (MD between 10% to 20% of the scale) or large (MD more than 20% of the scale).

CI: confidence interval; **HRQoL:** health related quality of life; **MCID:** minimal clinically important difference; **MD:** mean difference; **PSS-14**: 14-tiem Perceived Stress Scale; **RCT:** randomised controlled trial; **SBP:** systolic blood pressure; **SF-36**: 36-item short form survey

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
b. Serious imprecision. Small study (fewer than 50 participants) with wide confidence intervals (upper and lower bounds overlap with large and small or no important difference). Certainty of evidence downgraded.
c. Publication bias suspected. The evidence is limited to a small number of small trials. Certainty of evidence downgraded.
d. Serious risk of bias. One RCT at high risk of bias that raises some doubts about the results. Certainty of evidence downgraded.
e. Serious imprecision. Wide confidence intervals (lower bound overlaps with no important difference). Certainty of evidence downgraded.

4.10.4.2 Forest plots

Outcome results related people recovering from acute cardiac events is presented in Figure 38 (cardiorespiratory health), Figure 39 (activities of daily living), Figure 40 (perceived stress), Figure 41 (psychosocial wellbeing) and Figure 42 (pain).

Figure 38 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cardiac rehabilitation – cardiorespiratory health

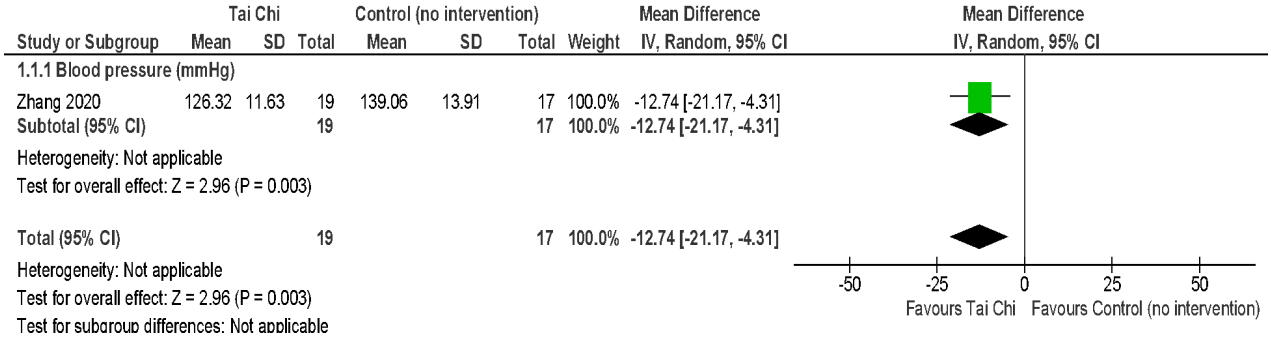


Figure 39 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cardiac rehabilitation – activities of daily living

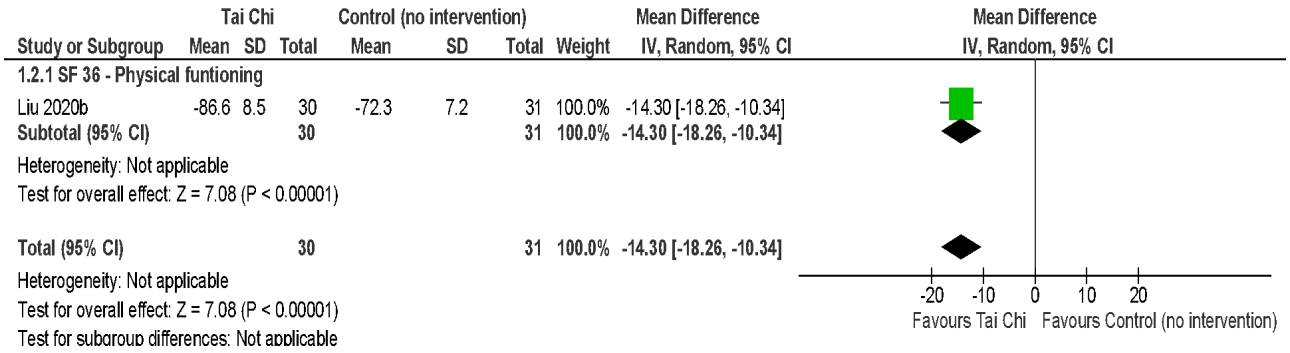


Figure 40 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cardiac rehabilitation – perceived stress

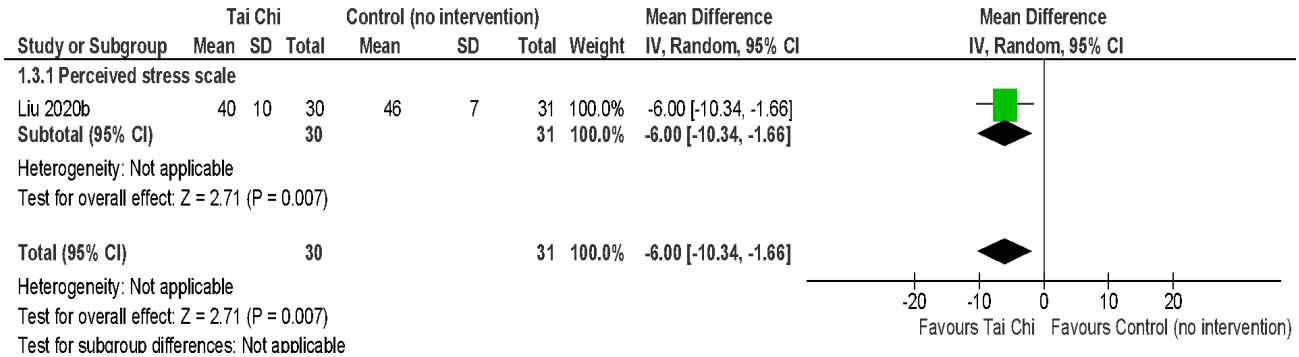


Figure 41 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cardiac rehabilitation – psychosocial wellbeing

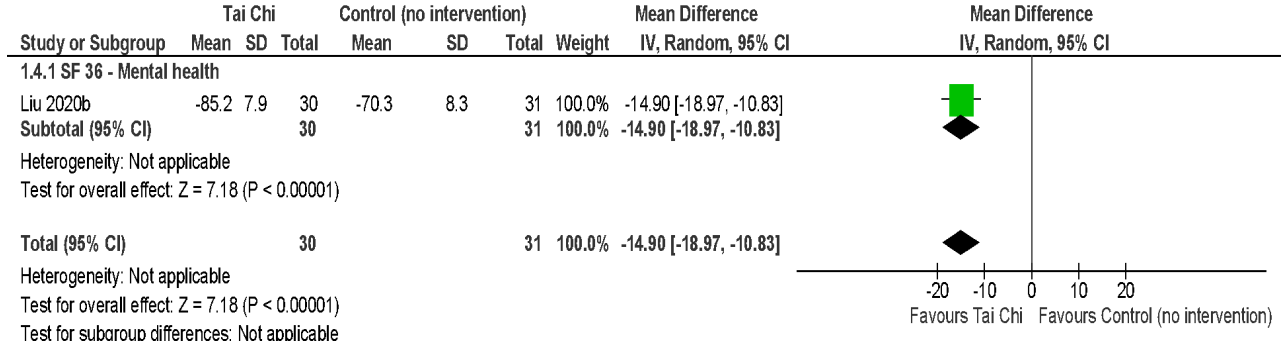
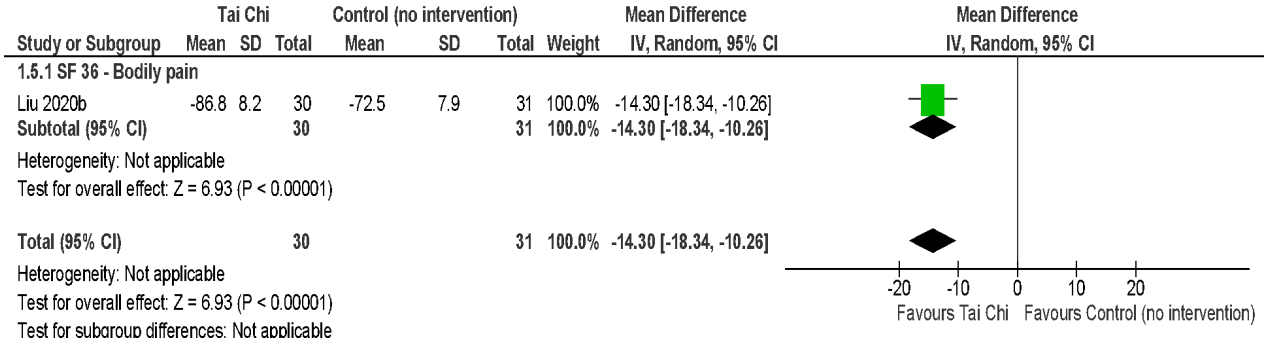


Figure 42 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Cardiac rehabilitation – pain



4.11 Hypertensive heart disease

4.11.1 Description of the condition

Elevated blood pressure (BP) is a significant contributor to global burden of cardiovascular disease (CVD) and mortality (225). Approximately 1 in 3 Australians over 18 years have high blood pressure, 23% of whom are uncontrolled (BP remains above 140/90 mmHg whether or not a person is taking medication) (226). As an independent risk factor for stroke, heart failure, chronic kidney disease and premature death, uncontrolled hypertension poses a significant burden to Australia's healthcare system (227). Structural changes to the left atria, responsible for regulating left ventricular functioning during systole and diastole, can occur as an adaptive process in response to prolonged elevated blood pressure. This may lead to reduced functioning and myocardium fibrosis (228).

There are different categories and grades to assist in the diagnosis and management of BP (227). In adults, normal BP is defined as systolic 120-129 mmHg and diastolic 80-84 mmHg, thus optimal BP is described as 120/80 mmHg. Normal to high BP is classified as systolic 130-139 mmHg and diastolic 85-89 mmHg.

Hypertension is classified into three grades as follows:

- grade 1 (mild) hypertension is systolic 140-159 mmHg and diastolic 90-99 mmHg;
- grade 2 (moderate) hypertension is systolic 160-179 mmHg and diastolic 100-109 mmHg;
- grade 3 (severe) hypertension is ≥ 180/110 mmHg.

Appropriately controlling, managing and reducing hypertension is imperative to reducing CVD burden. Studies have demonstrated the benefits of regular exercise on cardiovascular health, with regular physical activities and progressive resistance exercises demonstrated to reduce blood pressure (229, 230) and improving cardiovascular function in those with cardiovascular disease (e.g. heart failure) (230, 231). The National Heart Foundation of Australia Guidelines recommend regular physical exercise, including muscle strengthening activities at least two days a week to aid in the management and reduction of blood pressure (227).

4.11.2 Description of studies

Twelve citations (13, 232-242) corresponding to 4 RCTs (Chan 2016, Ma 2018, Sun 2015, Young 1999), 2 quasi-RCTs (Shou 2019, Tsai 2003) and one cluster-randomised trial (Talebi 2017) were identified in the literature. There were 5 ongoing studies and 17 studies awaiting classification (15 of which were published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D4.2.1.

One study (Young 1999) was carried out in single centre settings in the United States. Three studies were carried out in multicentre settings in either Hong Kong (Chan 2016), China (Ma 2018) or Iran (Talebi 2017). The remaining 3 studies did not provide information on the setting of the trial but were conducted in China (Shou 2019, Sun 2015a) or Taiwan (Tsai 2003). Sample sizes ranged between 62 and 300 participants (total 1126). All studies included adults (mean age between 51.6-70.24 years) with hypertension, enrolling both male and female participants, except for one study (Talebi 2017) which only recruited female participants. Two studies (Tsai 2003, Young 1999) included adults aged 50+ years with pre/early hypertension and Shou 2019 only enrolled participants with grade 1 hypertension.

Three studies (Ma 2018, Talebi 2017, Tsai 2003) compared a modified form of Tai Chi with no intervention or a usual care control. Two studies (Ma 2018, Tsai 2003) examined the effect of Yang style Tai Chi, whereas Talebi 2017 assessed the effect of a modified 8-form style. The other 4 studies examined the effect of a Yang style Tai Chi with various active controls including conventional physical activity (brisk walking) with community activity (Chan 2016), aerobic exercise (Young 1999), a wellness education program (Shou 2019), or reading and computer activities (Sun 2015a). Chan 2016 also included a non-exercise attention control where participants completed community activities throughout the three-month period.

In all studies, the Tai Chi sessions were typically 40 to 90 minutes in duration lasting for 6 (Talebi 2017), 12 (Chan 2016, Shou 2019, Tsai 2003, Young 1999), 29 (Ma 2018) or 52 weeks (Sun 2015a) but varied in intensity from 2 (Ma 2018), 3 (Talebi 2017, Tsai 2003) or 5 session per week (Chan 2016, Young 1999) up to once or twice a day (Shou 2019). After 5 weeks of trainer-led sessions, one study (Ma 2018) included 24 weeks of group practice (participant-led) that was conducted 3 to 5 days per week for 60 minutes at a time. Sun 2015a did not provide sufficient information on the intensity of the intervention but included 3 hours per week community sessions and 2 hours of home practice per week. Young 1999 also encouraged home practice.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.11.4.1) (and Appendix F2).

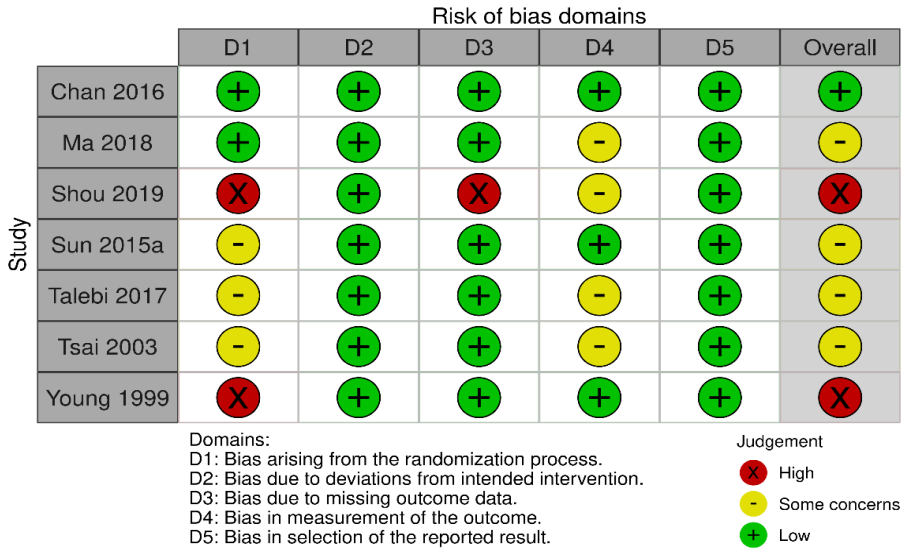
Results for 4 studies (Sun 2015a, Shou 2019, Chan 2016 and Young 1999) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.11.3 Risk of Bias – per item

The risk of bias of included RCTs for hypertensive heart disease is summarised in Figure 43. Details are provided in Appendix 4.2.2.

One study (Chan 2016) was judged to be at overall low risk of bias.

Figure 43 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Hypertensive heart disease



4.11.4 Main comparison (vs control)

Three RCTs (Ma 2018, Tsai 2003, Talebi 2017) were eligible for this comparison and contributed data relevant to 4 outcomes. There were 13 additional studies awaiting classification (total 599+ participants) that compared Tai Chi with control (no intervention, usual care) in people with hypertensive heart disease that could have contributed data to these outcomes but there was limited information to make a judgment regarding the extent of missing data (see Appendix C6).

4.11.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for hypertensive heart disease

Patient or population: Hypertensive heart disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Cardiovascular health assessed with: SBP (closer to 120 mmHg is best) follow-up: 12 to 29 weeks	The mean SBP ranged from **148.64 to 154.6** mmHg	MD **16.17 mmHg lower** (39.23 lower to 6.88 higher)	-	189 (2 RCTs)	⊕◯◯◯ VERY LOW A,B,C,D	The evidence is very uncertain about the effect of Tai Chi on cardiovascular health (SBP) in people with hypertensive heart disease.
Cardiovascular health assessed with: DBP (closer to 80 mmHg is best) follow-up: 12 to 29 weeks	The mean DBP ranged from **87.6 to 89.6** mmHg	MD **7.03 mmHg lower** (14.8 lower to 0.74 higher)	-	189 (2 RCTs)	⊕◯◯◯ VERY LOW A,B,C,D	The evidence is very uncertain about the effect of Tai Chi on cardiovascular health (DBP) in people with hypertensive heart disease.
HRQoL – physical wellbeing assessed with: SF-36 Physical Component Score (higher is better) follow-up: 29 weeks	The mean HRQoL (physical) was **76.63**	MD **6.21 higher** (0.82 higher to 11.6 higher)	-	113 (1 RCT)	⊕⊕◯◯ LOW A,C,D,E	Tai Chi may result in slight improvements in HRQoL (physical wellbeing) in people with hypertensive heart disease.**
HRQoL – psychosocial wellbeing assessed with: SF-36 Mental Component Score (higher is better) follow-up: 29 weeks	The mean HRQoL (mental) was **83.54**	MD **5.63 higher** (0.85 lower to 12.11 higher)	-	113 (1 RCT)	⊕⊕◯◯ LOW A,C,D,E	Tai Chi may result in slight improvements in HRQoL (mental wellbeing) in people with hypertensive heart disease.**

Tai Chi compared to Control (no intervention, waitlist, usual care) for hypertensive heart disease

Patient or population: Hypertensive heart disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Disease risk - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disease risk in people with hypertensive heart disease is unknown.
Disease progression - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disease progression in people with hypertensive heart disease is unknown.
Psychosocial wellbeing assessed with: PSS-14 (higher is worse) follow-up: 12 weeks	The mean perceived stress score was **25.44**	MD **1.60 lower** (5.72 lower to 2.52 higher)	-	64 (1 RCT)	⨁⨁◯◯ LOW [A,C,D,E]	Tai Chi may result in little to no difference in perceived stress in people with hypertensive heart disease.
Adverse events - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on adverse events in people with hypertensive heart disease is unknown.
Fitness/exercise capacity - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on fitness/exercise capacity in people with hypertensive heart disease is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

** The MCID is assumed to be around 2 to 4 points in the general population (i.e. 0.5 of the SD) (98).
***The MCID is estimated to be around 15 points.

CI: confidence interval; **DBP:** diastolic blood pressure; **HRQoL:** health related quality of life; **IQR:** interquartile range; **MD:** mean difference; **MCID:** minimal clinically important difference; **PSS:** perceived stress scale**; RCT:** randomised controlled trial; **SBP**: Systolic blood pressure

Tai Chi compared to Control (no intervention, waitlist, usual care) for hypertensive heart disease

Patient or population: Hypertensive heart disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Serious inconsistency. Significant statistical heterogeneity (I^2 > 90%) with minimal overlap in confidence intervals. Certainty of evidence downgraded.

c. Serious imprecision. Wide confidence interval (upper and lower bounds overlap with large and no important difference). Certainty of evidence downgraded.

d. Publication bias suspected. Evidence is limited to a small number of small trials. Missing data from studies published in a language other than English, with non-translation likely due to the nature of the results. Certainty of evidence downgraded.

e. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

4.11.4.2 Forest plots

Outcome results relating to people with hypertensive heart disease are presented in Figure 44 (cardiovascular health), Figure 45 (health-related quality of life) and Figure 46 (perceived stress).

Figure 44 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Hypertensive heart disease – cardiovascular health

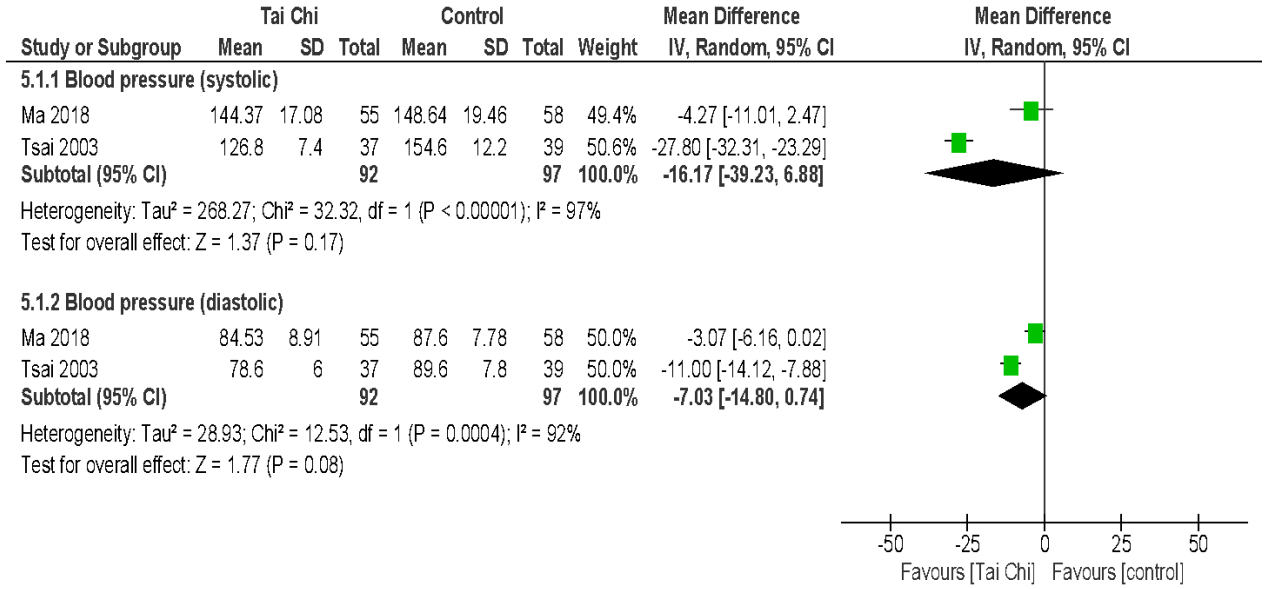


Figure 45 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Hypertensive heart disease – health-related quality of life

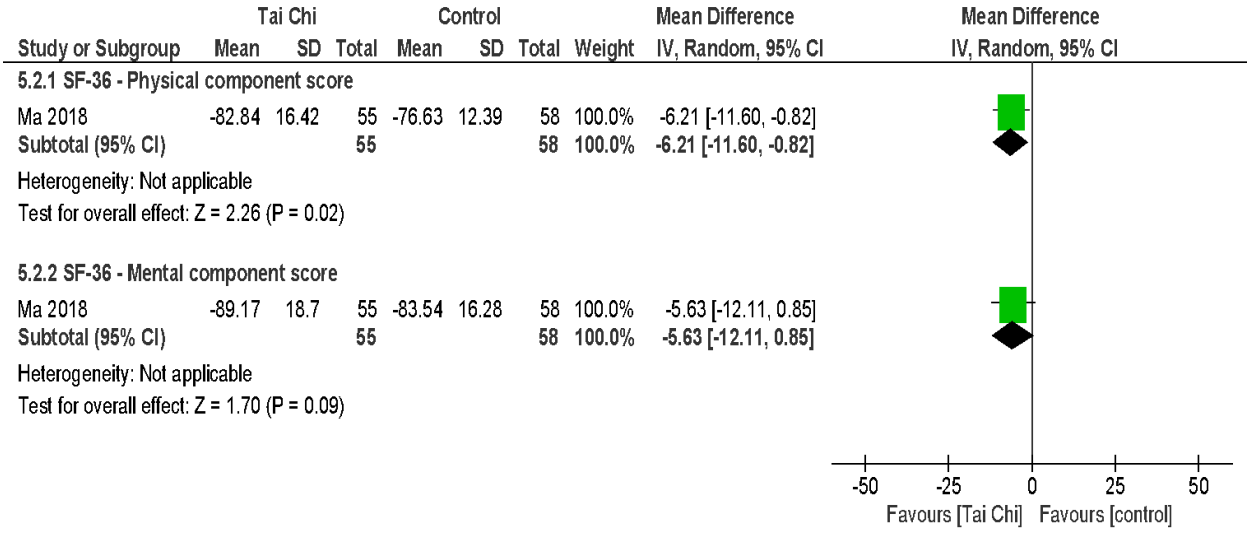
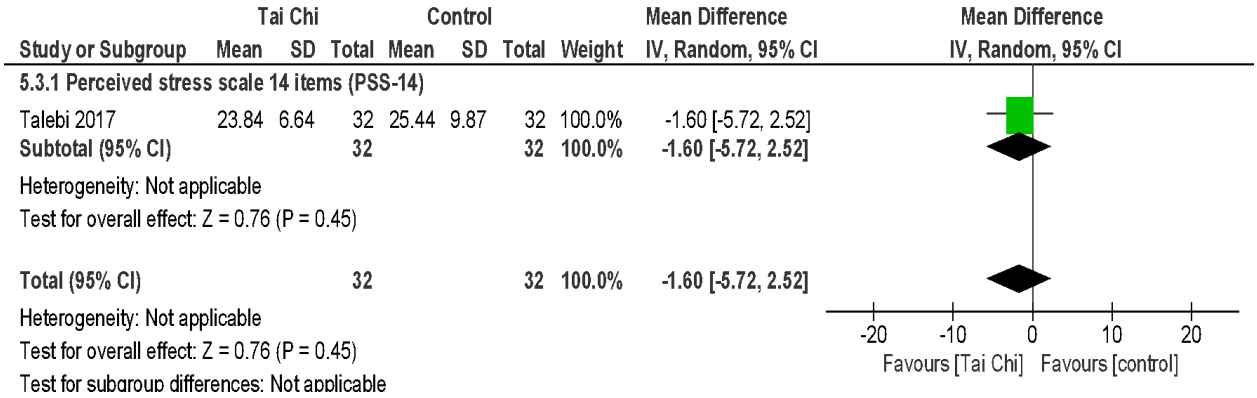


Figure 46 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Hypertensive heart disease – psychosocial wellbeing



4.12 Coronary heart disease

4.12.1 Description of the condition

Heart attack (or myocardial infarction) and angina are the two major clinical forms of coronary heart disease (CHD). Heart attack is the result of a complete blockage of blood supply and is life-threatening. Angina occurs due to sporadic episodes of temporary blood supply deficiency and is a chronic condition (138).

