# Health benefits of tai chi

## *What is the evidence?*

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## Abstract

***Objective*** To summarize the evidence on the health benefits of tai chi.

***Sources of information*** A literature review was conducted on the benefits of tai chi for 25 specific conditions, as well as for general health and fitness, to update a 2014 review of systematic reviews. Systematic reviews and recent clinical trials were assessed and organized into 5 different groups: evidence of benefit as excellent, good, fair, or preliminary, or evidence of no direct benefit.

***Main message*** During the past 45 years more than 500 trials and 120 systematic reviews have been published on the health benefits of tai chi. Systematic reviews of tai chi for specific conditions indicate excellent evidence of benefit for preventing falls, osteoarthritis, Parkinson disease, rehabilitation for chronic obstructive pulmonary disease, and improving cognitive capacity in older adults. There is good evidence of benefit for depression, cardiac and stroke rehabilitation, and dementia. There is fair evidence of benefit for improving quality of life for cancer patients, fibromyalgia, hypertension, and osteoporosis. Current evidence indicates no direct benefit for diabetes, rheumatoid arthritis, or chronic heart failure. Systematic reviews of general health and fitness benefits show excellent evidence of benefit for improving balance and aerobic capacity in those with poor fitness. There is good evidence for increased strength in the lower limbs. There is fair evidence for increased well-being and improved sleep. There were no studies that found tai chi worsened a condition. A recent systematic review on the safety of tai chi found adverse events were typically minor and primarily musculoskeletal; no intervention-related serious adverse events have been reported.

***Conclusion*** There is abundant evidence on the health and fitness effects of tai chi. Based on this, physicians can now offer evidence-based recommendations to their patients, noting that tai chi is still an area of active research, and patients should continue to receive medical follow-up for any clinical conditions.


### EDITOR'S KEY POINTS

- Tai chi is a meditative martial art that consists of a series of gentle movements designed to strengthen and relax the body and mind. Increasingly, its therapeutic effects have come under study. This review aims to summarize the evidence on the therapeutic and fitness benefits of tai chi so that clinicians can offer evidence-based recommendations to their patients.

- More than 500 studies and 120 systematic reviews have been published. The strongest evidence of benefit is for preventing falls in older adults living in the community, osteoarthritis, Parkinson disease, chronic obstructive pulmonary disease rehabilitation, improving cognitive capacity, and improving balance and aerobic capacity.

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Tai chi is a meditative martial art that has been practised in China for centuries and that has become increasingly popular in the West.[1] It consists of a series of gentle movements that strengthen and relax the body and mind.[2] There are different schools of tai chi, yet all share key features such as mindfulness, structural alignment, and flexibility (**Table 1**).[3] New forms of tai chi continue to evolve, including shortened protocols for the elderly. Some forms, such as Taoist tai chi, have a specific health recovery focus.[4]

With tai chi becoming increasingly popular, patients might ask physicians whether it could be beneficial for them. The objective of this review was to summarize the evidence on the therapeutic benefits of tai chi so that clinicians can offer evidence-based recommendations to their patients.

## Case description

B.G., a 48-year-old woman, comes into your office for follow-up of borderline hypertension and a slightly elevated fasting blood glucose level. She has worked all her adult life and recently

the last of her 3 grown children has left home. When you ask how things are going, she says she is OK but feels burned out. She has neglected herself, gets no regular exercise, has gained some weight, and feels depressed about her "empty nest syndrome." She asks about tai chi, noting that her mother swears by it. Her mother says she sleeps better, that her osteoarthritis has improved, and that she is now more socially active than ever. On examination, B.G.'s blood pressure is 140/85 mm Hg, her body mass index is 29 kg/m$^2$, and screening reveals a positive score for depression. What should you do? What are your recommendations regarding tai chi?

**Table 1. Key features of tai chi**

| FEATURE | DESCRIPTION |
|---|---|
| Mindfulness | Awareness of the current moment is cultivated during tai chi by focusing on the body's position, movements, and sensations |
| Imagery | Images are used as a learning strategy (eg, one of the moves is called *wave hands like clouds*) |
| Structural alignment | Movements are biomechanically efficient, calling for the least amount of effort |
| Flexibility and relaxation | Circular and flowing motions provide dynamic stretching and help to shift the body and mind into a state of deeper relaxation |
| Strength and balance | Placing weight on one foot at a time in a slightly flexed position leads to greater strength in the lower extremities and improved balance |
| Natural breathing | Rhythmic breathing with movement appears to improve gas exchange and promote calmness |
| Social support | Positive interactions within a community give a sense of belonging and support |
| Integration of body, mind, and spirit | Tai chi creates a practical framework for living a more holistic life |

Adapted from Wayne.[3]

## Sources of information