Globally, more people have died from cardiovascular diseases such as CHD than from any other cause (243). In Australia, CHD is the single leading cause of disease burden and death, representing 11% of all deaths in 2018, noting mortality rates have declined in Australia and other developed countries over the past few decades (138, 243). In 2017-2018, approximately 580 000 adult Australians had CHD, with prevalence rapidly increasing with age. An estimated 169 acute CHD events (heart attack or unstable angina) occurred daily in 2017 (138). Numerous risk factors for CHD are modifiable making it a largely preventable disease. These include tobacco use, alcohol use, hypertension, hyperlipidaemia, obesity, unhealthy diet, physical inactivity and psychosocial stress (243).

Given the nature of CHD, appropriate management and support is essential to minimise risk of repeat events or death. Lifestyle modifications can be achieved through various methods. Interventions and practices that may improve physical activity and stress management, for example yoga, Tai Chi and other mind-body practices, may provide beneficial effects for patients with CHD (218, 244). The National Heart Foundation of Australia Guidelines recommend regular physical exercise, including muscle strengthening activities at least two days a week to aid in the management cardiovascular disease and decrease the risk of developing heart failure (245).

4.12.2 Description of studies

Three citations (246-248) corresponding to one RCT (Li 2019b) and 2 quasi-RCTs (Liu 2010, Sato 2010) were identified in the literature. There were 4 ongoing studies and 6 studies awaiting classification (including 4 studies published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D4.3.1.

One study was carried out in an outpatient setting in China (Li 2019b) and 2 studies were carried out in either the United States (Liu 2010) or Japan (Sato 2010), but did not provide any information on the trial setting. Sample sizes ranged from 20 to 326 (total 376 participants), with all studies enrolling adults with coronary heart disease. Li 2019b included participants over 18 years with LVEF[8] below 40% whereas Sato 2010 included participants with ejection fraction above 40%. Across most studies, participants with atrial fibrillation or the need for defibrillation to restore cardiac reflex were excluded.

Two studies (Liu 2010, Sato 2010) compared a modified form of Tai Chi with no intervention. The remaining study (Li 2019b) compared Yang style Tai Chi with physical exercise as an active control. Routine treatment and care were also provided to participants across all 3 studies. In all studies the Tai Chi sessions were 60 minutes in duration, but the treatment programmes ranged in intensity from daily for 6 months (Li 2019b), twice per week for 12 weeks (Liu 2010), down to once per week for one year (Sato 2010). Participants in Sato 2010 were also encouraged to continue individual home-based practice 3 times a week for the duration of the study.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.12.4.1 and Appendix F2).

[8] Primary classification of heart failure is based on left ventricular ejection fraction (LVEF).

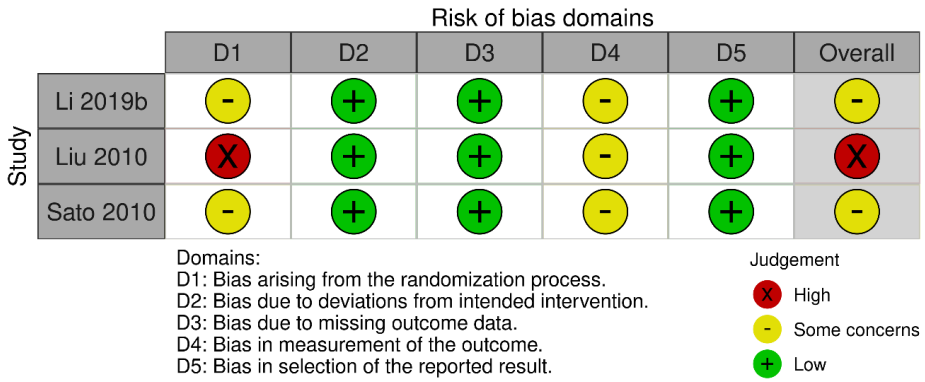
Results of the study (Li 2019d) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.12.3 Risk of Bias – per item

The risk of bias of included RCTs for coronary heart disease is summarised in Figure 47. Details are provided in Appendix D4.3.2.

No studies were judged to be at overall low risk of bias.

Figure 47 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: coronary heart disease



4.12.4 Main comparison (vs control)

Both quasi-RCTs (Liu 2010, Sato 2010) contributed data to one outcome. The other RCT (Li 2019b) did not report any outcome measures considered to be critical or important for decision making.

One study (Sato 2010) comparing Tai Chi with no intervention in people with coronary heart disease were eligible for this comparison and contributed data relevant to one outcome. There were 5 studies awaiting classification and one ongoing study that compared Tai Chi with no intervention in people with coronary heart disease (total 335+ participants) that could have contributed data to the outcomes considered critical or important to this review, but information was limited about the extent of missing data (see Appendix C6).

4.12.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for coronary heart disease

Patient or population: coronary heart disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Disease severity - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disease severity in people with coronary heart disease is unknown.
Disease progression - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disease progression in people with coronary heart disease is unknown.
HRQoL - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on HRQoL in people with coronary heart disease is unknown.
Cardiorespiratory health assessed with: Heart rate variability (higher is better) follow-up: 52 weeks	The mean LF/HF ratio was **16 ms**^{2}	MD **4.0 ms**^{2} **lower** (23.45 lower to 15.45 higher)	-	20 (1 RCT)	⨁⨁◯◯ LOW A,B,C,D,E	Tai Chi may result in little to no difference on cardiorespiratory health for adults with coronary heart disease. **
Activities of daily living - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on activities of daily living in people with coronary heart disease is unknown.
Sleep - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on sleep in people with coronary heart disease is unknown.
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on psychosocial wellbeing in people with coronary heart disease is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** MCID unknown. Healthy norms for HR variability (LV/HF) are reported be mean 2.8 (SD: 2.6) (range 1.1 to 11.6) (72).

CI: confidence interval; **HF:** high frequency; **HRQoL:** health related quality of life; **LF:** low frequency; **MCID:** minimal clinically important difference; **MD:** mean difference; **RCT:** randomised controlled trials

Tai Chi compared to Control (no intervention, waitlist, usual care) for coronary heart disease

Patient or population: coronary heart disease
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

c. No serious indirectness. The available evidence is directly generalisable to the Australian healthcare context with few caveats and could be sensibly applied. Certainty of evidence not downgraded.

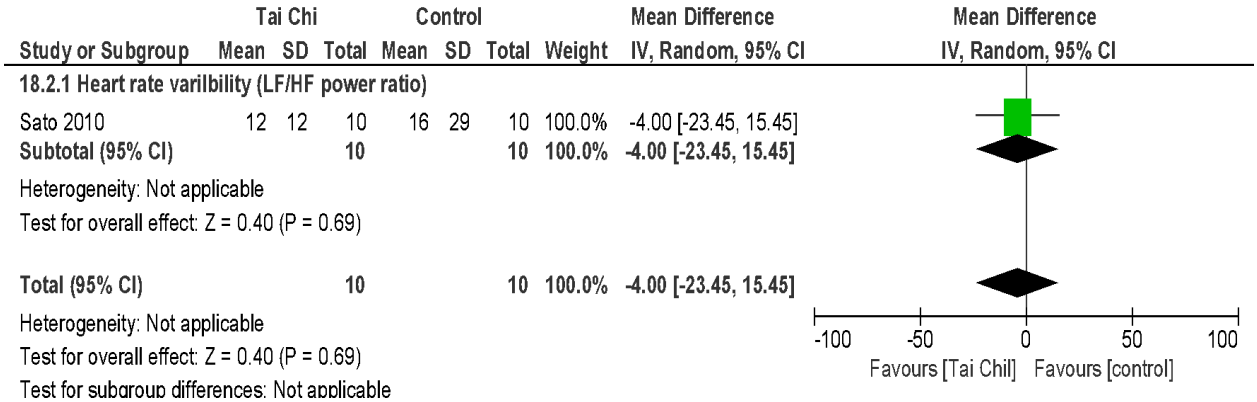
d. Serious imprecision. Small study (20 participants) with wide confidence intervals (upper and lower bounds overlap with both an important and no important difference. Certainty of evidence downgraded.

e. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.

4.12.4.2 Forest plots

Outcome results for people with coronary heart disease is shown in Figure 48 (cardiorespiratory health).

Figure 48 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Coronary heart disease – cardiorespiratory health



4.13 Heart failure

4.13.1 Description of the condition

Heart failure occurs when the heart does not pump blood around the body effectively. A complex clinical syndrome, heart failure is secondary to an abnormality of cardiac structure or function that impairs the ability of the heart to fill with blood at normal pressure or eject enough blood to fulfil the needs of metabolising organs (245). Heart failure has a significant impacting the health of Australia. In 2017-2018, more than 104 000 Australian adults had heart failure (predominantly aged over 65 years), representing 1.6% of all hospitalisations and one in 50 deaths (249).

Primary classification of heart failure is based on left ventricular ejection fraction (LVEF) (245). Heart failure with reduced ejection fraction (systolic heart failure) is defined as the clinical symptoms with or without signs of heart failure and LVEF below 50%. Heart failure with preserved ejection fraction (diastolic heart failure) is also defined as the clinical symptoms with or without signs of heart failure and LVEF below 50% with the addition of objective evidence of either relevant structural heart disease or diastolic dysfunction without an alternative cause (e.g. significant valvular heart disease). The New York Heart Association (NYHA) provides four functional classifications of heart failure based on physical activity (from no limitation to symptoms on any physical activity or at rest) (245).

Heart failure is most commonly caused by underlying coronary heart disease, often with a history of heart attack (250). An array of other causes includes ischaemia, hypertension, vulvar dysfunctions and arrhythmias (245). Risk factors for heart failure, and other cardiovascular conditions, include age, family history, obesity, diabetes and lifestyle behaviours such as smoking, poor diet and inadequate physical activity (250).

The National Heart Foundation of Australia Guidelines (245) recommends regular physical activity to decrease the risk of cardiovascular events and developing heart failure. Other recommendations include weight reduction and smoking cessation. Aside from pharmacological management, the National Heart Foundation of Australia Guidelines (245) also recommend self-management, dietary modifications and exercise. In patients with stable chronic heart failure, particularly those with reduced LVEF, the Guidelines recommend regular exercise (up to moderate intensity) to improve physical functioning and quality of life.

4.13.2 Description of studies

Seventeen citations (251-269) corresponding to 4 RCTs (Redwine 2019, Yeh 2004, Yeh 2011, Yeh 2013) and 3 quasi-RCTs (Barrow 2007, Caminiti 2011, Hagglund 2018) were identified in the literature. There was one ongoing study and 3 studies awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D4.4.1.

One study (Yeh 2013) took place in a single centre in the United States. Four studies were carried out in outpatient or multicentre setting in either Italy (Caminiti 2011), Sweden (Hagglund 2018) or the United States (Redwine 2019, Yeh 2011). The remaining 2 studies did not report the setting of the trial but were carried out in the United Kingdom (Barrow 2007) or the United States (Yeh 2004). Sample sizes ranged from 16 to 100 (total 386), with all studies enrolling older adults diagnosed with chronic heart failure. One study enrolled participants with LVEF greater or equal to 50% (Yeh 2013). Two studies (Barrow 2007, Redwine 2019) included participants with NYHA symptom class II-III. The remaining studies included participants with a LVEF 40% or below (Yeh 2004, Yeh 2011), 45% or below (Caminiti 2011) or below 50% (Hagglund 2018). Caminiti 2011 also included participants of NYHA class II and Yeh 2013 of class I-III. In all trials, participants were over the age of 40 years (mean age between 64 to 75.6 years) and included both female and male participants. Across most studies, participants with unstable angina or recent myocardial infarction were excluded from the trial.

Four studies (Barrow 2007, Hagglund 2018, Redwine 2019, Yeh 2004) compared a modified form of Tai Chi with an inactive control of usual care and activities One study (Redwine 2019) also included an active control arm (resistance band). Three studies (Hagglund 2018, Redwine 2019, Yeh 2004) all conducted a Yang style form of Tai Chi, whereas Barrow 2007 carried out Wu Chian Chuan and Chi Kung Tai Chi. The remaining studies compared Tai Chi with an active intervention. Two studies compared Yang style Tai Chi with either a wellness education program (Yeh 2011) or low impact aerobic exercise (Yeh 2013). One study (Caminiti 2011) compared a dual programme of Yang style Tai Chi plus conventional physical exercise with conventional physical exercise alone. The co-intervention comprised endurance training of either cycling or walking.

In all studies, the Tai Chi sessions were typically 55 to 60 minutes in duration and were practised twice a week over 12 weeks (Caminiti 2011, Yeh 2004, Yeh 2011, Yeh 2013) or 16 weeks (Barrow 2007, Hagglund 2018, Redwine 2019). Three of the 7 studies also included a 35-minute programme to be practised 3 times per week at home (Redwine 2019, Yeh 2011, Yeh 2013).

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.13.4.1 and Appendix F2).

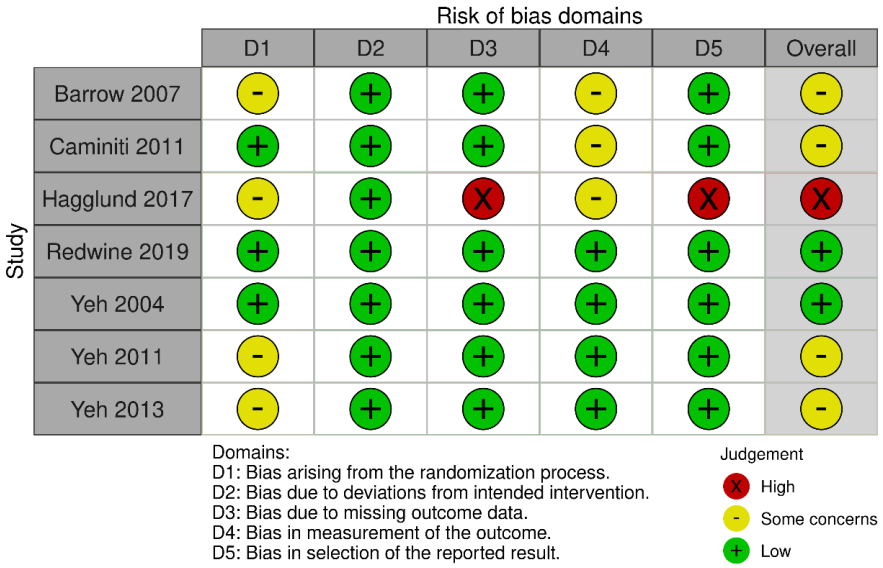
Results for 4 studies that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.13.3 Risk of Bias – per item

The risk of bias of included RCTs for heart failure is summarised in Figure 49. Details are provided in Appendix D4.4.2.

Two studies (Redwine 2019, Yeh 2004) were judged to be at overall low risk of bias.

Figure 49 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Heart failure



4.13.4 Main comparison (vs control)

Four RCTs (Barrow 2007, Hagglund 2018, Redwine 2019, Yeh 2004) were eligible for this comparison and contributed data to 3 outcomes. There were 3 studies awaiting classification (available as abstracts only) that compared Tai Chi with no intervention in participants with heart failure (total 97 participants) that could have contributed data, but it did not measure or assess any outcomes considered to be critical important for this review (see Appendix C6).

4.13.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist, usual care) for heart failure

Patient or population: Heart failure
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Cardiorespiratory health assessed with: Blood pressure	Authors report incomplete data		-	52 (1 RCT)	-	The effect of Tai Chi on cardiorespiratory health in people with heart failure is unknown.
Disease progression - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on disease progression in people with heart failure is unknown.

Tai Chi compared to Control (no intervention, waitlist, usual care) for heart failure

Patient or population: Heart failure
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist, usual care)

Activities of daily living assessed with: 6MWT (m) (further is best) Score from: 0 to 700 follow-up: 12 weeks	The mean distance was **289** metres	MD **123 metres further** (225.07 more to 20.93 more)	-	30 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in a large increase in functional mobility in people with heart failure.**
HRQoL assessed with: MLHFQ (higher is worse) Score from: 0 to 105 follow-up: 12 weeks	The mean HRQoL was **52** points	MD **26 points lower** (43.19 lower to 8.81 lower)	-	30 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in a large improvement on HRQoL in people with heart failure.***
Biomarkers assessed with: Serum B-type natriuretic peptide (higher is worse) follow-up: 12 weeks	The mean BNP level was **375** pg/mL	MD **94 pg/mL lower** (379.05 lower to 191.05 higher)	-	30 (1 RCT)	⊕◯◯◯ VERY LOW [A,B,C,E]	The evidence is very uncertain about the effect of Tai Chi results on BNP levels in people with heart failure.****
Biomarkers assessed with: N-terminal-proB-type Natriuretic Peptide (higher is worse) follow-up: 16 weeks	The mean NT-proBNP level was **2736** pg/mL	**MD 543 pg/mL higher** (1489.2 lower to 2575.2 higher)	-	34 (1 RCT)	⊕◯◯◯ VERY LOW [A,B,C,E]	The evidence is very uncertain about the effect of Tai Chi on NT-proBNP levels in people with heart failure.****
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on psychosocial wellbeing in people with heart failure is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID for changes in 6MWT values in patients with stable CHF over a period of 6 to 12 months is ~ 36 metres (270).
*** The MCID for the total score is estimated to be between 8.2 and 19.14 points (271).
**** For people without heart failure, normal BNP levels are less than 100 mg/mL and normal NT-proBNP levels are less than 450 pg/mL for adults over the age of 75 (272).

6MWT: 6-minute walk test; **CI:** confidence interval; **HRQoL:** quality of life; **MD:** mean difference; **MCID:** minimal clinically important difference; **MLHFQ:** Minnesota Living with Heart Failure Questionnaire; **RCT:** randomised controlled trial

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

c. Serious imprecision. Small study (30 participants) with wide confidence intervals (lower bound overlaps with no important difference). Certainty of evidence downgraded.

d. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.

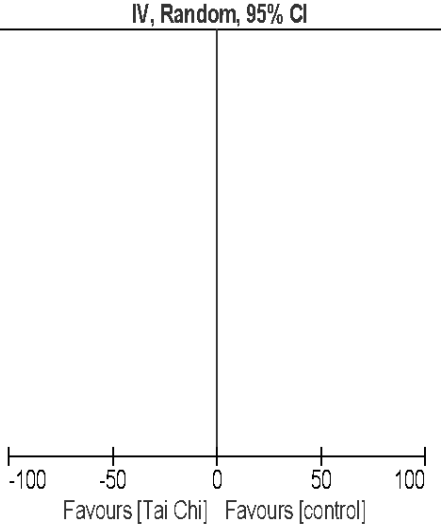
e. Very serious imprecision. Small study (30 to 34 participants) with wide confidence intervals (upper and lower bounds overlap with an important and no important difference). Certainty of evidence downgraded 2 levels.

4.13.4.2 Forest plots

Outcome results for people with heart failure are presented in Figure 50 (cardiorespiratory health), Figure 51 (activities of daily living), Figure 52(health-related quality of life) and Figure 53 (biomarkers).

Figure 50 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Heart failure – cardiorespiratory health

	Tai Chi			Control				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
19.1.1 Systolic Blood pressure (mmHg)									
Barrow 2007 (1)	123	0	25	124	0	27		Not estimable	
Subtotal (95% CI)			**25**			**27**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									
19.1.2 Diastolic blood pressure (mmHg)									
Barrow 2007 (2)	71	0	25	71	0	27		Not estimable	
Subtotal (95% CI)			**25**			**27**		**Not estimable**	
Heterogeneity: Not applicable									
Test for overall effect: Not applicable									

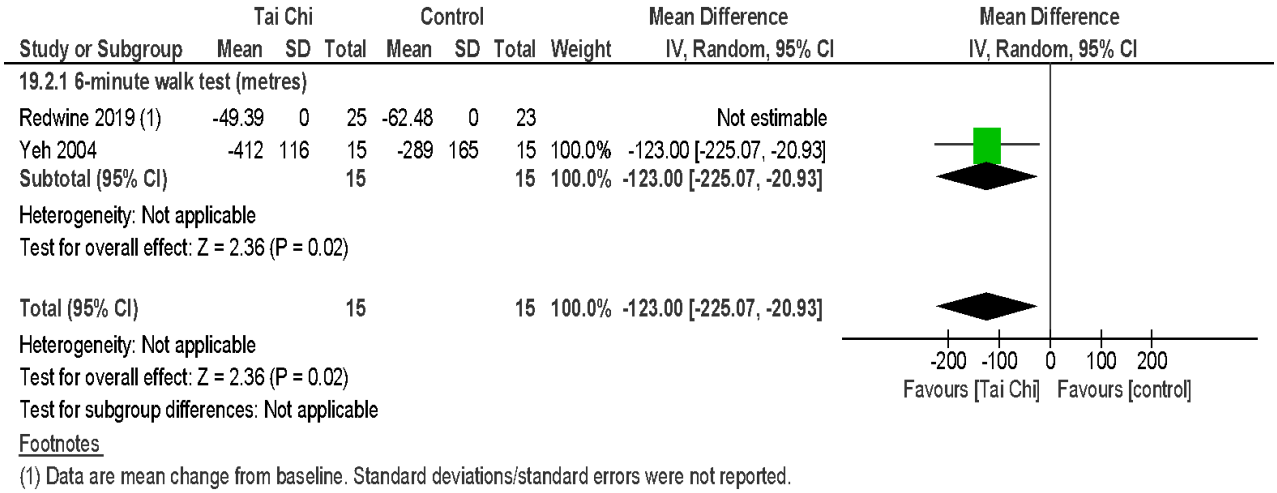


Footnotes

(1) Standard deviations/standard errors were not reported.

(2) Standard deviations/standard errors were not reported.

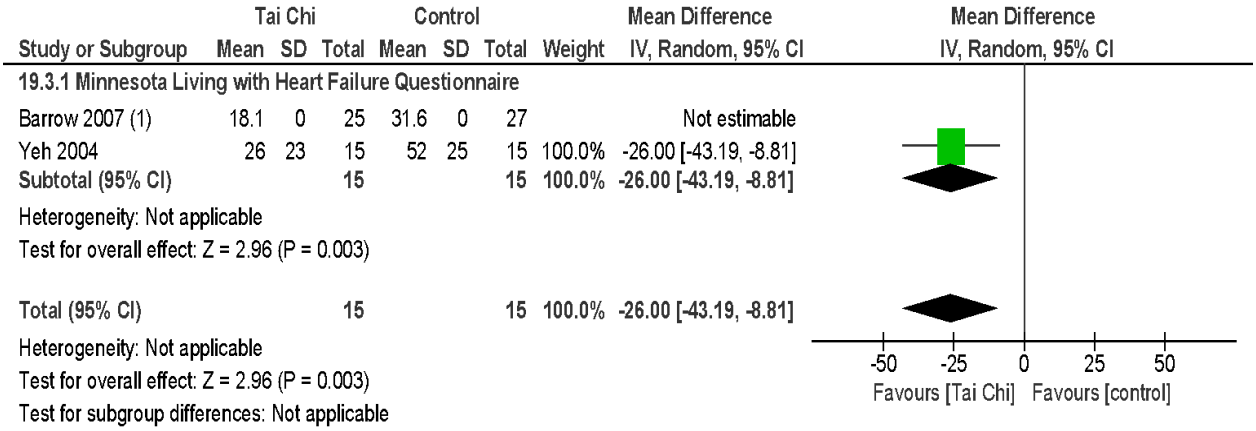
Figure 51 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Heart failure – activities of daily living



Footnotes

(1) Data are mean change from baseline. Standard deviations/standard errors were not reported.

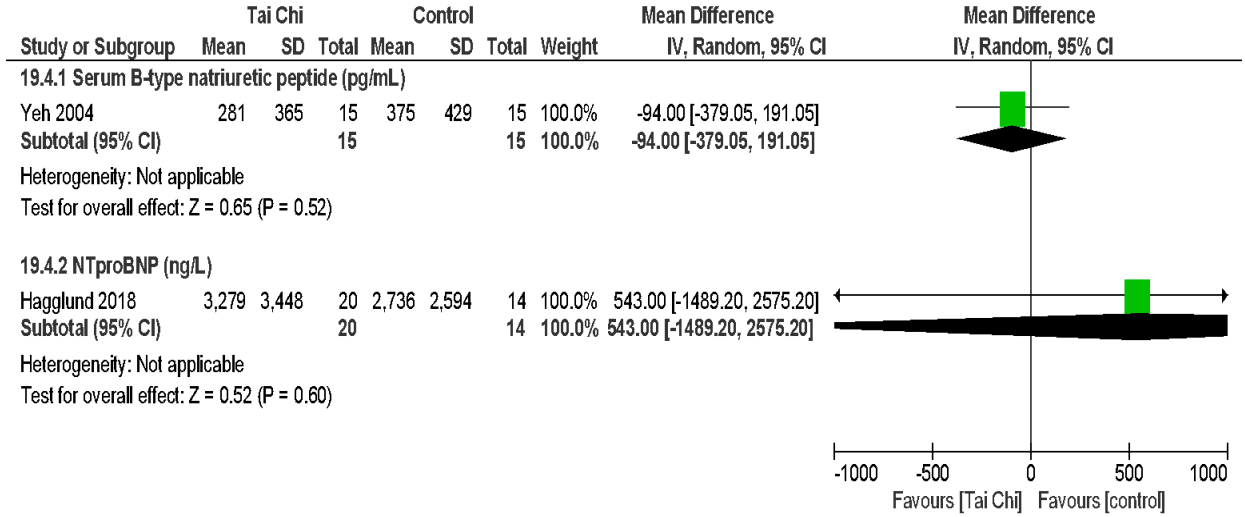
Figure 52 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Heart failure – health related quality of life



Footnotes

(1) Standard deviations/standard errors were not reported.

Figure 53 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Heart failure – biomarkers



4.14 Rehabilitation due to chronic obstructive pulmonary disease

4.14.1 Description of the condition

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease characterised by a chronic inflammation of the airways causing obstruction of airflow to the lungs (273). COPD arises from a combination of genetic and environmental factors including tobacco smoking, lung development during gestation and childhood, air pollution, and other chronic conditions such as asthma (273). Reduced airflow over time causes lung damage and results in symptoms such as cough, sputum production and difficulty breathing (273). While COPD is treatable, the damage is not fully reversible.

Almost 600 000 (2.5%) Australians experience COPD according to the Australian Bureau of Statistics (274), however estimating the true prevalence of COPD is made difficult by the fact that clinical testing is required to detect abnormal lung function. An Australian based study to estimate the prevalence of COPD found 7.5% of those over the age of 40 met the criteria for having COPD, and that this increases to almost 30% for those over 75 years (275). COPD is the third highest contributor to the burden of disease in Australia, accounting for 3.9% of the total burden (88). Additionally, COPD was the fifth leading cause of death in Australia in 2018, accounting for 4.7% of deaths (273).

While there is no cure for COPD, there are a range of treatment and preventative actions to slow the progression of disease including bronchodilator medication, corticosteroids, oxygen therapy, vaccination against respiratory infections and pulmonary rehabilitation programs (276). The Lung Foundation of Australia recommends that those with chronic lung disease should aim to exercise for 30 minutes at least 5 times per week, and that exercise may help to improve breathlessness and clear mucus (277).

4.14.2 Description of studies

Twenty-three citations (278-300) corresponding to 7 RCTs (Chan 2010, Kantatong 2019, Leung 2011, Ng 2014, Niu 2013, Yeh 2010, Zhu 2018) and 2 quasi-RCTs (Polkey 2017, Wang 2019) were identified in the literature. There were 4 ongoing studies and 9 studies awaiting classification (6 of which were published in a language other than English and one was published after the literature search date). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix F (technical report, version 2).

The sample size for the trials ranged from 10 to 206 participants (total 770). The inclusion and exclusion criteria were reasonably consistent across studies, requiring participants to have clinically diagnosed COPD according to the GOLD criteria[9] of post-bronchodilator FEV_1/FVC[10] less than 0.7. Most studies also required participants to be able to walk independently or have no physical conditions that would preclude a 6-minute walk test, no recent exacerbation of COPD symptoms, and no regular physical activity or Tai Chi practice in the past year. Polkey 2017 also specified that participants should be bronchodilator naïve.

[9] GOLD criteria - Global Initiative for Chronic Obstructive Lung Disease criteria

[10] FEV_1/FVC – Forced expiratory ratio

The style of Tai Chi varied between the trials: Chan 2010 and Kantatong 2019 delivered Tai Chi Qigong, Leung 2011 and Ng 2014 delivered Sun style Tai Chi, Yeh 2010, Polkey 2017, Wang 2019 and Zhu 2018 delivered a Yang style Tai Chi, and Niu 2013 did not specify the style of Tai Chi delivered. All interventions were delivered for 3 months except for Ng 2014 which lasted 6 weeks, and Niu 2013 which lasted 6 months. Three trials included a co-intervention: Polkey 2017 delivered bronchodilators, Chan 2010 maintained prescribed medical treatments and Ng 2014 delivered a pulmonary rehabilitation program that included aerobic exercise.

Five studies (Chan 2010, Leung 2011, Wang 2019, Yeh 2010, Zhu 2018) included a control group that received an inactive control (either usual care or routine activities). One study (Chan 2010) had 2 control groups (one inactive and one exercise group) and control participants in one study received educational advice (Zhu 2018). Four other studies included an active comparator group: being either relaxation exercises (Ng 2014), conventional pulmonary rehabilitation (Polkey 2017), standard medical care (Niu 2013) or weekly educational meetings (Kantatong 2019).

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.14.4 and Appendix F2).

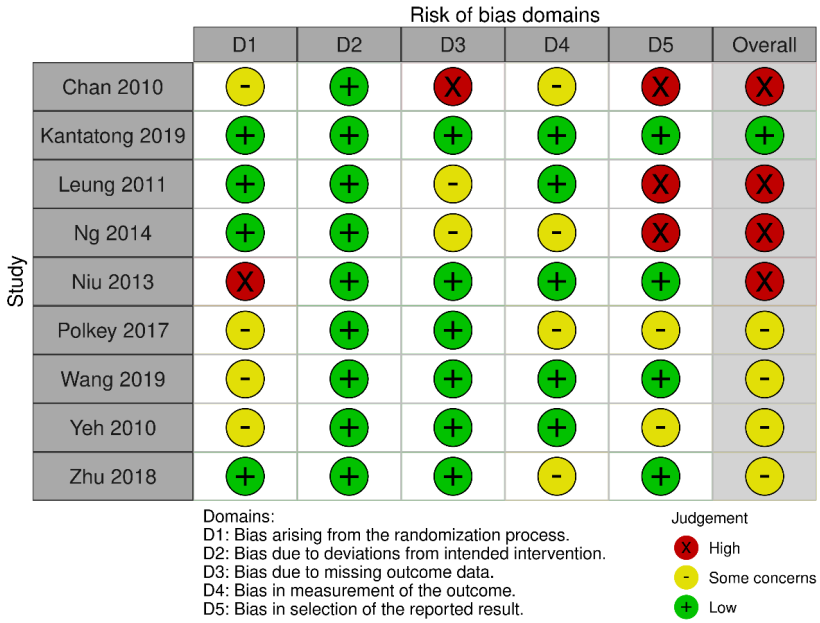
Results for 3 of the 4 studies (Kantatong 2019, Ng 2014, Polkey 2017) that examined Tai Chi versus an active comparator are presented in Appendix F2. Niu 2013 did not provide data for any outcomes considered relevant for this review.

4.14.3 Risk of Bias – per item

The risk of bias of included RCTs for COPD rehabilitation is summarised in Figure 54. Details are provided in Appendix D5.1.2.

One study (Kantatong 2019) was judged to be at overall low risk of bias.

Figure 54 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: COPD Rehabilitation



4.14.4 Main comparison (vs control)

Five RCTs (Chan 2010, Leung 2011, Wang 2019, Yeh 2010, Zhu 2018) comparing Tai Chi with no intervention were eligible for this comparison and contributed data to 4 outcomes. There were 8 additional studies awaiting classification (7 not published in English) and one ongoing study that compared Tai Chi with no intervention in people living with COPD (466+ participants) that could have contributed data to these outcomes (see Appendix C6).

4.14.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (usual care) for COPD rehabilitation

Patient or population: COPD rehabilitation
Setting: Community
Intervention: Tai Chi
Comparison: Control (usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Respiratory health assessed with: spirometry (values between 70% to 80% considered normal) follow-up: 3 months	The mean FEV_1/FVC ratio was **55.47%**	MD **0.96 lower** (11.45 lower to 9.53 higher)	-	50 (1 RCT)	⊕⊕◯◯ LOW [A,B,C]	Tai Chi may result in little to no difference in respiratory health for people living with COPD.**
HRQoL assessed with: CRD survey or St George's Respiratory Questionnaire (higher is worse) Scale from: 0 to 7 and 0 to 100 respectively follow-up: 12 weeks	-	SMD **0.21 SD lower** ^ (0.57 lower to 0.14 higher)	-	175 (2 RCTs)	⊕◯◯◯ VERY LOW [A,B,C,D]	The evidence is very uncertain about the effect of Tai Chi on HRQoL in people living with COPD.***
Level of Dyspnoea assessed with: Modified MRC Dyspnoea Scale (higher is worse) Scale from: 0 to 4 Follow-up: 3 months	The mean level of dyspnoea-related disability was **1.36** points	MD **0.1 higher** (0.3 lower to 0.5 higher)	-	60 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,E]	Tai Chi may result in little to no difference in the level of dyspnoea-related disability for people living with COPD.****
Functional Capacity assessed with: Modified Physical Performance Battery test (higher is best) Scale from: 0 to 12 follow-up: 12 weeks	The mean functional capacity was **2.25**	MD **0.06 higher** (2.2 lower to 2.32 higher)	-	38 (1 RCT)	⊕◯◯◯ VERY LOW [A,B,C,D]	The evidence is very uncertain about the effect of Tai Chi on functional capacity in people living with COPD.

Tai Chi compared to Control (usual care) for COPD rehabilitation

Patient or population: COPD rehabilitation
Setting: Community
Intervention: Tai Chi
Comparison: Control (usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
General health assessed with: BODE index - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on general health in people living with COPD is unknown.
Physical wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on physical health in people living with COPD is unknown.
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on general health in people living with COPD is unknown.

*The **risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MDC in people with COPD is 4% (301).
*** The MCID for CRD survey is 0.5 points per item (302). The MCID for the SGRQ is 4 points (303).
**** The MCID for the MRC dyspnoea scale is 0.5 points (304).

CI: confidence interval; **CRD:** Chronic Respiratory Disease survey; **FEV1/FVC:** forced expiratory volume/forced vital capacity; **HRQoL:** health-related quality of life **MCID:** minimal clinically important difference; **MD:** mean difference; **RCT:** randomised controlled trial

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.
b. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with important and no important difference). Certainty of evidence downgraded.
c. Publication bias suspected. The evidence is limited to a small number of small trials. Certainty of evidence downgraded.
d. Serious risk of bias related to missing data and exclusion of some participants. Certainty of evidence downgraded.
e. No serious indirectness. Evidence directly generalisable to the Australian healthcare context with few caveats. The study is conducted in China and may not be applicable to the practice of Tai Chi among people living with COPD in Australia. Certainty of evidence not downgraded.

4.14.4.2 Forest plots

Outcome results related people recovering from COPD are presented in Figure 55 (respiratory health), Figure 56 (health-related quality of life), Figure 57 (dyspnoea-related disability) and Figure 58 (functional capacity).

Figure 55 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): COPD rehabilitation – respiratory health

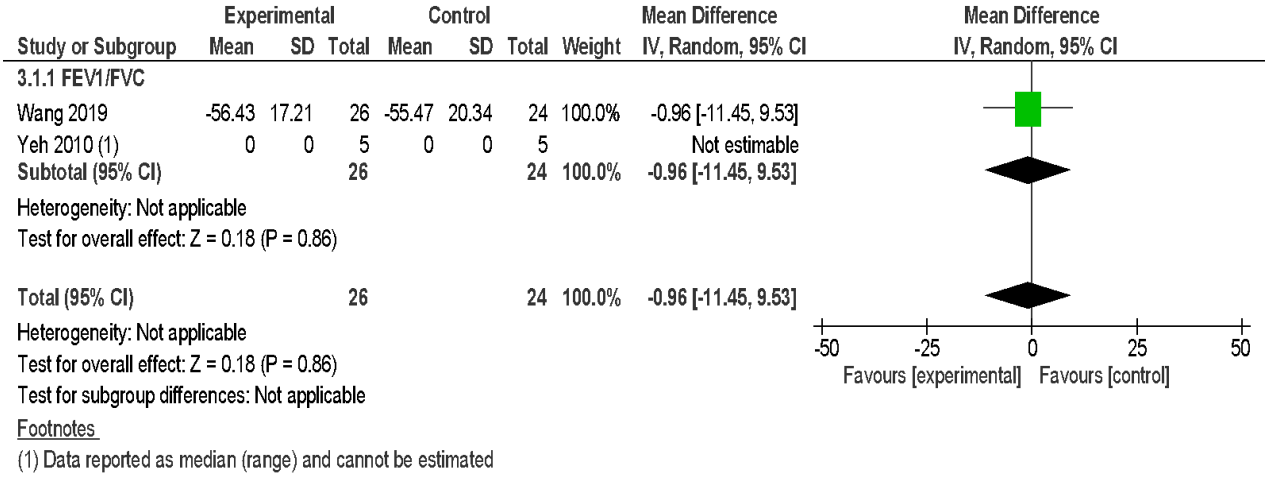


Figure 56 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): COPD rehabilitation – health-related quality of life

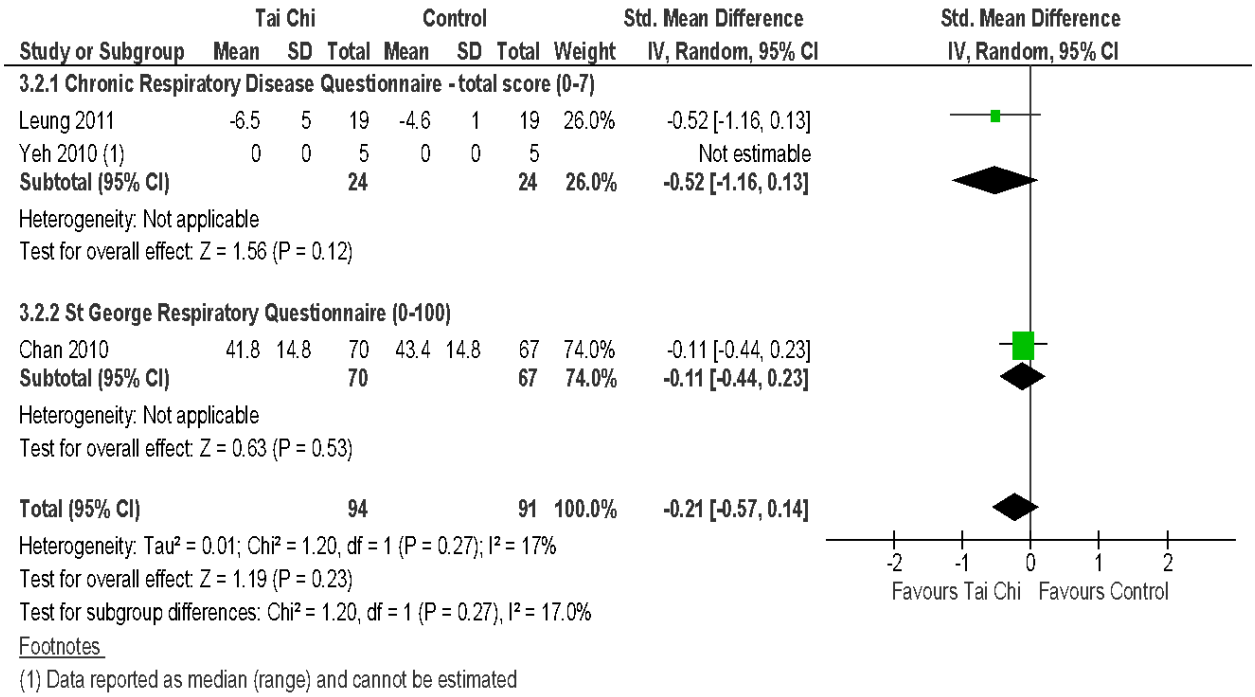
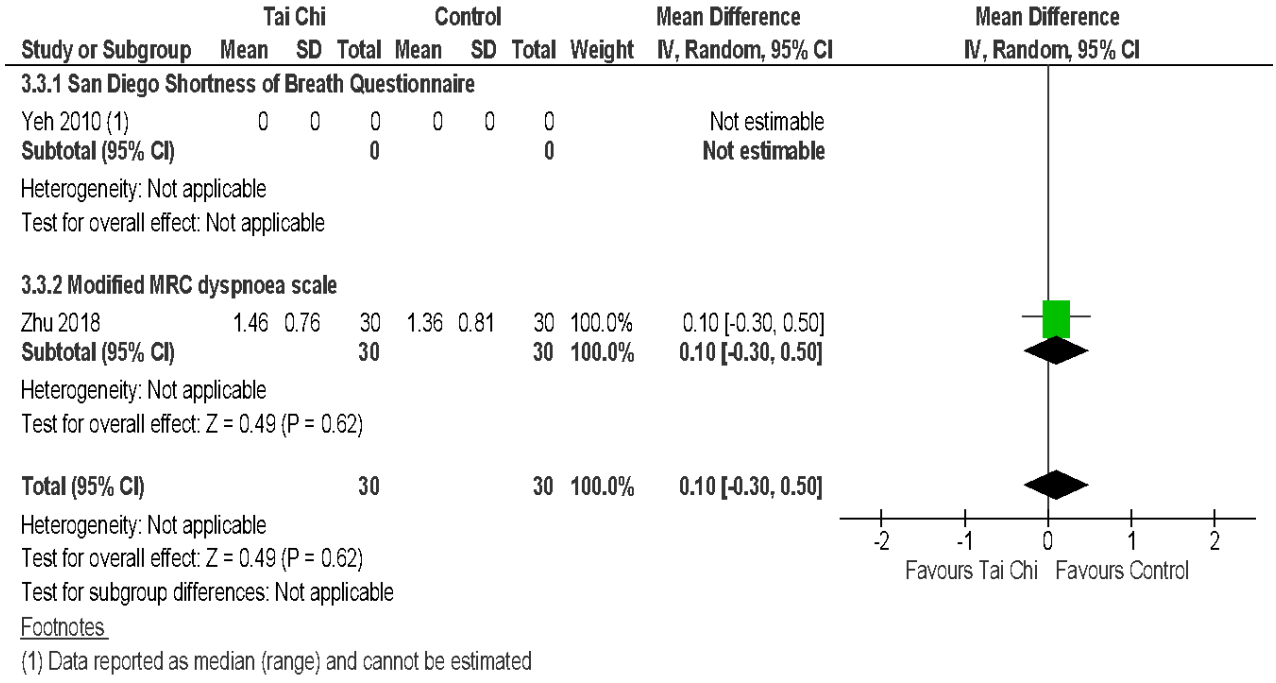


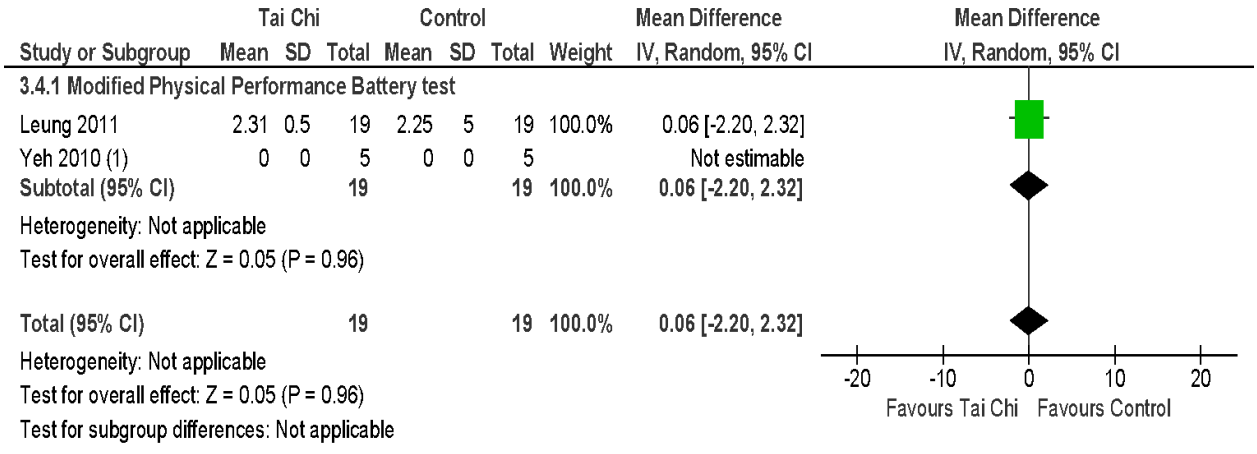
Figure 57 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): COPD rehabilitation – level of dyspnoea



Footnotes

(1) Data reported as median (range) and cannot be estimated

Figure 58 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): COPD rehabilitation – functional capacity



Footnotes

(1) Data reported as median (range) and cannot be included here.

4.15 Osteoarthritis

4.15.1 Description of the conditions

Osteoarthritis (OA) is a chronic disease that primarily impacts the articular cartilage and the subchondral bone of a synovial joint, which eventually results in joint failure (305). Individuals with OA experience joint pain, stiffness and swelling which mainly affects the hands, knees and hips (306). As OA progresses it can impact a person's quality of life as it becomes difficult to perform everyday tasks (306).

OA is the most common form of arthritis in Australia (305-307). In 2007 to 2008, it was estimated 2.2 million (9.3%) Australians were living with OA (307). There is no specific cause of OA, however several factors contribute to the onset and progression of disease, including being female, overweight or obese and older age. Although younger people can be affected by osteoarthritis, it most frequently occurs in people over 55 years of age with just over one third of all adults 75 years and over experiencing this condition (306, 307).

There is no cure for osteoarthritis (307), with recommended treatments focused on relieving pain and improving joint function. International guidelines (308-310) recommend routine aerobic exercise and/or physiotherapy to assist in improving pain and maintain and strengthen joint function and range of motion. Australian guidelines (306) strongly recommend regular land based exercise such as muscle strengthening exercises, Pilates, walking and Tai Chi.

4.15.2 Description of studies

There were 55 citations (20, 311-363) corresponding to 13 RCTs (Brismee 2007, Callaghan 2010, Fransen 2007, Hartman 2000, Lee 2009, Li 2019d, Liu 2019a, Nahayatbin 2018, Song 2007, Song 2010, Wang 2008b, Wang 2013a, Wang 2015a), one cluster-randomised trial (Tsai 2013) and one quasi-RCT (Wortley 2013) that were identified in the literature. There were 2 ongoing studies and 3 studies awaiting classification (Manlapaz 2020, Song 2009, Zhang 2011e) (including one study that was published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D6.1.1.

Nine studies were carried out in single centre settings in either the United States (Brismee 2007, Hartman 2000, Wang 2008b, Wortley 2013), Australia (Fransen 2007), South Korea (Lee 2009, Song 2007), Iran (Nahayatbin 2018) or China (Wang 2013a). Three studies were conducted across multicentre settings in either the United States (Callahan 2010, Tsai 2013) or China (Li 2019d). The remaining studies did not specify the setting of the trial but were conducted in either China (Liu 2019a), South Korea (Song 2010) or the United States (Wang 2015a).

Across the 15 studies, sample size ranged from 33 to 343 (total 1474), with all studies enrolling adults with osteoarthritis. Eight studies enrolled participants with knee osteoarthritis (Brismee 2007, Lee 2009, Liu 2019a, Nahayatbin 2018, Tsai 2013, Wang 2008b, Wang 2015a, Wortley 2013). Two studies (Fransen 2007, Hartman 2000 included older adults with both knee and hip osteoarthritis and one study (Li 2019d) focussed on participants with knee osteoarthritis who were also recovering from unilateral total knee arthroplasty. One study (Callahan 2010) included adults over the age of 18 years with any type of arthritis, however the primary type reported by participants was osteoarthritis. The remaining 3 studies (Song 2007, Song 2010, Wang 2013a) did not specify the type of osteoarthritis. In all trials except Callahan 2010, participants were at least 40 years old, and 4 studies limited the population to participants aged 60 years or over (Fransen 2007, Tsai 20013, Wang 2013a, Wortley 2013). Most studies included both female and male participants; however, 3 studies were conducted in women only (Song 2007, Song 2010, Wang 2013a).

Seven studies (Brismee 2007, Callahan 2010, Fransen 2007, Lee 2009, Nahayatbin 2018, Song 2007, Wortley 2013) compared a modified form of Tai Chi with no intervention or a waitlisted control, of which 3 studies also included an active comparator varying from hydrotherapy (Fransen 2007), kinetic chain exercises (Nahayatbin 2018) and resistance training (Wortley 2013). The remaining 9 studies compared Tai Chi with another intervention. Five studies compared Tai Chi to a wellness education program (Liu 2019, Song 2010, Tsai 2013, Wang 2008b, Wang 2013a). Hartman 2000 compared Tai Chi to group meetings, which included educational advice and fortnightly phone calls. The remaining 2 studies compared Tai Chi to either conventional physical therapy (Wang 2015a) or conventional physical exercise (Wortley 2013). Style of Tai Chi varied within the trials, with 5 studies employing Yang style (Hartman 2000, Nahayatbin 2018, Wang 2008b, Wang 2015a, Wortley 2013) and 5 studies using Sun style (Callahan 2010, Fransen 2007, Song 2007, Song 2010, Tsai 2013). Callahan 2010 used a version of Sun style Tai Chi adapted for arthritis participants by the Arthritis Foundation. The remaining studies either did not specify the style of Tai Chi or used a custom-designed format for the patient population.

In all studies, the Tai Chi sessions were typically 40-60 minutes in duration, except for one study (Nahayatin 2018) which carried out 20-minute sessions. The intensity ranged across trials from 5 times a week for 12 weeks (Li 2019d), 3 times a week for 4 (Nahayatbin 2018), 12 (Brismee 2007, Song 2007) or 20 weeks (Tsai 2013), down to twice a week for 8 (Callahan 2010, Lee 2009), 10 (Wortley 2013) or 12 weeks (Fransen 2007, Hartman 2000, Wang 2008b, Wang 2015a). Brismee 2006 separated the 12 weeks into 6 weeks of group practice and 6 weeks of home practice. The remaining studies varied the intensity of the program: Song 2010 included sessions twice a week for the first 3 weeks and once a week for the remaining 6 months; and in Wang 2013a practised twice a week for 4 weeks and 3 times a week for the remaining 20 weeks, which took place in groups or home-practice.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (and Appendix F2).

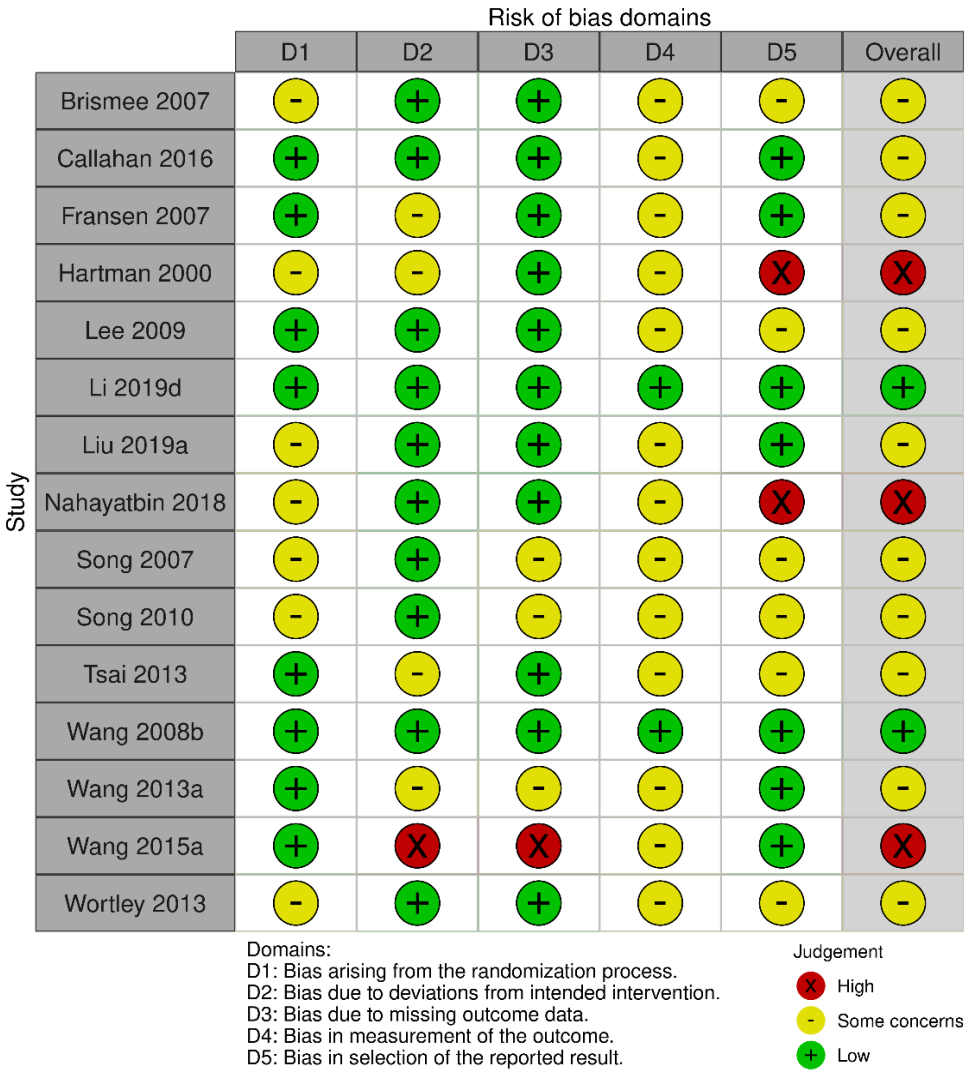
Results for the studies (Brismee 2007, Fransen 2009, Li 2019d, Nahayatbin 2018, Tsai 2013, Wang 2005, Wang 2008b, Wang 2013a, Wang 2015a, Wortley 2013) that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.15.3 Risk of Bias – per item

The risk of bias of included RCTs for osteoarthritis is summarised in Figure 59. Details are provided in Appendix D6.1.2.

Two studies (Li 2019d, Wang 2008b) were judged to be at overall low risk of bias.

Figure 59 Risk of bias graph: review authors' judgements about each risk of bias item for each included study: Osteoarthritis



4.15.4 Main comparison (vs control)

Six RCTs (Callahan 2016, Fransen 2007, Lee 2009, Nahayatbin 2018, Song 2007, Wortley 2013) contributed data relevant to 5 outcomes. There was one additional study awaiting classification (available as abstract only), and 2 ongoing studies (complete, results not published) comparing Tai Chi with no intervention in people with osteoarthritis (total 225 participants) that could have contributed data to the outcomes considered critical or important to this review.

There was also one study (Duan, 2012), published in a language other than English, that assessed Tai Chi compared with no intervention in 200 participants with peri-arthritis of the shoulder that could also have contributed data, but no further details were available to make a judgement (see Appendix C6).

4.15.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist) for Osteoarthritis

Patient or population: Osteoarthritis
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Pain assessed with: VAS or WOMAC subscale (higher is worse) or KOOS subscale (higher is better) Scale from: variable follow-up range: 8 to 12 weeks	-	SMD **0.75 SD lower ^** (1.20 lower to 0.30 lower)	-	524 (6 RCTs)	⊕⊕⊕◯ MODERATE [A,B,C]	Tai Chi probably reduces pain in people with arthropathies.**
Reduction in disease severity/impact - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on reduction in disease severity/impact in people with arthropathies is unknown.
Functional status assessed with: WOMAC subscale (higher is worse) or KOOS subscale (higher is better) Scale from: variable follow-up range: 8 to 12 weeks		SMD **0.56 SD lower ^** (1.05 lower to 0.07 lower)	-	197 (4 RCTs)	⊕⊕◯◯ LOW [B,C,D]	Tai Chi may result in an improvement in physical function for people with arthropathies. ***
Stiffness assessed with: VAS or WOMAC subscale (higher is worse) or KOOS subscale (higher is better) Scale from: variable follow-up range: 8 to 12 weeks	-	SMD **1.07 SD lower ^** (1.85 lower to 0.28 lower)	-	427 (5 RCTs)	⊕⊕⊕◯ MODERATE [E,F]	Tai Chi probably reduces stiffness for people with arthropathies. ****
Quality of life assessed with: KOOS-QoL subscale (higher is better) Scale from: 0 to 100 follow-up: 12 weeks	The mean knee-related QoL was **40.44** points	MD **23.19 points higher** (35.12 higher to 11.26 higher)	-	32 (1 RCT)	⊕⊕◯◯ LOW [E,F,G]	Tai Chi may improve knee-related quality of life in people with arthropathies.*****

Tai Chi compared to Control (no intervention, waitlist) for Osteoarthritis

Patient or population: Osteoarthritis
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Psychosocial wellbeing assessed with: SF-12 or SF-36 MCS (higher is better) Scale from: 0 to 100 follow-up: range 8 weeks to 12 weeks	The mean psychosocial wellbeing ranged from **48 to 52.4** points	**MD 7.66 higher** (3.69 lower to 19.00 higher)	-	141 (2 RCTs)	⨁◯◯◯ VERY LOW [F,H]	The evidence is very uncertain about the effect of Tai Chi on psychosocial wellbeing in people with arthropathies.#
Balance - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on reduction in balance in people with arthropathies is unknown.

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID for the VAS is reported to be 20 mm in people with chronic pain (364) and is between 7 to 12 points for the WOMAC pain subscale in people with knee OA (365, 366).
*** The MCID for the WOMAC function subscale is estimated to be 10.1 mm in people with knee OA (367) and around 17.1 points for the KOOS ADL subscale (368).
**** The MCID for knee and hip OA is 1.91 and 1.53 points, respectively (369).
***** The MCID for the KOOS QoL subscale in people with knee OA is 16.5 points (368). #

^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (86).
# The effect estimate was considered based on the following thresholds: small (MD <10% of the scale), moderate (MD between 10% to 20% of the scale), or large (MD more than 20% of the scale).

CI: confidence interval; **KOOS - QoL:** Knee Injury and Osteoarthritis Outcome Score – Quality of Life; **MCID:** minimal clinically important difference; **MD:** mean difference; **MCS:** mental component score; **SF-36:** 36-item short form survey; **SMD:** standardised mean difference; **RCT:** randomised controlled trial; **WOMAC:** Western Ontario and McMaster Universities Osteoarthritis Index; **VAS:** Visual analogue scale

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. One RCTs at a high risk of bias (~13% weight) that does not seriously influence the result. In a sensitivity analysis the overall direction of effect was not changed, and the size of the effect estimate remained moderate when the study at high risk of bias was removed. Certainty of evidence not downgraded.

b. No serious inconsistency. Certainty of evidence not downgraded.

c. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with both large and small important difference). Certainty of evidence downgraded.

d. Serious risk of bias. One RCTs at a high risk of bias (~21% weight) that influences the result. In a sensitivity analysis the size of the effect estimate was smaller, but the overall direction of effect did not change. Certainty of evidence downgraded.

e. No serious risk of bias. One RCTs at a high risk of bias (~13% weight) that does not seriously influence the result. In a sensitivity analysis the overall direction of effect was not changed, and the size of the effect estimate remained moderate when the study at high risk of bias was removed. Certainty of evidence not downgraded.

f. Serious inconsistency. Some statistical heterogeneity (I^2 > 70%) with important differences in the observed effect across studies. Certainty of evidence downgraded.

e. Serious risk of bias. One RCTs at a high risk of bias (100% weight) that likely overstates the effect estimate.

f. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

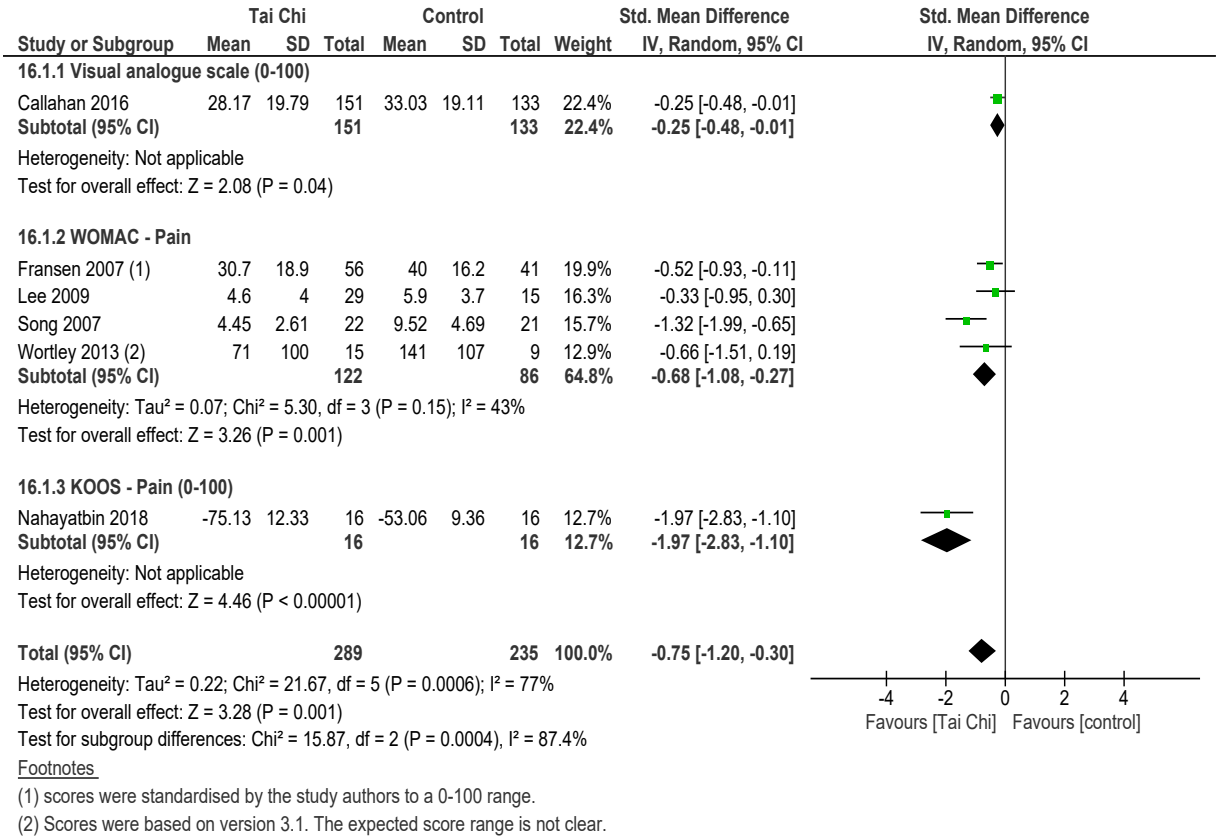
g. Serious imprecision. Wide confidence intervals (upper and lower bound overlap with both a large and no important difference). Certainty of evidence downgraded.

h. Very serious imprecision. Wide confidence intervals (upper and lower bound overlap with both a large and no important difference). Certainty of evidence downgraded 2 levels.

4.15.4.2 Forest plots

Outcome results related people with osteoarthritis are presented in Figure 60 (pain), Figure 61 (functional disability), Figure 62 (stiffness), Figure 63 (knee-related quality of life) and Figure 64 (psychosocial wellbeing).

Figure 60 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist): osteoarthritis – pain

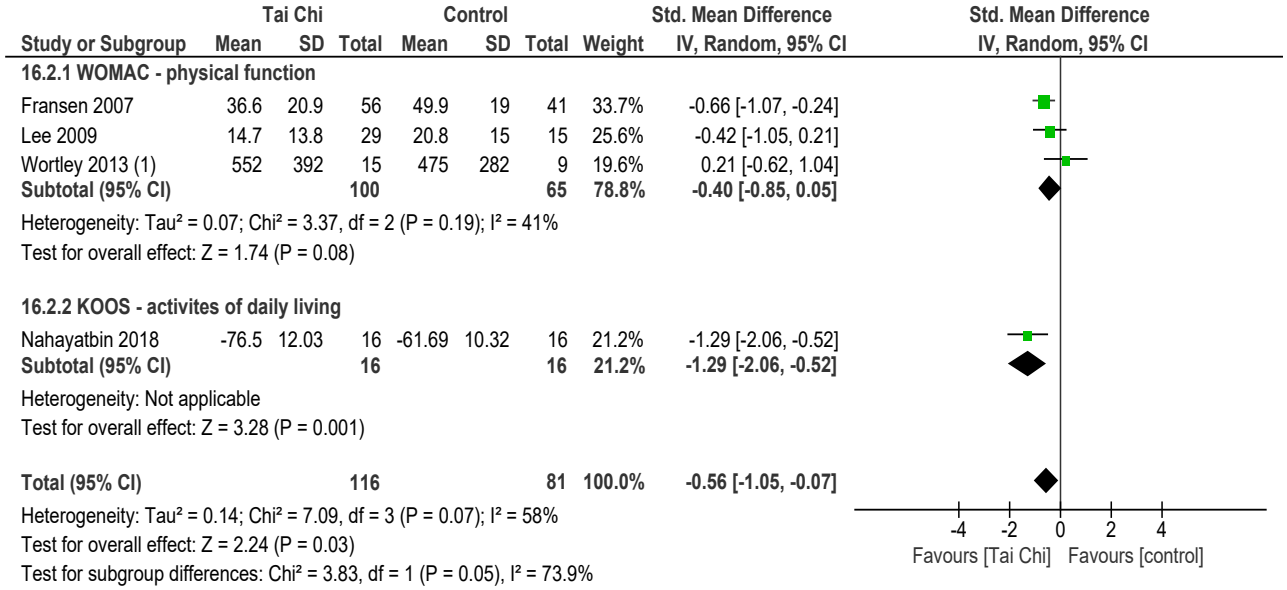


Footnotes

(1) scores were standardised by the study authors to a 0-100 range.

(2) Scores were based on version 3.1. The expected score range is not clear.

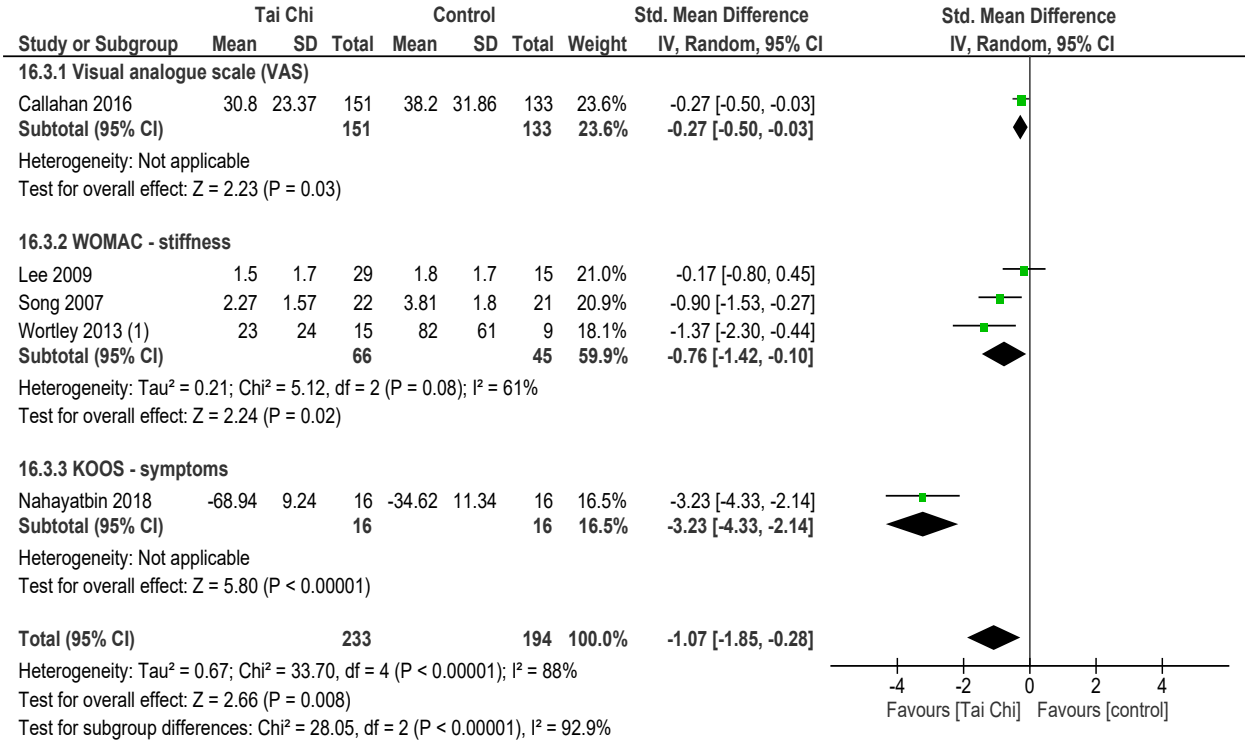
Figure 61 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist): osteoarthritis – functional status/disability



Footnotes

(1) Scores were based on version 3.1. The expected score range is not clear.

Figure 62 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist): osteoarthritis – stiffness



Footnotes

(1) Scores were based on version 3.1. The expected score range is not clear.

Figure 63 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist): osteoarthritis – quality of life

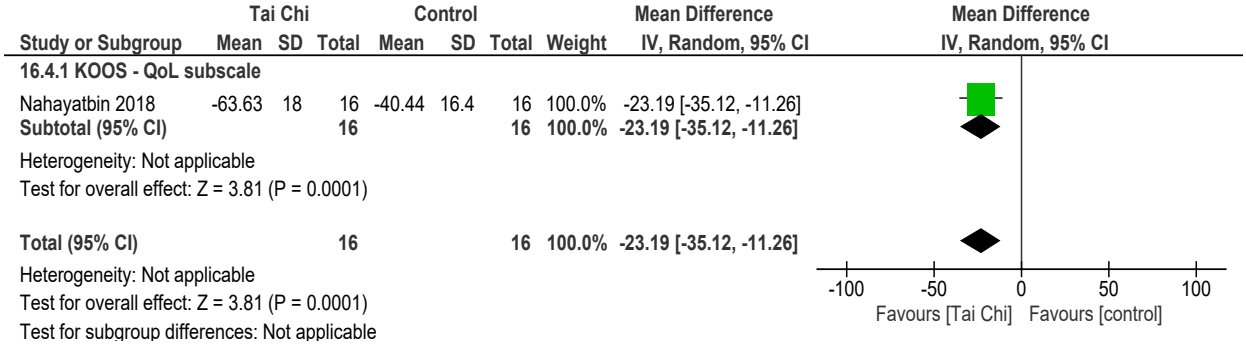
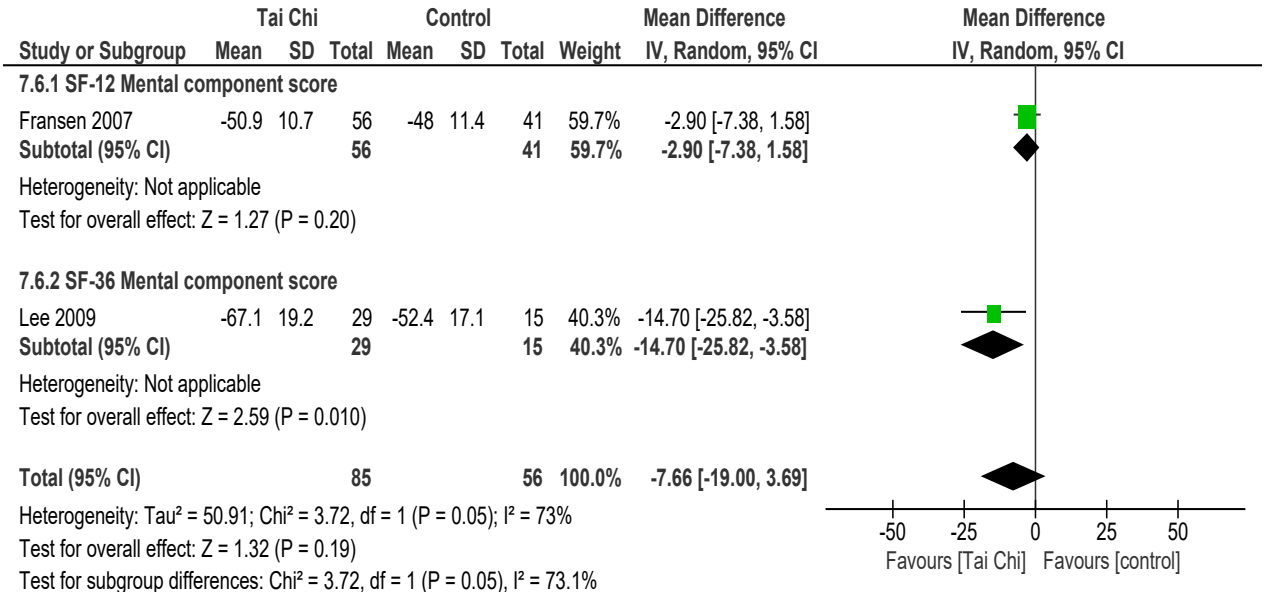


Figure 64 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist): osteoarthritis – psychosocial wellbeing



4.16 Rheumatoid arthritis

4.16.1 Description of the conditions

Rheumatoid arthritis (RA) is a chronic autoimmune disease characterised by joint swelling, tenderness, and destruction of synovial joints (370). Instead of producing nourishing and lubricating fluid, the synovial membrane lining affected joints is attacked by the immune system and becomes thick and inflamed. This results in unwanted tissue growth, bone erosion, and irreversible joint damage (371). RA typically affects hand joints and both sides of the body at the same time (371).

The estimated prevalence of RA in Australia is 1.9%, or around 456,000 people (371). RA is more common in women than in men, and occurs most commonly in people over age 75 (371). In 2017-18, there were 12 045 hospitalisations for RA (371).

There are several pharmacological options indicated for management of RA. Disease-modifying anti-rheumatic drugs (DMARDs), biologic disease-modifying anti-rheumatic drugs (bDMARDs), and corticosteroids can slow disease progression (371). If initiated early, these medications can help prevent irreversible damage and disability (371). In addition to pharmacological interventions, low-impact physical activity is also recommended to help reduce inflammation, increase and maintain mobility, and increase muscle strength around the joints (371).

4.16.2 Description of studies

Two citations (372, 373) corresponding to one RCT (Wang 2005) were identified in the literature search. There was one ongoing study (374) and no studies awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in provided in Appendix D6.1.1.

Wang 2005 was carried out an outpatient clinic in the United States. Twenty adult participants with rheumatoid arthritis participated, receiving either Yang style Tai Chi or wellness education and stretching. Both interventions were delivered twice per week for 60 minutes over the course of 12 weeks.

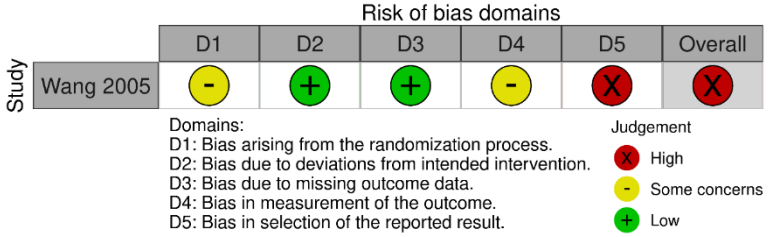
Results for Wang 2005 that examined Tai Chi versus an active comparator are presented in Appendix F2.

4.16.3 Risk of Bias – per item

The risk of bias of included RCTs for rheumatoid arthritis is summarised in Figure 65. Details are provided in Appendix D6.1.2.

No studies were judged to be at overall low risk of bias.

Figure 65 Risk of bias graph: review authors' judgements about each risk of bias item for each included study: Rheumatoid arthritis



4.16.4 Main comparison (vs control)

There were no studies found for outcomes selected *a priori* as critical or important, thus the effect of Tai Chi compared with control on these outcomes in people with rheumatoid arthritis is unknown.

The following outcomes were selected (in order of importance):

- pain
- disease severity/impact
- functional status/disability
- stiffness
- quality of life
- psychosocial wellbeing
- balance

4.17 Low back pain

4.17.1 Description of the condition

Low back pain (LBP) is the most encountered musculoskeletal problem in general practice in Australia and the leading cause of disability globally (375-377). National data found that approximately 16% of Australians reported experiencing back pain in 2017-18 (378). While LBP is generally benign and self-limiting, approximately 10-40% with acute LBP develop persistent and debilitating LBP (376). Direct and indirect costs of LBP are reportedly $1 billion and $8 billion, respectively (379). LBP is defined by the location of pain, typically between the lower rib margins and the buttock creases and is commonly accompanied by pain in one or both legs. Some may also experience associated neurological symptoms in the lower limbs (377). In most cases there is no specific cause of LBP and is subsequently labelled nonspecific LBP. Individuals with other general physical and mental health conditions are more likely to experience LBP and pain in other body sites. While the cause of LBP remains unclear, risk factors include genetics, previous episode of LBP, poor posture, physically demanding tasks ad lack of physical activity (377).

International guidelines consistently recommend the consideration of alternative diagnosis; however, spinal imaging should not be routinely ordered (375, 376). Advice to stay active and return to normal activities as soon as possible is a core recommendation across international guidelines (375). Furthermore, the international guidelines recommend some various forms of exercise as therapy, but no one approach is superior to another (375). However, evidence-based guidelines are not consistently translated into clinical practice and medications including opioids are overprescribed (380). Help seeking behaviours are primarily driven by characteristic factors of pain, impaired daily activities and an ability to carry out normal work (381). Providers commonly sought include physiotherapists, chiropractors, massage therapists and acupuncturists and as per guidelines, exercise is commonly prescribed for people experiencing LBP (381). Various nonpharmacological therapies that may be beneficial for LBP include rehabilitation, spinal manipulation, exercise therapy and mind-body interventions (382). Incorporating exercise therapy as a management strategy has proven to be effective in decreasing pain and improving function in adults with chronic LBP (383).

4.17.2 Description of studies

Ten citations (384-394) corresponding to 4 RCTs (Hall 2009, Lui 2019b, Weifen 2013, Zou 2019) and 2 quasi-RCTs (Cho 2014, Jang 2015) were identified in the literature. There were 3 ongoing studies and 2 studies awaiting classification (one of which was published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D7.1.1.

One study (Liu 2019b) was carried out in the single centre setting in China. Three studies were carried out under multicentre settings in either Australia (Hall 2009) or China (Weifen 2013, Zou 2019). The remaining 2 studies did not specific the setting of the trial but were conducted in Korea (Cho 2014, Jang 2015). Sample sizes ranged from 30 to 320 (total 593), with all studies enrolling adults with lower back pain. One study (Cho 2014) only recruited participants with acute LBP, whereas all other others focused on chronic low LBP. In all studies, the mean age ranged between 26 and 58 years with one study enrolling only males (Cho 2014) and one only females (Jang 2015). Two studies (Hall 2009, Liu 2019b) included both male and females, however over 75% of participants were women. Weifen 2013 and Zou 2019 similarly included both male and females, but with 60% male participants.

Four studies (Hall 2009, Liu 2019b, Weifen 2013, Zou 2019) compared a modified form of Tai Chi with an inactive control. Liu 2019b and Zou 2019 also included a third control group with core stabilisation exercises and Weifen 2013 included 3 additional control groups of either swimming, jogging, or backwards walking. Hall 2009 assessed a Sun Style form of Tai Chi, whereas Liu 2019b, Weifen 2013, and Zou 2019 assessed the effect of a Chen Style form of Tai Chi. The 2 remaining studies (Cho 2014, Jang 2015) compared Tai Chi exercise with a stretching exercise program only.

In all studies, Tai Chi sessions were typically 40 to 60 minutes in duration, but the treatment programmes ranged in intensity from 5 times a week for 6 months (Weifen 2013) to 3 times a week for 4 (Cho 2014), 8 (Jang 2015) and 12 weeks (Liu 2019b, Zou 2019) down to twice a week for 8 weeks (Hall 2009).

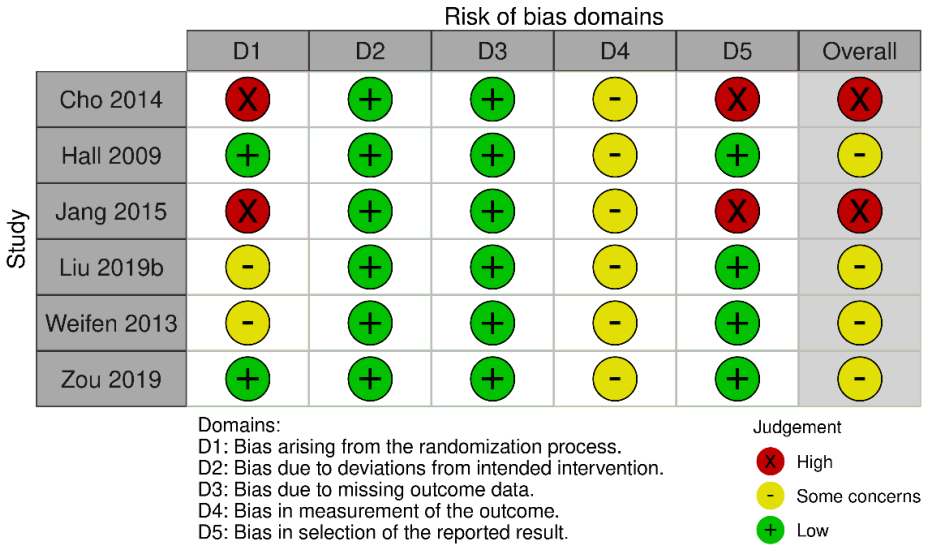
Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.17.3 and Appendix F2). Three of these RCTs (Liu 2019b, Weifen 2013, Zou 2019) alongside 2 additional trials were identified comparing Tai Chi with an active comparator, results of which are presented in Appendix F2.

4.17.3 Risk of Bias – per item

The risk of bias of included RCTs for low back pain is summarised in Figure 66. Details are provided in Appendix D7.1.2.

No studies were judged to be at overall low risk of bias.

Figure 66 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Low back pain



4.17.4 Main comparison (vs control)

Four RCTs (Hall 2009, Liu 2019b, Weifen 2013, Zou 2019) were eligible for this comparison and contributed data to 2 outcomes. There was one study awaiting classification (not published in English) and 2 ongoing studies (complete, result not available) that compared Tai Chi with no intervention in people with low back pain (total 131 participants) that could have contributed data to these outcomes (see Appendix C6).

4.17.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, usual care) for Low back pain

Patient or population: Low back pain
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Pain assessed with: VAS (cm) (higher is worst) Scale from: 0 to 10 follow-up: range 10 weeks to 6 months	The mean pain score ranged from **3.24 to 5.85** cm	MD **1.65 cm lower** (2.34 lower to 0.95 lower)	-	404 (4 RCTs)	⊕⊕⊕◯ MODERATE A,B,C,D	Tai Chi probably results in little to no difference in pain for people with low back pain.**
Disability assessed with: RMDQ (higher is worse) Scale from: 0 to 24 follow-up: 10 weeks	The mean disability score was **9.1**	MD **2.09 lower** (3.64 lower to 0.54 lower)	-	160 (1 RCT)	⊕⊕◯◯ LOW A,C,D,E	Tai Chi may result in in little to no difference in disability for people with low back pain.***
Quality of life - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on quality of life in people with low back pain is unknown
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on psychosocial wellbeing in people with low back pain is unknown

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

** The MCID for the VAS 0-100 is 2.0 cm for chronic low back pain and 3.5 cm for acute low back pain (395).
*** The MICD for the RMDQ in people with low back pain is 3 points (396).

CI: confidence interval; **MCID:** minimal clinically important difference; **MD:** mean difference; **RCT:** randomised controlled trial; **RMDQ:** Roland Morris Disability Questionnaire; **VAS:** Visual analogue scale

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. No serious inconsistency. Certainty of evidence not downgraded.

c. Serious imprecision. Wide confidence intervals (lower bound overlaps with no important difference). Certainty of evidence downgraded.

d. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

e. Publication bias suspected. Evidence is limited to one study with possible non-reporting bias related to the nature of the results. Certainty of evidence downgraded.

4.17.4.2 Forest Plots

Outcome results for people with low back pain are presented in Figure 67 (pain) and Figure 68 (disability)..

Figure 67 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Low back pain – pain

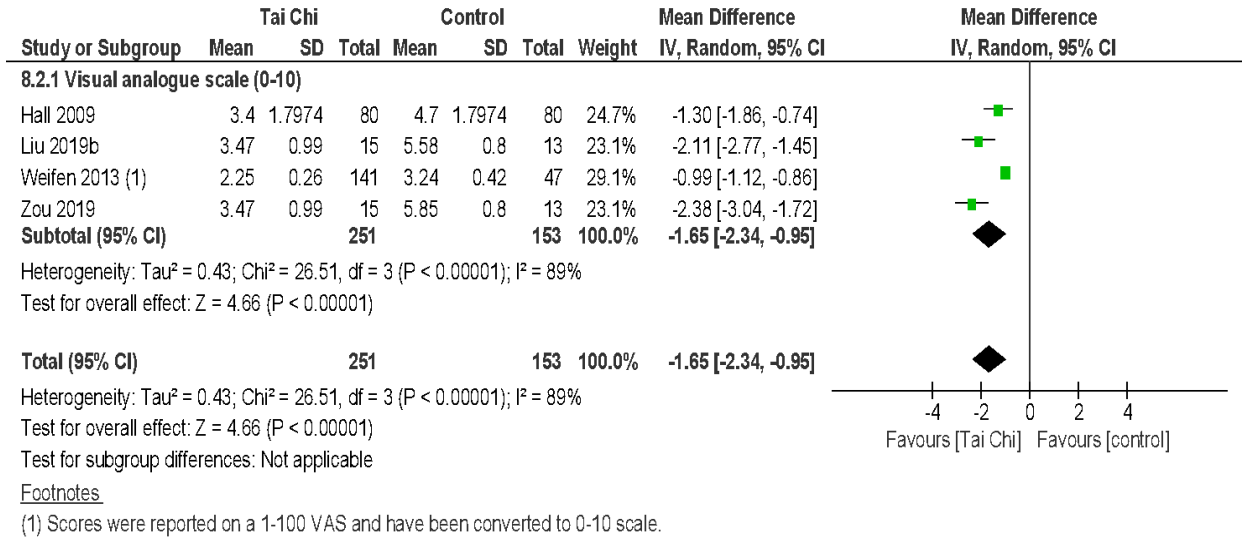
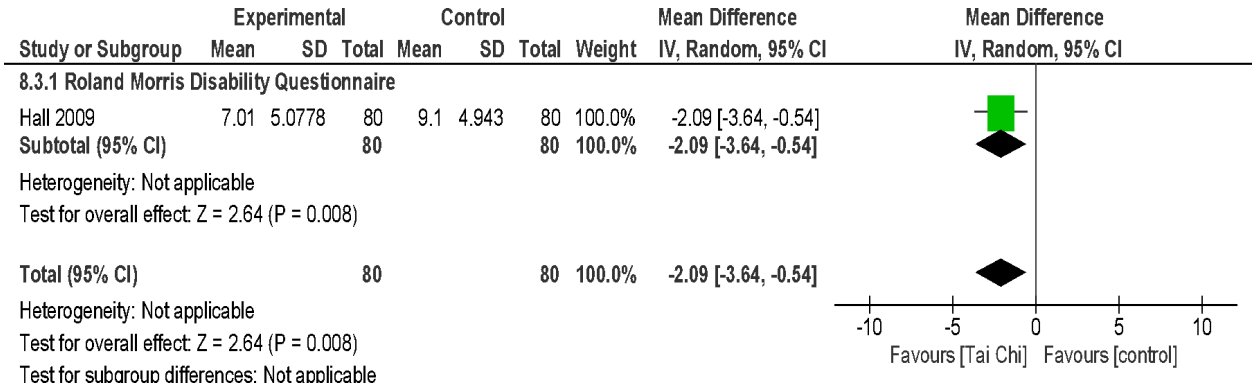


Figure 68 Forest plot of comparison: Tai Chi vs control (no intervention, usual activities): Low back pain – disability/function



4.18 Neck pain

4.18.1 Description of the condition

Neck and shoulder pain are common complaints that can impact a person's ability to carry out normal daily activities (397) and lead to considerable disability and economic burden (398). Prevalence of neck pain is high. In Australia, the number of incident cases of neck pain were reportedly 190,000 in 2017 (398). In some situations, neck and shoulder pain may occur concurrently and may also be accompanied by pain in other anatomical sites. Other times pain isolated to the neck may be reflective of local pathology (397). The duration of neck pain can be grouped as acute (less than 30 days), subacute (30 to 90 days), or chronic (longer than 90 days) (399).

Neck pain is as ubiquitous a symptom as headaches, abdominal pain or back pain. They are conditions that often prompt a person to consider action. There are multiple origins of neck pain. Pain can arise from musculoskeletal conditions including cervical spondylitis and subacromial bursitis (397), and is typically located between the occiput to upper thoracic spine with the associate musculature (400). However, in many cases the pathophysiological mechanisms underlying pain are unclear (397). With no readily or accurately identifiable pain source, this classification of neck pain is defined as non-specific (400). Risk factors for non-specific neck pain include individual factors (sex, mental distress, low physical capacity, history of neck or back pain) and workplace factors (physical workload, organisational structure and psychosocial factors) and person's general physical health and well-being is thought to be associated with neck pain (401).

Nonpharmacologic therapies such as mind-body therapies (Tai Chi, Yoga) are thought to improve outcomes for people with neck pain. Studies investigating the benefits of mind-body exercises on neck pain are limited. Exercises that may reduce pain, improve movement and increase function include strengthening exercises, stretching and breathing techniques (402-404).

4.18.2 Description of studies

Five citations (405-409) corresponding to 2 RCTs (Lauche 2016, Rajalaxmi 2018) were identified in the literature. There were no ongoing studies and one study awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D7.2.1

Both studies were conducted in university hospitals in either Germany (Lauche 2016) or India (Rajalaxmi 2018) with sample sizes ranging from 40 to of 114 participants. One study (Lauche 2016) included participants with chronic nonspecific neck pain and the second study (Rajalaxmi 2018) recruited participants with chronic mechanical neck pain. Both studies excluded participants with neck pain caused by trauma or those who had undergone invasive spinal treatment within the last 6 weeks. Across both trials, participants were middle-aged (mean age 52 years) and both males and females were included.

Lauche 2016 compared a Yang style form of Tai Chi with a waitlisted control. A third control group conducting neck exercises was also included. The Tai Chi sessions went for 75-90 minutes in duration, once per week for 12 weeks. The participants were also instructed to perform 15 minutes per day of home exercise. Rajalaxmi 2018 compared Tai Chi against Yoga, Pilates and an inactive control group. Across all 4 groups, sessions were conducted 12 times per week for 3 weeks. The duration of each session was not reported.

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.18.4.1 and Appendix F2).

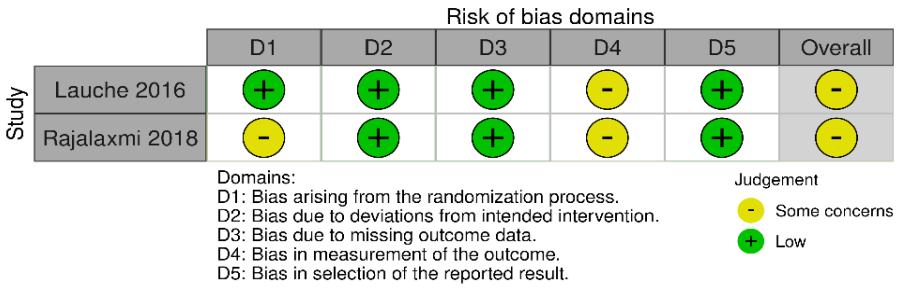
Results comparing Tai Chi versus an active comparator are presented in Appendix F2.

4.18.3 Risk of Bias – per item

The risk of bias of included RCTs for neck pain is summarised in Figure 69. Details are provided in Appendix D7.2.2.

No studies were judged to be at overall low risk of bias.

Figure 69 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Neck pain



4.18.4 Main comparison (vs control)

Two RCTs (Lauche 2016, Rajalaxmi 2018) contributed data relevant to all included outcomes. There were no additional studies awaiting classification or ongoing that compared Tai Chi with no intervention in participants with chronic neck pain that could have contributed data to the outcomes considered critical or important to this review (see Appendix C6).

4.18.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (waitlist) for Neck pain

Patient or population: Neck pain
Setting: Community
Intervention: Tai Chi
Comparison: Control (waitlist)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)	Evidence Statement
	Risk with Control	Risk with Tai Chi				
Pain assessed with: VAS (mm) OR NPQ (higher is worse) Scale from: 0 to 100 follow-up range: 3 to 12 weeks	The mean pain score ranged from **41.8 to 56.7** mm	MD **8.23 lower** (13.09 lower to 3.38 lower)	-	96 (2 RCTs)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference in pain in people with chronic neck pain.**
Disability/ Function assessed with: Neck Disability Index (higher is worst) Scale from: 0 to 50 follow-up: 12 weeks	The mean disability index was **27.5**	MD **6 lower** (11.28 lower to 0.72 lower)	-	77 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in a slight reduction in disability/ function in people with chronic neck pain.***

Tai Chi compared to Control (waitlist) for Neck pain

Patient or population: Neck pain
Setting: Community
Intervention: Tai Chi
Comparison: Control (waitlist)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence Statement
	Risk with Control	Risk with Tai Chi				
Quality of Life assessed with: SF-36 MCS (higher is best) Scale from: 0 to 100 follow-up: 12 weeks	The mean HRQoL (mental) score was **46.1**	MD **0.70 higher** (5.76 higher to 4.36 lower)		77 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference on quality of life (mental) in people with neck pain.****
Quality of Life assessed with: SF-36 PCS (higher is best) Scale from: 0 to 100 follow-up: 12 weeks	The mean HRQoL (physical) score was **42.9**	MD **4.40 higher** (1.05 higher to 7.75 higher)		77 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in a slight increase in quality of life (physical) in people with neck pain.****
Psychosocial wellbeing assessed with: PSS (higher is worst) Scale from: 0 to 40 follow-up: 12 weeks	The mean psychosocial wellbeing was **16.3** points	MD **0.6 higher** (2.38 lower to 3.58 higher)	-	77 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference in psychosocial wellbeing in people with neck pain.*****

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
** The MCID for the VAS 0-100 is 26 points (413). The MCID for the NPQ is defined as a 25% reduction in score from baseline (410).
*** The MDC for the NDI is estimated to be between 4.7 and 5.0 points (411). #
**** MCID for SF-36 MCS is unknown and is estimated to be 2.6 points for the SF-36 PCS (412). #
***** The MCID is estimated to be between 2.19 and 2.66 points for an overall PSS score (413).

The effect estimate was considered based on the following thresholds: small (MD <10% of the scale), moderate (MD between 10% to 20% of the scale), or large (MD more than 20% of the scale).
^ As a rule of thumb, an SMD of 0.2 is considered a small difference, 0.5 is medium, and 0.8 is large difference (73).

CI: confidence interval; **NPQ:** Northwick Park Pain Questionnaire; **MCID:** minimal clinically important difference; **MCS:** mental component score; **MD:** mean difference; **PCS:** physical component score; **PSS:** perceived stress scale; **RCT:** randomised controlled trial; **VAS:** visual analogue scale

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

c. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with both and large important effect and no effect). Certainty of evidence downgraded.

d. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.

4.18.4.2 Forest plots

Outcome results related to people with neck pain are presented in Figure 70 (pain), Figure 71 (disability), Figure 72 (quality of life) and Figure 73 (psychosocial wellbeing).

Figure 70 Forest plot of comparison: Tai Chi vs control (waitlist): Neck pain – pain

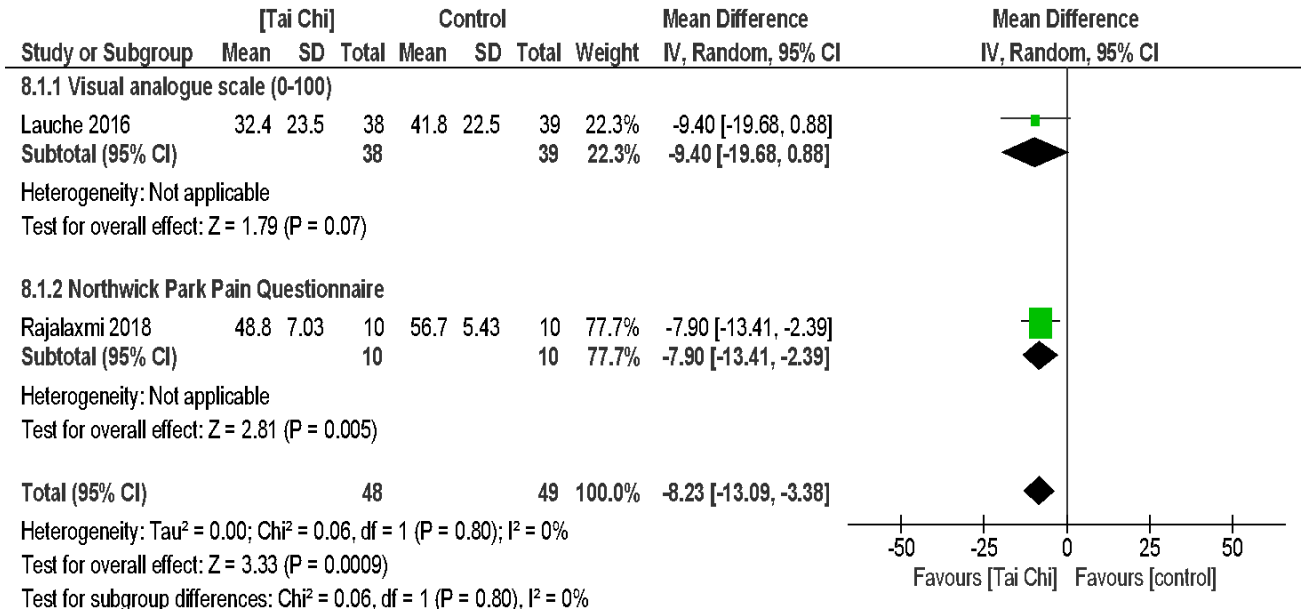


Figure 71 Forest plot of comparison: Tai Chi vs control (waitlist): Neck pain – function/disability

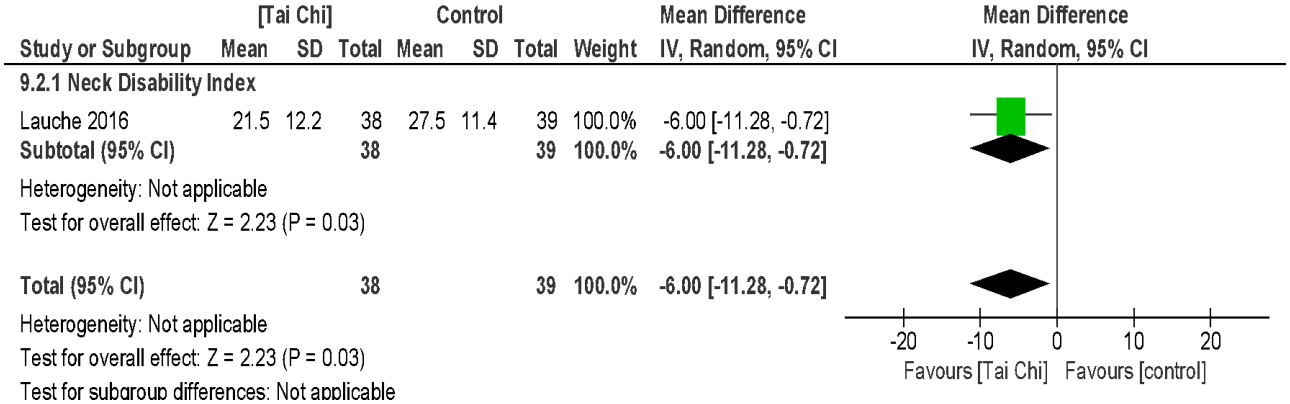


Figure 72 Forest plot of comparison: Tai Chi vs control (waitlist): Neck pain – quality of life

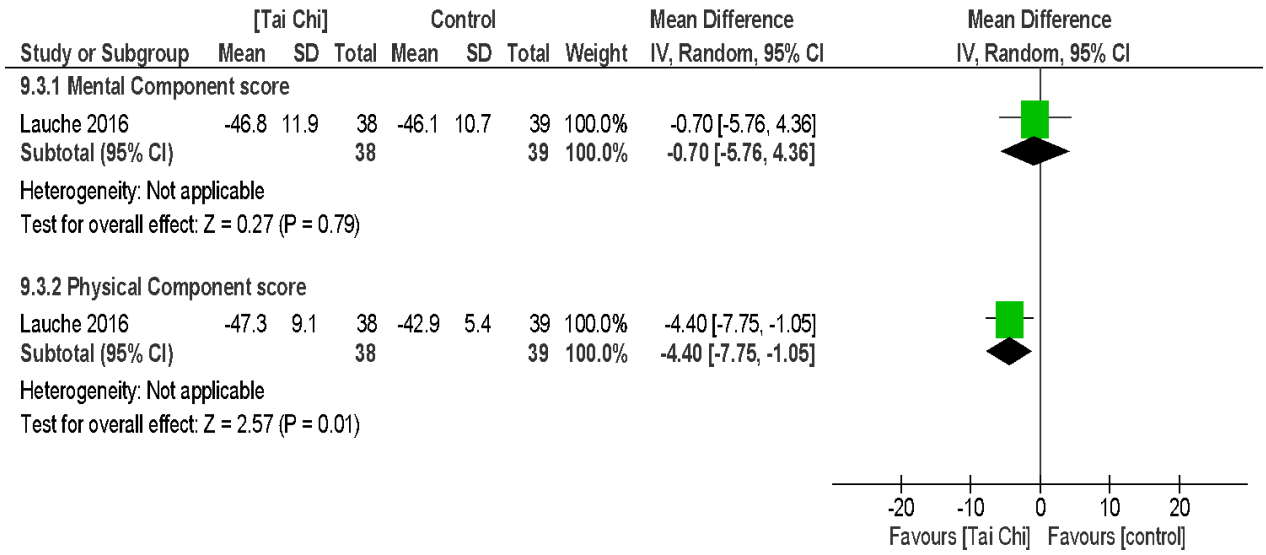
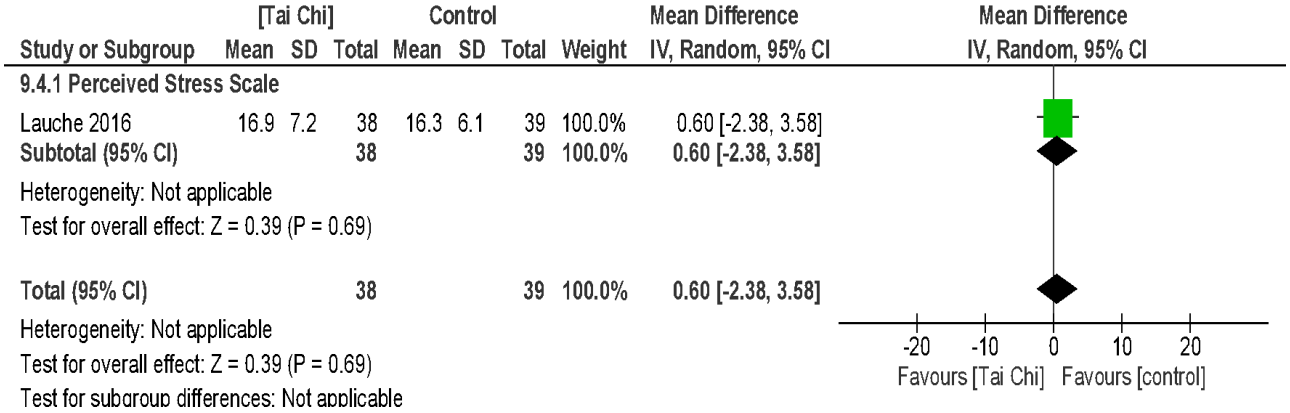


Figure 73 Forest plot of comparison: Tai Chi vs control (waitlist): Neck pain – psychosocial wellbeing



4.19 Fibromyalgia

4.19.1 Description of the condition

Fibromyalgia, as defined by the American College of Rheumatology[11] (415), is characterised as a widespread and prolonged pain persisting for more than three months with pain on at least 11 of 18 specified tender points on the body when palpated. People diagnosed with fibromyalgia not only experience widespread pain but also experience poor sleep quality, fatigue, extreme sensitivity, irritable bowel (diarrhoea, stomach pain) and headaches (416). Fibromyalgia can be difficult to diagnose as there is no single diagnostic test, symptoms may fluctuate from day to day, and it often co-exists with other chronic illnesses such as arthritis, depression or sleep apnoea (414). In a North American survey, approximately half of the participants surveyed had consulted three to six healthcare professionals before receiving their diagnosis (417).

Fibromyalgia is a chronic and disabling condition that can affect all aspects of life, including work, family and leisure (418). In Australia, fibromyalgia is estimated to affect approximately 3-5% of the population, which includes as many as 1 million Australians who experience this chronic pain condition. Although it is reported to affect people of all ages, in Australia, fibromyalgia has a significantly higher prevalence in females (419). For those who are successfully diagnosed, management of symptoms is the mainstay of treatment, with various drug and non-drug treatments playing a supportive role in managing pain, promoting sleep and reducing stress. International and local guidelines (420-422) therefore encourage physical therapy and exercise, including Yoga, Pilates as well as Tai Chi. Regular exercise is important to manage fibromyalgia as it can improve range of motion, flexibility, bone and muscle strength as well as balance (422). Sedentary lifestyles for people diagnosed with fibromyalgia can increase their risk for several chronic diseases and therefore, optimising overall health and quality of life through regular exercise and physical activity is important (423).

4.19.2 Description of studies

There were 25 citations (424-448) corresponding to 5 RCTs (Jones 2011, Wang 2009, Wang 2015b, Wong 2018, You 2018) and one quasi RCT (Bongi 2016) identified in the literature search. There were 2 ongoing studies and no studies awaiting classification. No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D7.3.1.

Four studies were carried out in the United States at either a single centre (Wang 2009, Wang 2015b), across multiple centres (You 2018) or not specified (Jones 2011). The remaining studies did not provide information on the setting of the trial but were conducted in Italy (Bongi 2016) and Korea (Wong 2018). Sample sizes ranged from 37 to 224 participants (total 532), with all studies enrolling adults with chronic widespread pain. One study (Wong 2018) enrolled women only and all other studies included both men and women with an average of 86% female participants. The mean age across all studies was 55.35 years.

[11] the most frequently used criteria by clinicians to diagnose fibromyalgia 414. Guymer E, Littlejohn G. Fibromylagia. *Australian family physician*. 2013;42:690-4.

One study (Wong 2018) compared a Yang style form of Tai Chi with no intervention in females with Fibromyalgia. Three studies (Jones 2011, Bongi 2016, Wang 2009) compared a modified form of Tai Chi with an education program, with twice weekly meetings over the intervention period. You 2018 compared Yang style Tai Chi with light physical activity including walking, resistance and stretching and Wang 2015b compared Tai Chi over 2 different time periods (12 or 24 weeks) as well as an aerobic exercise active control. In all studies the Tai Chi sessions were typically 60 to 90 minutes in duration, but the treatment programmes ranged in intensity from 3 times a week for 12 weeks (Wong 2018) to twice a week for 12 (Jones 2011, Wang 2009, You 2018) or 16 weeks (Bongi 2016) down to once a week for 12 or 24 weeks (Wang 2015b).

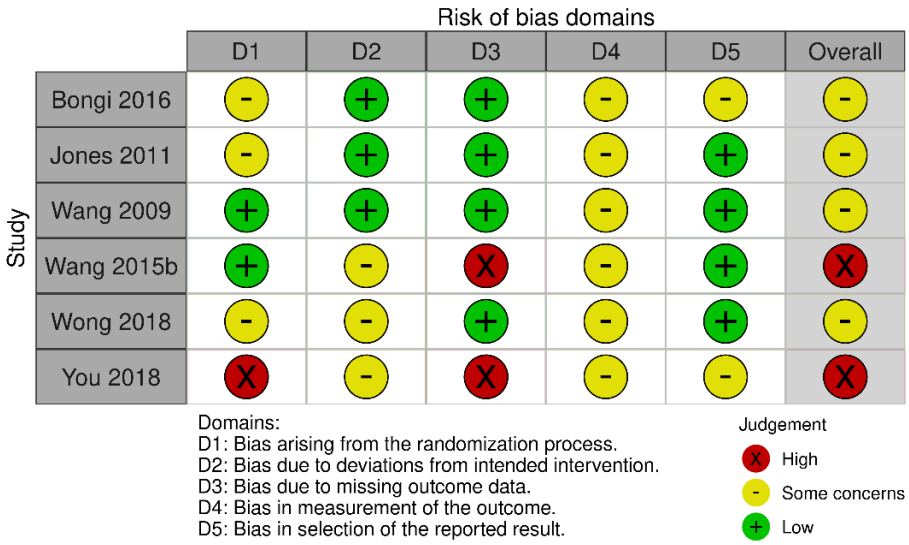
Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.19.4.1 and Appendix F2). The additional RCTs examined Tai Chi versus an active comparator, results of which are presented in Appendix F2.

4.19.3 Risk of Bias – per item

The risk of bias of included RCTs for fibromyalgia is summarised in Figure 74. Details are provided in Appendix D7.3.2.

No studies were judged to be at overall low risk of bias.

Figure 74 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Fibromyalgia



4.19.4 Main comparison (vs control)

One RCT (Wong 2018) was eligible for this comparison and contributed data relevant to one outcome. There were no additional studies awaiting classification or ongoing that compared Tai Chi with no intervention in participants with fibromyalgia that could have contributed data to the outcomes considered critical or important to this review (see Appendix C6).

4.19.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, waitlist or usual care) for Fibromyalgia

Patient or population: Fibromyalgia
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Pain assessed with: VAS (cm) (higher is worse) Scale from: 0 to 10 follow-up: 12 weeks	The mean change from baseline score was **0.3** cm	MD **1.9 lower** (2.55 lower to 1.25 lower)	-	31 (1 RCT)	⊕⊕◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference in pain in people with fibromyalgia. **
Function - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on function in people with fibromyalgia is unknown.
Quality of life - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on quality of life in people with fibromyalgia is unknown.
Fatigue - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on fatigue in people with fibromyalgia is unknown.
Psychosocial wellbeing - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on psychosocial wellbeing in people with fibromyalgia is unknown.
Sleep - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on sleep in people with fibromyalgia is unknown.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

** The MCID for VAS 0-10 (cm) in people with fibromyalgia is 2.0 cm (364).

CI: confidence interval; **MCID:** minimally clinically important difference; **MD:** mean difference; **RCT:** randomised controlled trial; **VAS:** Visual analogue scale

Tai Chi compared to Control (no intervention, waitlist or usual care) for Fibromyalgia

Patient or population: Fibromyalgia
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, waitlist or usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				

GRADE Working Group grades of evidence

High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.

b. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

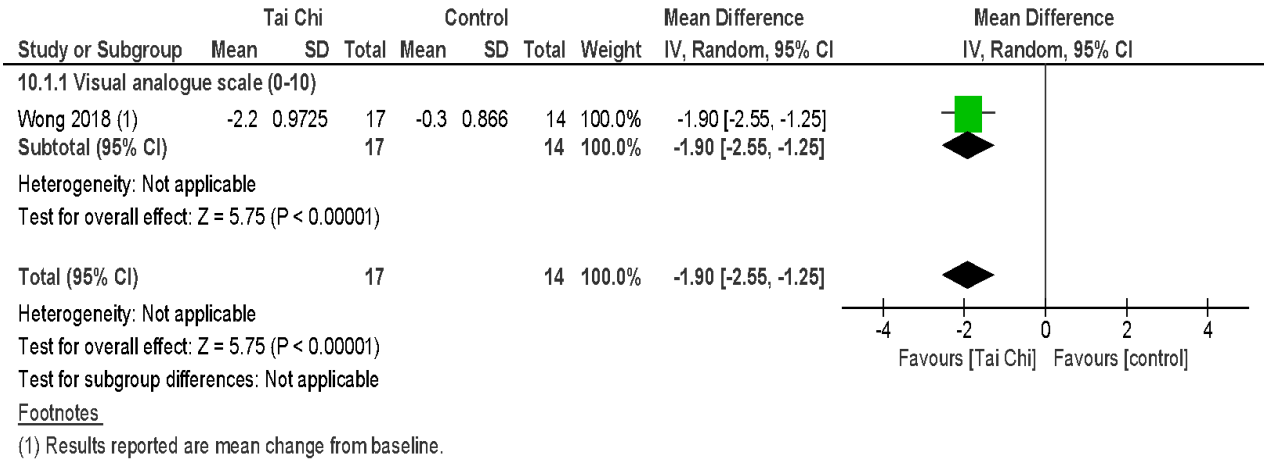
c. Serious imprecision. Small study (less than 35 participants) with wide confidence intervals (upper and lower bounds overlap with no important difference).

d. Publication bias suspected. Evidence is limited to a small number of small trials. Certainty of evidence downgraded.

4.19.4.2 Forest plots

Outcome results related to people with fibromyalgia are presented in Figure 75 (pain).

Figure 75 Forest plot of comparison: Tai Chi vs control (usual activities): Fibromyalgia – pain



4.20 Prevention of falls

4.20.1 Description of the condition

Fall prevention has remained a high priority in the health promotion of older populations with approximately one-third of community-dwelling people over the age of 65 reported to fall each year (449, 450). Falls can have serious consequences, such as fractures and head injuries, and the rate of such fall related injuries only increases with age (451). Around 10% of falls result in a fracture (452), with fall-associated fractures in older people a significant source of morbidity and mortality (453). Even less serious fall-related injuries, such as bruising, lacerations and sprains can still lead to pain, reduced function and substantial healthcare costs (453).

Across Australia, fall-related injury represents one of the single largest causes of hospital presentations with 27 000 hospitalisations and more than 400 deaths occurring from falls in NSW each year (454). For people aged 65 years or older, the average health system cost per fall injury in Australia is estimated by WHO to be US$ 1049 (455). In addition to the substantial financial costs from fall-related injuries, there is also significant psychological impacts associated with a fear of falling and loss of balance confidence that can result in self-restricted activity levels – leading to a reduction in physical activities and social interactions (456).

A review on the risk factors associated with falling noted that 15% of falls result from an external event, a similar proportion from one identifiable source (such as a syncope), and with the remainder resulting from several interacting factors (457). World guidelines for falls prevention and management for older adults (496) consider older adults who do not have a history of falling (and no gait or balance issues) to be at 'low risk' of falling; older adults who have had a single non-severe fall but also have gait and/or balance problems are at 'intermediate risk' , and older adults are at 'high risk' if they have had a fall accompanied by one or more of the following: (i) injury, (ii) 2 or more falls in the previous 12-months, (iii) known frailty, (iv) inability to get up after the fall without help for at least an hour and (v) (suspected) transient loss of consciousness. The current review included only participants at high risk of falls.

Local and international clinical guidelines consistently assert that interventions such as group and home-based exercise programmes, which are generally comprised of balance and strength-based training exercises effectively reduced falls (496)(458)(459)(460). To minimise the many integrated risk factors associated with falls, Tai Chi comprises a multi-faceted approach, placing emphasis on both physical activity as well as breathing and relaxation techniques. The Royal Australian College of General Practitioners (RACGP) recommend Tai Chi as the *"only single exercise intervention that is proven to reduce the risk of falling"* (459) providing a means of reducing the burden of falls and fractures in Australia (460).

4.20.2 Description of studies

For falls prevention, many studies enrolled participants aged 60 years or over, but did not include an individual assessment of participants at enrolment for other risk factors such as history of falls, clinician or self-reported difficulty with a mobility task, balance impairment or dizziness. Although around one-third of people aged over 65 are at-risk of falls, this meant a proportion of participants in these trials were not at an elevated baseline risk. It is noted that to be eligible for this review, participants in the prevention studies had to be assessed by the trialists at study entry to be at-risk of the condition (rather than a broad, population-based risk factor) (see Appendix A4.2). Therefore, to be considered at sufficient risk of falls, studies that included a fall-related outcome or mentioned falls prevention in the title or abstract (but did not meet the eligibility criteria) were further examined to determine if the baseline characteristics of participants met other falls risk criteria or if a subgroup analysis of participants with an elevated baseline risk had been conducted by the trialists.

There were 35 citations (461-495) corresponding to 12 RCTs (Aviles 2019, Day 2012, Hwang 2016, Lee 2015, Li 2018b, Logghe 2009, Quigley 2014, Nnodim 2006, Taylor 2011, Tousignant 2012, Zhang 2006, Zhao 2017), 6 quasi-RCTs (Chewing 2019, Gatts 2007, Hall 2009c, Kim 2009a, Maciaszek 2012, Ni 2014), and 2 cluster-randomised trials (Choi 2005, Wolf 2001) identified in the literature search as meeting the eligibility criteria of being at high risk of falling. There were 5 ongoing studies[12] and 10 studies[13] awaiting classification (5 of which were published in a language other than English). No additional studies were identified in the Department's public call for evidence. An overview of the PICO criteria of included studies is provided in Appendix D8.1.1.

Four studies were carried out in single-centre settings in either South Korea (Choi 2005), the United States (Ni 2014), Canada (Tousignant 2012) or Hong Kong (Zhao 2017). Six studies were carried out in a multicentre setting across the United States (Chewing 2020, Nnodim 2006, Wolf 2001), Australia (Day 2012), Hong Kong (Lee 2015) or New Zealand (Taylor 2011). Two trials were conducted in the community in the United States (Quigley 2014) or Poland (Maciaszek 2012). An additional 4 studies were home-based being in either Taiwan (Hwang 2016), the United States (Li 2018b), the Netherlands (Logghe 2009) or China (Zhang 2006). The remaining 4 studies did not provide information on the trial setting but were conducted in either the United States (Aviles 2019, Gatts 2007, Hall 2009c) or South Korea (Kim 2009a).

Sample sizes ranged from 22 to 702 participants (total 4428), with all studies enrolling adults aged over 60 years except for one study (Quigley 2014) that enrolled adults aged over 18 years. Sixteen of the 20 studies included adults who had either fallen in the preceding year prior to the study or were at high risk of falling (Chewing 2020, Choi 2005, Gatts 2007, Hall 2009c, Hwang 2016, Kim 2009a, Lee 2015, Li 2018b, Logghe 2009, Ni 2014, Nnodim 2006, Taylor 2011, Tousignant 2012, Wolf 2001, Zhang 2006, Zhao 2017), which was either self-reported or defined by a series of risk factors and functional testing scores. One study (Aviles 2019) included participants with a hip bone mineral density t-score greater than –2 and one study (Day 2012) included participants who were preclinically disabled. The remaining 2 studies enrolled participants with distal symmetric polyneuropathy (Quigley 2014) or a history of dizziness (Maciaszek 2012). In most trials, participant samples included both men and women; however, the majority had a higher percentage of females than males. One study (Maciaszek 2012) only enrolled men.

Seven studies compared a modified form of Tai Chi with no intervention (Chewing 2019, Choi 2005, Gatts 2007, Logghe 2009, Maciaszek 2012, Zhang 2006, Zhao 2017). Ten studies compared a modified form of Tai Chi with an exercise intervention: being either balance training (Aviles 2019, Li 2018b, Ni 2014, Nnodim 2006, Quigley 2014), low impact flexibility and stretching programs (Day 2012, Taylor 2011), lower extremity training (Hwang 2016, Lee 2015) or conventional physiotherapy (Tousignant 2012). A further 3 studies (Hall 2009c, Kim 2009a, Wolf 2001) compared Tai Chi to a wellness education program. Four studies also included a third comparator group comprising either a low impact stretching program (Li 2018b), Yoga (Ni 2014), a wellness education program (Quigley 2014) or a balance improvement program (Zhao 2017). One study (Taylor 2011) compared the intensity of the intervention with a third intervention group practising Tai Chi twice as often.

[12] Includes one RCT in people with cerebellar ataxia.

[13] Includes one RCT in people with distal peripheral neuropathy.

In 7 of the studies (Aviles 2019, Chewing 2019, Gatts 2007, Hwang 2016, Logghe 2009, Nnodim 2006, Zhao 2017) participants practised Yang style Tai Chi, in 3 studies (Day 2012, Choi 2005, Taylor 2011) the participants practised Sun style Tai Chi, in one study (Ni 2014) they practised Chen style Tai Chi. Tousignant 2012 examined Baduan-Jin Qijong as the selected intervention. All other studies did not specify the style of Tai Chi carried out in the intervention. In all studies the Tai Chi sessions were typically 30 to 90 minutes in duration, but the treatment programs ranged in intensity from daily for 8 weeks (Zhang 2006) to 5 times a week for 3 weeks (Gatts 2007), 3 times a week for 4 (Aviles 2019), 12 (Choi 2005, Kim 2009a, Lee 2015), and 16 weeks (Zhao 2017), twice a week for 10- (Quigley 2014), 12- (Hall 2009c, Ni 2014), 13- (Logghe 2009), 15- (Tousignant 2012), 18- (Maciaszek 2012), 24- (Day 2012, Li 2018b) and 48 weeks (Wolf 2001) down to once a week for 6 (Chewing 2020), 10- (Nnodim 2006), 20- (Taylor 2011) and 24 weeks (Hwang 2016).

Results for Tai Chi versus inactive control (no intervention, waitlist or usual care, if considered inactive) are provided in the Summary of Findings table (see 4.20.4.1) (and Appendix F2).

Results of the 9 studies (Aviles 2019, Hwang 2016, Li 2018, Ni 2014a, Nnodim 2006, Taylor 2011, Tsousignant 2012, Wolf 2001, Zhao 2017) that examined Tai Chi versus an active comparator are presented in Appendix F2.

In addition, there were 14 trials (12, 497-524) that comprised a mixed group of ineligible (healthy older adults) and eligible participants (considered to be at 'high risk' of falls based on reported baseline characteristics) that were considered for inclusion, but were later excluded because they did not provide separate data for the eligible population (see Appendix C1, table C.2 and Appendix C8). It is noted that studies in which all participants had an underlying primary clinical condition that increases their risk of falls (e.g. stroke, Parkinson's disease, multiple sclerosis, dementia) were considered elsewhere in the review.

4.20.3 Risk of Bias – per item

The risk of bias for each item in the included RCTs for falls prevention is summarised in Figure 76. Details are provided in Appendix D8.1.2.

One study (Taylor 2011) was judged to be at overall low risk of bias.

Figure 76 Risk of bias summary: review authors' judgements about each risk of bias item for each included study: Falls Prevention

4.20.4 Main comparison (vs control)

Seven RCTs (Chewing 2019, Choi 2005, Gatts 2007, Logghe 2009, Maciaszek 2012, Zhang 2006, Zhao 2017) comparing Tai Chi with no intervention in people at high risk of falls contributed data relevant to 4 outcomes. There were 6 additional studies that compared Tai Chi with no intervention in people at high risk of falls (total 240+ participants) that could have contributed data to some of these outcomes, but data were incomplete, not available or not translated (see Appendix C6). Any serious concerns that missing results may bias an estimate is considered in the GRADE assessment of publication bias.

4.20.4.1 Summary of findings and evidence statements

Tai Chi compared to Control (no intervention, usual care) for Falls Prevention

Patient or population: Prevention of falls
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
Falls assessed with: Number with at least one fall episode (higher is worse) follow-up: range 12 weeks to 12 months	460 per 1000	**391 per 1000** (280 to 547)	**RR 0.85** (0.61 to 1.19)	328 (2 RCTs)	⨁⨁◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference in the number of people who experience one or more falls among adults at high risk of falling.**
Falls assessed with: rate of falls (per person-years) (higher is worse) follow-up: range 12 weeks to 12 months	-	-	-	(0 studies)		No studies found. The effect of Tai Chi on rate of falls in adults at high risk of falls is not known.
Balance assessed with: Berg Balance Scale (higher is best) Scale from: 0 to 56 follow-up: 12 months	The mean balance score was **50.2**	MD **0.2 higher** (1.02 lower to 1.42 higher)	-	269 (1 RCT)	⨁⨁⨁◯ MODERATE [D,E]	Tai Chi probably results in little to no difference in balance stability in adults at high risk of falling.***
Fall Injury - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on fall injury in adults at high risk of falls is not known.
Fear of falling assessed with: FES (16 to 64), FAES (7 to 28) or ABC scale (0 to 100) (higher is best) follow-up: range 6 weeks to 12 months	-	SMD **0.27 SD higher ^** (0.06 higher to 0.48 higher)	-	572 (4 RCTs)	⨁⨁⨁◯ MODERATE [A,B,C]	Tai Chi probably results in a slight reduction in fear of falling in adults at high risk of falling.
Functional Mobility assessed with: TUG (higher is worse) follow-up: range 6 weeks to 18 weeks	The mean score ranged from **5.74 to 11.9** seconds	MD **0.65 lower** (1.32 lower to 0.02 higher)	-	278 (3 RCTs)	⨁⨁◯◯ LOW [A,B,C,D]	Tai Chi may result in little to no difference in functional mobility in adults at high risk of falling.****

Tai Chi compared to Control (no intervention, usual care) for Falls Prevention

Patient or population: Prevention of falls
Setting: Community
Intervention: Tai Chi
Comparison: Control (no intervention, usual care)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	Evidence statement
	Risk with Control	Risk with Tai Chi				
HRQoL - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on quality of life in adults at high risk of falls is not known.
Functional Capacity - not reported	-	-	-	(0 studies)	-	No studies found. The effect of Tai Chi on functional capacity in adults at high risk of falls is not known.

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

** A 25% relative reduction was considered important (i.e. RR < 0.75).
*** The MCID for older adults is unknown. Scores were so close to the maximum and it may not be possible to measure a clinically important difference due to a ceiling effect. #
**** The MCID is unknown. A TUG score < 13.5 seconds suggests participants in both groups are not at high risk of falling (525).

In the absence of an MCID, effect estimates were considered based on the following thresholds: small (MD <10% of the scale), moderate (MD between 10% to 20% of the scale), or large (MD more than 20% of the scale.
^ Based on Cohen's guidance for interpreting the magnitude of the SMD, where 0.2 represents a small difference, 0.5 is moderate, and 0.8 is large

ABC: Activities-Specific Balance Confidence; **CI:** confidence interval; **FAES:** Falls Avoidance Efficacy Scale **FES:** Falls Efficacy Scale; **HRQoL:** health related quality of life; **MCID:** minimal clinically important difference; **MD:** mean difference; **SMD:** standardised mean difference; **RCT:** randomised controlled trial; **TUG:** Timed up and go

GRADE Working Group grades of evidence
High certainty: we are very confident that the true effect lies close to that of the estimate of the effect.
Moderate certainty: we are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low certainty: our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect.
Very low certainty: we have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of effect.

Explanations

a. No serious risk of bias. Certainty of evidence not downgraded.
b. No serious inconsistency. Certainty of evidence not downgraded.
c. Serious imprecision. Wide confidence intervals (upper and lower bounds overlap with an important and no important difference). Certainty of evidence downgraded.
d. Publication bias suspected. The evidence is limited to a small number of small trials. There is a strong suspicion of non-reporting of results relating to *p* value or direction of effect (see Appendix C6). Certainty of evidence downgraded.
e. Single study. Inconsistency not assessed. Certainty of evidence not downgraded.

4.20.4.2 Forest plots

Outcome results related to people at high risk of falling are presented in Figure 77 (number who experienced at least one fall), Figure 78 (balance stability), Figure 79 (fear of falling) and Figure 80 (mobility).

Figure 77 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Falls prevention – number who experienced one or more fall

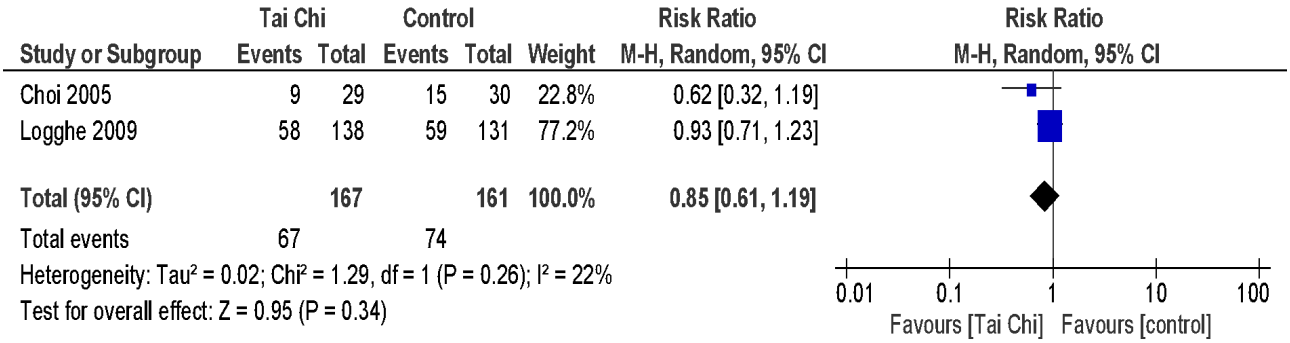


Figure 78 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Falls prevention – balance stability

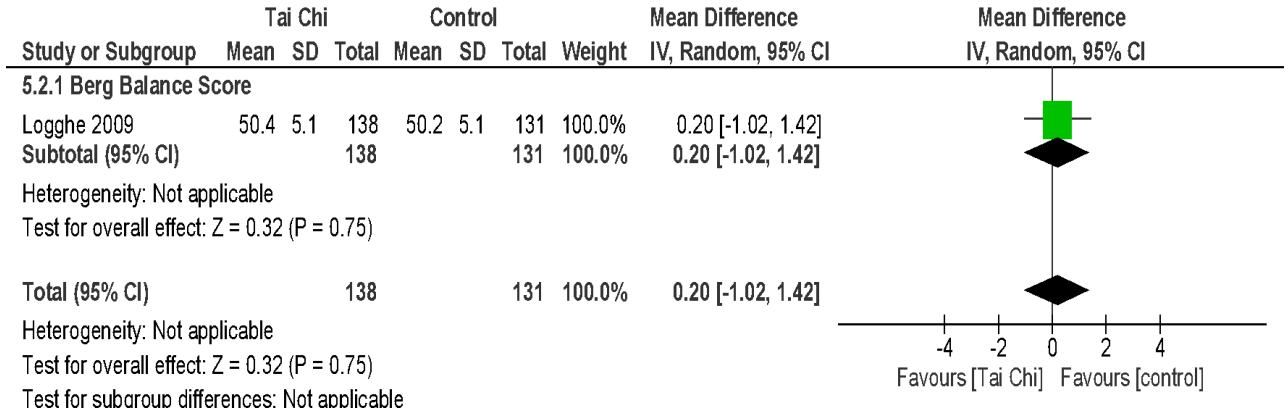


Figure 79 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Falls prevention – fear of falling

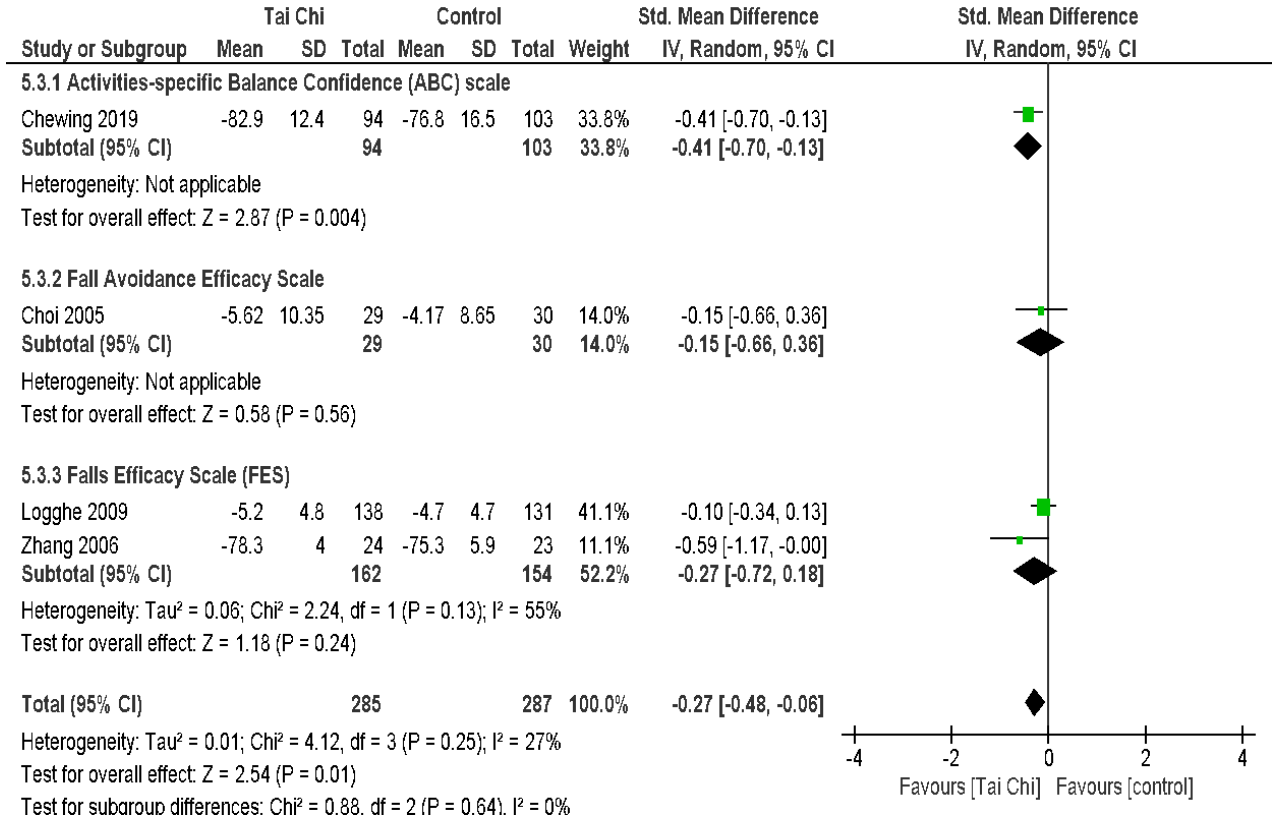
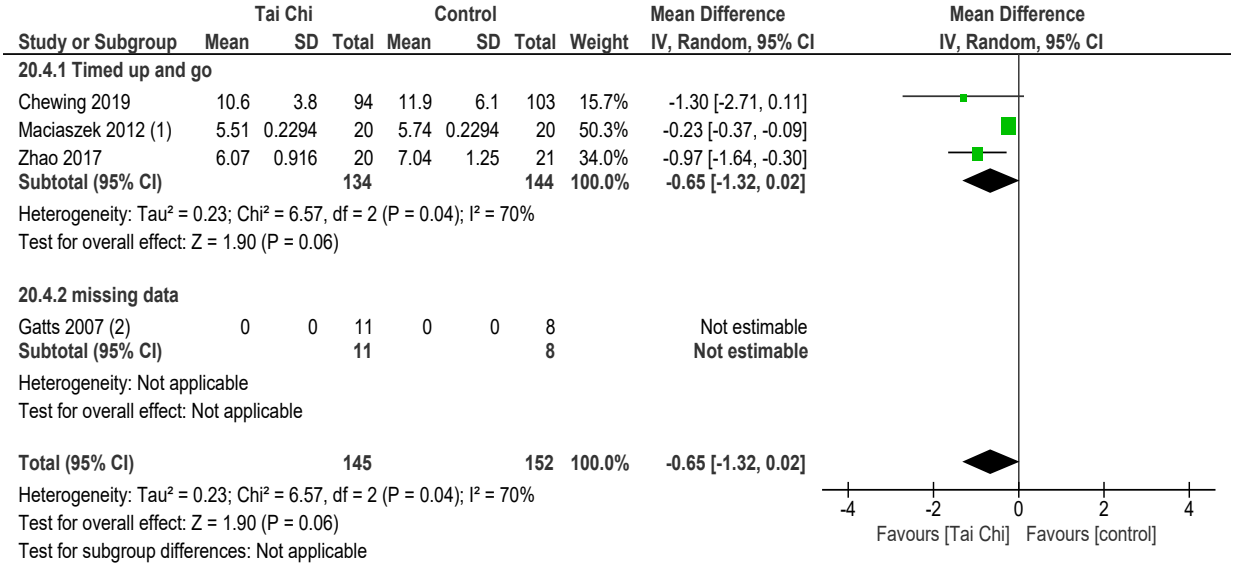


Figure 80 Forest plot of comparison: Tai Chi vs control (no intervention, waitlist, usual activities): Falls prevention – mobility



Footnotes

(1) Authors only report post-test mean scores. SD calculated as per Handbook

(2) Authors only measured and reported before treatment results.

5 Discussion

5.1 Summary of main results

We conducted a systematic review of RCTs to evaluate the effectiveness of Tai Chi for 19 clinical or preclinical conditions prioritised (by NTWC) as most relevant to the practice of Tai Chi in Australia. We identified 129 studies that were eligible for inclusion. Of these studies, 65 studies compared Tai Chi exercises with the main comparator of interest, 'inactive control.' Out of the 19 conditions prioritised by NTWC, there were 56 studies that reported either critical or important outcomes which were included in the final analysis and are presented in the summary of findings tables.

Results for studies of prioritised conditions with active comparators are presented in Appendix F2 and the studies are briefly described in Appendix D. These are not included in the synthesis or summary of findings tables, as the wide range of comparators and outcomes did not allow for synthesis as planned in the protocol.

Our confidence in the result from the body of evidence for each outcome was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) framework. GRADE combines information to assess overall how certain systematic review authors can be that the estimates of the effect (reported across a study/s for each critical or important outcome) are close to the true effect.

Certainty of evidence is interpreted as follows:

Certainty	Definition
High certainty	The authors have a lot of confidence that the true effect is similar to the estimated effect.
Moderate certainty	The true effect is probably close to the estimated effect.
Low certainty	The true effect may be very different from the estimated effect.
Very low certainty	The true effect is probably markedly different from the estimated effect. Reviewers' confidence was so limited that interpretation was not provided.

For 17 prioritised conditions, there was moderate or low certainty evidence about the effect of Tai Chi on at least one of the outcomes considered critical or important for decision-making by the NTWC.

The review found:

- Moderate certainty evidence that Tai Chi probably results in:
    - a moderate reduction (10-20%) in pain (6 studies, 524 participants) and a moderate reduction (10-20%) in stiffness (5 studies, 427 participants) in people with osteoarthritis
    - a slight reduction in fear of falling in adults at high risk of falling (4 studies, 572 participants)
    - a slight improvement in psychosocial wellbeing in adults with neurocognitive disorders (1 study, 74 participants)
- Low certainty evidence that Tai Chi may result in:
    - a large increase (>20%) in activities of daily living and a large increase (>20%) in psychosocial wellbeing in people recovering from acute cardiac events (1 study, 61 participants)
    - a large decrease (>20%) in pain in people recovering from acute cardiac events (1 study, 61 participants)

  - a large improvement (>20%) in functional mobility and a large improvement in HRQoL in people with heart failure (1 study, 30 participants)
  - a moderate reduction (10-20%) in fatigue in cancer survivors (1 study, 30 participants)
  - a moderate improvement (10-20%) in state and trait anxiety (1 study, 33 participants) and a moderate improvement (10-20%) in some aspects of HRQoL (1 study, 33 participants) in people with symptoms of anxiety
  - a moderate improvement (10-20%) in some aspects of HRQoL (2 studies, 65 participants) and cardiovascular health (SBP) (1 study, 32 participants) in people living with an anxiety disorder
  - a moderate improvement (10-20%) in physical function in people with osteoarthritis (4 studies, 197 participants)
  - a slight improvement (<10%) in cardiorespiratory health in people recovering from acute cardiac events (1 study, 50 participants)
  - a slight improvement (<10%) in motor function in people rehabilitating after stroke (1 study, 28 participants)
  - a slight reduction (<10%) in the number of falls in people rehabilitating after stroke (1 study, 58 participants)
  - slight improvement (<10%) in health-related quality of life in people with hypertensive heart disease (1 study, 113 participants)
  - a slight reduction (<10%) in disability/function (1 study, 77 participants) and a slight improvement (<10%) in quality of life (physical) in people with neck pain (1 study, 160 participants)
  - a slight reduction (<10%) in the number of falls (1 study, 76 participants) and a slight improvement (<10%) in motor aspects of experience of daily living (1 study, 20 participants) in people living with Parkinson's Disease
  - a slight reduction (<10%) in fatigue in people undergoing treatment for cancer (2 studies, 164 participants)
  - a slight improvement (<10%) in symptoms of anxiety in people living with an anxiety disorder (1 study, 32 participants)
  - a slight improvement (<10%) in perceived stress in people with symptoms of anxiety (1 study, 33 participants)

- Moderate evidence certainty that Tai Chi probably results in little (to no) change in:
  - activities of daily living for people rehabilitating after stroke (2 studies, 123 participants)
  - balance stability in adults at high risk of falling (1 study, 269 participants)
  - pain for people with low back pain (4 studies, 404 participants)

- Low certainty evidence that Tai Chi may result in little (to no) change in:
  - respiratory health (1 study, 50 participants) or the level of dyspnoea-related disability (1 study, 60 participants) for people living with COPD
  - mobility (3 studies, 278 participants) or the number of people who experience one or more falls (2 studies, 328 participants) in adults at high risk of falling
  - perceived stress in people with hypertensive heart disease (1 study, 64 participants)
  - knee-related quality of life in people with osteoarthritis (1 study, 32 participants)
  - disability for people with low back pain (1 study, 160 participants)
  - pain (2 studies, 96 participants) and psychosocial wellbeing (1 study, 77 participants) in people with neck pain
  - pain in people with fibromyalgia (1 study, 31 participants)
  - balance stability (2 studies, 109 participants) and motor function (5 studies, 178 participants) in people living with Parkinson's Disease
  - sleep quality (1 study, 50 participants) and general health (HRV) for people undergoing treatment for cancer (1 study, 114 participants)
  - disease symptoms (improvement or severity) for people with depression (1 study, 38 participants)

- cardiovascular health (DBP) for people living with an anxiety disorder (1 study, 32 participants)
- balance stability for people with living with multiple sclerosis (1 study, 34 participants)
- neurocognitive function (2 studies, 145 participants) activities of daily living (1 study, 72 participants) or balance stability (1 study, 68 participants) in adults with neurocognitive disorders
- cardiorespiratory health for adults with coronary heart disease (1 study, 20 participants)

The evidence provides very low certainty of the effect of Tai Chi versus inactive control (no intervention, wait list or usual care) for 11 out of the 134 critical or important outcomes prioritised for analysis in this review. For these outcomes, the true effect is probably markedly different from the estimated effect, with more studies needed to determine the true effect.

Of the 134 outcomes prioritised as critical or important in this review 73 were not addressed by any studies, and therefore the effect of Tai Chi on these 73 outcomes is unknown.

A complete summary of harms of Tai Chi is not possible, as it was out of scope of this review to assess adverse events related to the practice of Tai Chi.

Overall, the evidence suggests that people who practise Tai Chi may be afforded with moderate or small benefit, for a small number of outcomes (between one and 3 for a given condition) when compared with inactive control (no intervention, wait list or usual care if considered inactive). In some cases, the true size of the effect is uncertain. Many of the effect estimates were based on one or 2 small studies of short duration (typically 30 to 100 total participants) which can impact the precision of the results by either under- or overestimating the effect.

5.2 Overall completeness and applicability of evidence

The evidence from studies included in the review was from a range of countries including Australia, Canada, China, Germany, India, Iran, Israel, Korea, Taiwan, United Kingdom and the United States. Across the included studies, Tai Chi sessions were generally conducted in small groups at tertiary institutions, medical, community or senior citizen centres. All studies examined Tai Chi exercises delivered in a manner that would be considered generally applicable to the Australian context. Participant ages generally ranged between 18 to 75 years, many studies focused on conditions in older adults (50 years or older). Most studies evaluated group Tai Chi classes that were 45 to 60 minutes in duration, most commonly in the Yang style (generally simplified or abbreviated versions). Session frequency varied over the course of treatment, ranging between one and 4 sessions per week. The treatment provider was often not specified, but when reported, tended to be experienced masters trained in Tai Chi. The study duration typically lasted between 10 and 16 weeks, with a small number of studies examining Tai Chi exercises delivered for either 8 or 24 weeks. Studies that provided longer-term data (Tai Chi practised for more than 6-months) typically continued Tai Chi as 'home-practice'. Outcomes were typically measured at the beginning and at the end of the intervention period and participants were rarely followed beyond this to determine the effect of stopping Tai Chi.

The included studies assessing the 19 prioritised conditions provided a clear description of the condition, outcomes and interventions examined in the study. However, among the studies comparing Tai Chi with inactive control (no intervention, wait list or usual care), 74 (~55%) out of the 134 prioritised outcomes were not measured or reported. This includes 2 priority conditions (rheumatoid arthritis, headache disorders) that did not have any available evidence for the 12 critical or important outcomes prioritised by NTWC.

We identified several studies with missing outcome information, meaning the studies had indicated in a trial registry or published protocol that they measured the outcome, but the results had not been reported. In rare cases, results presented in figures or graphs were not extracted. However, as per the protocol, we did not attempt to extract information contained in graphs and we made no requests to authors for this information. It is considered unlikely this information would have substantially impacted the overall conclusions of this review.

Studies included in this review are those published up until 6-7 August 2020. Among the priority populations, an estimated 89 studies (5938+ participants) comparing Tai Chi with an inactive control are awaiting classification (~60% of which were in a language other than English) and a further 56 studies [6967 target participants] were listed as ongoing. Given the large amount of evidence for Tai Chi that remained unpublished or was not yet evaluated at the time of the search it is unknown whether these studies would meet the eligibility criteria for this review and therefore impact the overall results.

5.3 Certainty of the evidence

The certainty of evidence across outcomes was generally downgraded for issues with imprecision (related confidence intervals that were compatible with both important benefit and little or no difference) and suspected publication bias (relating to the likelihood that studies with negative outcome results were not published at the time of the search). In some cases, the certainty of evidence was downgraded for inconsistency, when the effect estimates differed importantly across studies (as indicated by minimal or no overlap in the confidence intervals). Other times, the certainty of evidence was downgraded due to serious concerns of bias relating to missing outcome data or deviations from the intended intervention. We did not downgrade for concerns relating to the inability of studies to blind participants, and outcome assessors being aware of the intervention received. Given the nature of the intervention, this was considered reasonable and generally did not raise serious concerns of bias when assessing the certainty of the evidence. We also did not downgrade for indirectness, although in some cases noted that the study may not be directly applicable to the Australian healthcare context, meaning the delivery of the intervention or the participants included within the trial may have unknown factors that do not directly match Tai Chi as delivered in Australia or a broader population group.

5.4 Potential biases in the review process

To ensure transparency in the review process we published the final NTWC endorsed research protocol on PROSPERO. Where possible, we have applied a methodological approach consistent with the *Cochrane Handbook for Systematic Reviews of Interventions* and other best practice methods.

To capture the majority of studies assessing the effectiveness of Tai Chi, we did not apply date, language or population restrictions in our search. In addition, we comprehensively searched multiple databases and did not limit by study design (RCTs, quasi RCTs, and cluster RCTs were included). We included detailed documentation of the inclusion criteria to avoid inconsistent application of study selection decisions and used standardised procedures for data collection and critical appraisal. Data collection was performed by 2 researchers, the first collected data using data extraction forms and the second checked for completeness and accuracy in data extraction. To minimise bias (and to ensure consistency), judgements that required the evidence reviewers to categorise comparators as ‘active’ or ‘inactive’ were discussed and checked among the reviewers prior to any data synthesis.

We did not include studies published in languages other than English in the analysis, so it is possible that we may have missed studies that may (or may not) impact the overall conclusions of this review. Databases in languages other than English were not searched. There were 103 publications identified through the English language databases but published in a language other than English that were not translated. These studies were listed in an inventory for completeness (Appendix C4.2).

While we have attempted to control for potential biases, some deviations from the protocol were necessary for pragmatic reasons. To ensure these deviations from the protocol are clear, deviations and post-hoc decisions have been documented and explained in **Appendix G**.

There was a potential for bias associated with focusing the review to areas important for decision-making. To minimise bias, decisions regarding prioritisation of conditions and critical or important outcomes were made by the NTWC, with input from NTREAP, who were blinded to the number and details of the studies found. There were 36 studies that met the eligibility criteria for the review (i.e. examined the effect of Tai Chi in humans) but examined the effects of Tai Chi for conditions not prioritised for analysis or synthesis by NTWC. Non-priority conditions did not make the priority list because they are less commonly seen by Tai Chi practitioners and therefore ranked lower in surveys relating to participation rates and use. It is possible that has introduced a bias against rare diseases or conditions. Another 26 studies were in conditions rated by the NTWC as being of lower priority than those included in the evidence synthesis (ranked between 14 to 23), and due to time and resource constraints were not considered for data extraction, critical appraisal or data synthesis. Again, this may have introduced bias against rarer diseases or conditions.

Another area with a potential for bias is related to decisions made about study eligibly in at-risk populations. While the protocol had clearly stated that studies in healthy participants were not eligible for inclusion, there were often queries about what constitutes 'healthy' and what is considered a risk factor for various conditions. In the absence of a long pre-specified list of risk factors covering all eligible conditions, the evidence reviewers relied on the information provided by trialists in published reports (or trial registries) about the study eligibility criteria. This meant that studies enrolling broad communities based on sex or age were not included unless additional risk factors were clearly described (e.g. a study in healthy college students was not be eligible unless the participants met another prespecified enrolment criteria that indicated they were at-risk of a condition such as sleep problems or anxiety). With these strict criteria for defining at-risk populations, it is probable that studies examining the use of Tai Chi for prevention among the general population are missing from the inventory of eligible studies. Studies that were screened at full text but excluded because they were deemed to be in healthy participants are listed in Appendix C1 (Table C.1) with the exclusion reasons being population out of scope. Along these lines, there were 13 studies that enrolled both eligible (i.e. clearly were at-risk of falls) and ineligible participants (aged older than 60, but otherwise healthy). These studies could not be included because they did not report separate data for the eligible population and are listed in an inventory titled *Characteristics of studies with mixed populations* (Appendix C1, Table C.2).

5.5 Agreements and disagreements with other studies or reviews

The results of this review are generally consistent with systematic reviews of Tai Chi published up until June 2022 that assess comparable priority populations, the findings of which suggest Tai Chi provides a clinically important benefit (526), but that there is an absence of high certainty evidence that practising Tai Chi is more effective than not practising Tai Chi.

There are 3 published Cochrane systematic reviews (CSR) specific to Tai Chi that are focused on people living with rheumatoid arthritis (527), COPD (528) or for preventing cardiovascular disease (CVD) (529). One other Cochrane review that assessed exercise interventions for prevention of falls was also considered (530).

The review exploring Tai Chi for rheumatoid arthritis (updated September 2019) included 7 studies (345 participants) and found there is very low certainty evidence for the effectiveness of Tai Chi in improving pain, disease activity and function in the short term (8 to 12 weeks) when compared with minimal intervention. For all reported outcomes, it is uncertain whether Tai Chi provides a clinically important improvement among Tai Chi participants compared to no therapy or alternate therapy (527). These results cannot be compared to that reported in our review as there were no studies found for the main comparison (vs inactive control). This is because there were several studies included in the Cochrane review that were not eligible for inclusion in this review, either because the intervention was out of scope (Tai Chi was delivered in combination with another intervention like massage and the effect of Tai Chi alone could not be determined) or the study design was out of scope (nonrandomised).

The CSR that assessed Tai Chi for people living with COPD (528) (updated June 2016) included evidence from 12 studies (984 participants) and found very low certainty of evidence that suggested Tai Chi increased functional capacity when measured with the 6-min walk test (6 RCTs, 618 participants), whereas results for functional capacity in this review were uncertain (1 RCT, 38 participants). This is likely because a different outcome measure was used (physical performance test battery) that includes several additional performance measures (including the 6-min walk test). The CSR (528) also found moderate certainty evidence of better pulmonary function (4 RCTs, 258 participants) when measured by FEV_1 whereas results in this review suggested there was little or no difference in pulmonary function (1 RCT, 50 participants). Again, the results for this outcome are different likely because this review used the FEV_1/FVC ratio, noting the CSR includes this as a secondary outcome (no GRADE assessment). The Cochrane review also suggests that the effects of Tai Chi in reducing dyspnoea level measured using the modified MRC scale (2 RCT, 96 participants) or improving quality of life (3 RCTs, 233 participants) remain inconclusive, which is in agreeance with our review. It is noted that the Cochrane review includes data from several studies published in a language other than English that were not included in this review, whereas this review includes a more recent study (Wang 2019).

The CSR of Tai Chi for the primary prevention of CVD (529) (updated June 2014) included studies in healthy participants as well as studies of adults at risk of CVD, which is broader in scope than this review. A more recent systematic review (search date August 2020) that focused on Traditional Chinese Exercise (TCE) for people with hypertension (531) found 10 studies that assessed Tai Chi and 3 studies that assessed Qi Gong. The review included several studies published in Chinese and concluded that TCE is likely effective in improving quality of life (both physical and mental health components) in people with essential hypertension (8 RCTs, 951 participants), but more rigorously designed RCTs are needed. This is in agreeance with our findings of low certainty evidence that Tai Chi slightly improves HRQoL in people with hypertensive heart disease. A similar systematic review (search date January 2020) (532) reported evidence from 4 studies in Tai Chi and 4 studies examining Qigong (all published in Chinese) that suggested TCE was more effective than control interventions in reducing SBP and DBP (1 study, 50 participants). This review found very low certainty evidence from 2 studies (published in English) about the effect of Tai Chi on cardiovascular health.

The CSR of exercise interventions for preventing falls in older people living in the community (530) (updated May 2018) was broader in scope than this review but provided a separate analysis of 3-dimentional exercise (Tai Chi and Qi Gong) versus control (noting Qi Gong was also not eligible for this review). The CSR found high certainty evidence that Tai chi reduces the number of people who experience one or more falls (8 RCTs, 2677 participants), whereas our review reports low certainty evidence that Tai Chi provides little to no difference for the same outcome (2 RCTs, 328 participants). The CSR also found low certainty evidence that Tai Chi reduces the rate of falls per person year (7 RCTs, 2655 participants), whereas our review had no evidence reported for this outcome. Given that the CSR included studies in people aged 60 years or older, whereas our review is specifically focused on adults at high risk of falling, it is not unexpected that the findings of the CSR are not in agreeance with this review. Given the strict prespecified criteria for defining at-risk populations in this review, assessing the effect of Tai Chi for primary prevention in people at low risk of falling would be outside the scope of this review.

Numerous other systematic reviews have been published that focus on Tai Chi and cover conditions included in this review, including chronic heart failure (533, 534), stroke (535, 536), functional mobility and quality of life in frail older adults (537), major depression (538), Parkinson's disease (539), osteoarthritis (540), multiple sclerosis (541), low back pain (542), neck pain (543) and fibromyalgia (544). Many of the reviews include additional studies to that included in this review, often because they include studies published in a language other than English, include evidence from NRSIs, or have a broader definition of the intervention (e.g. include Qi Gong or Tai Chi combined with another intervention). Like this review, these systematic reviews suggest that Tai Chi may be an effective exercise intervention to achieve a desired outcome, such as improving exercise capacity and quality of life in people with chronic heart failure (533, 534), or reduce pain and stiffness in people with osteoarthritis (540). Similarly, some systematic reviews report that the evidence for Tai Chi is insufficient to draw conclusions (535, 537-539). As concluded in this review, the systematic reviews authors state that there is an absence of high certainty evidence, with the limited number of studies, small sample size and heterogeneous outcomes making is difficult to definitively conclude the effectiveness of Tai Chi as an exercise intervention.

5.6 Limitations

5.6.1 At the study and outcome level

The main limitation at the study and outcome level relates to the certainty of the evidence, with the low number of trials combined with small sample sizes per comparison, which reduce the statistical precision of the effect estimate and prevented any subgroup analyses. An additional limitation is that it was not possible to statistically assess publication bias using funnel plots as there were fewer than 10 studies included across most outcomes.

5.6.2 At review level

This review was limited to assessment of the evidence for certain conditions and groups of people to inform the Australian Government about health policy decisions for private health insurance rebates. This review was not designed to assess all the reasons that people practise Tai Chi, or the reasons practitioners prescribe Tai Chi and was not intended to inform individual choices about practising Tai Chi. Given the breadth and diversity of conditions identified for inclusion in this review (and time and resource constraints) it is possible that some conditions, outcome domains and outcome measures have been misclassified or missed during the population and outcome prioritisation process. Importantly, we did not evaluate the effect of Tai Chi in healthy populations, and our strict eligibility criteria for defining at-risk populations limited the ability to assess the benefits of Tai Chi for health promotion.

The main comparison of interest was Tai Chi compared to inactive control (no intervention, wait list or usual care, if inactive). Studies of prioritised conditions with active comparators were not able to be included in the synthesis or summary of findings tables, as the wide range of comparators and outcomes did not allow for synthesis as planned in the protocol. Results of these studies are listed in Appendix F2. It is unknown whether the results of these studies would impact the overall conclusions of this review.

The outcomes assessed were limited to measures considered critical or important by NTWC for each priority condition. This meant that evidence on the effects of Tai Chi for most conditions was limited to between one and 4 outcomes, with 2 conditions having no evidence for critical or important outcomes. Many studies reported outcomes or used different measures that were not listed as critical or important and it is possible that assumptions made about outcome measures not listed in core outcome sets, but which measure critical outcome domains have been missed.

Many of the intervention effects were estimated from a few small studies, with the number of participants ranging from 30 to 300. Given the limited number of studies spread across a diverse range of prioritised conditions, it is challenging to conclude the effectiveness of Tai Chi for the conditions prioritised. An additional limitation of this review is that a number of studies were ongoing, unpublished, or not translated at the time of the search; noting there are 53 studies in priority conditions that compared Tai Chi with control and were published in a language other than English that could have contributed data. This missingness of this data was considered unlikely to substantially change the overall conclusions of the review.

It was out of scope of the review to assess safety, however a previous review (545) reported that evidence regarding safety is generally lacking.

A final limitation is that the literature search was last conducted in August 2020, it is possible that given the identification of a number of studies awaiting classification and ongoing studies, there may be additional evidence that may (or may not) impact the overall conclusions of this review.

6 Authors' conclusions

6.1 Implications for health policy

This report was commissioned by the Australian Government as part of the Natural Therapies Review, with findings intended to inform decisions relating to whether private health insurance cover should be reinstated to Tai Chi. As such, specific recommendations are not provided.

There is an absence of high certainty evidence examining the effectiveness of Tai Chi compared with no intervention, wait list or inactive control for the 19 priority conditions or outcomes that align with the reasons why consumers commonly practise Tai Chi in Australia.

There are 3 conditions for which the evidence provides moderate certainty of benefit for one (adults with neurocognitive disorders and adults at high risk of falling) or 2 (people with osteoarthritis) outcomes and 16 conditions for which the evidence provides low certainty that Tai Chi provides a benefit for up to 2 relevant outcomes (including cancer fatigue, anxiety disorders, rehabilitation after stroke or an acute cardiac event, Parkinson's disease, hypertensive heart disease, heart failure, osteoarthritis and neck pain). There are also 3 conditions where the evidence provides moderate certainty (stroke rehabilitation, low back pain and adults at high risk of falling) and fourteen conditions where is the evidence provides low certainty that Tai Chi provides little to no benefit for a small number of outcomes (3 or less).

The effect of Tai Chi remains uncertain for up to 6 outcomes in most populations including:

- cancer survivors
- people with depression
- adults recovering stroke acute cerebrovascular stroke
- people with multiple sclerosis
- people with hypertensive heart disease
- people with coronary heart disease
- people with fibromyalgia (chronic pain)

The effect of Tai Chi in people with headache disorders or people with rheumatoid arthritis is unknown.

6.2 Implications for research

There is a need for more robust trials evaluating the effectiveness of Tai Chi compared with no intervention or inactive control. The available evidence could be enhanced by larger studies (more participants enrolled), improved registering and reporting of the methods used, analysis of results from all randomised participants (or better transparency of missing data), as well as measuring and reporting outcomes that are considered critical or important for decision-making. Many of the studies focused on the effect of Tai Chi in participants who received treatment for a short time period (12 weeks or less), so it is possible the benefits of Tai Chi may be more apparent in people who continue the practice for more than 12 weeks. Information regarding the sustainability of the effect is also unknown, with few studies providing any follow-up data.

There were 86 studies (10,841 total target participants) identified in our search that were listed as ongoing, with 36 studies (4847 target participants) having an inactive control or placebo listed as a comparator group; 25 studies were in a priority population (total 3031 target participants). Evidence reported in these studies are expected to contribute to future updates where studies are completed, and results published.

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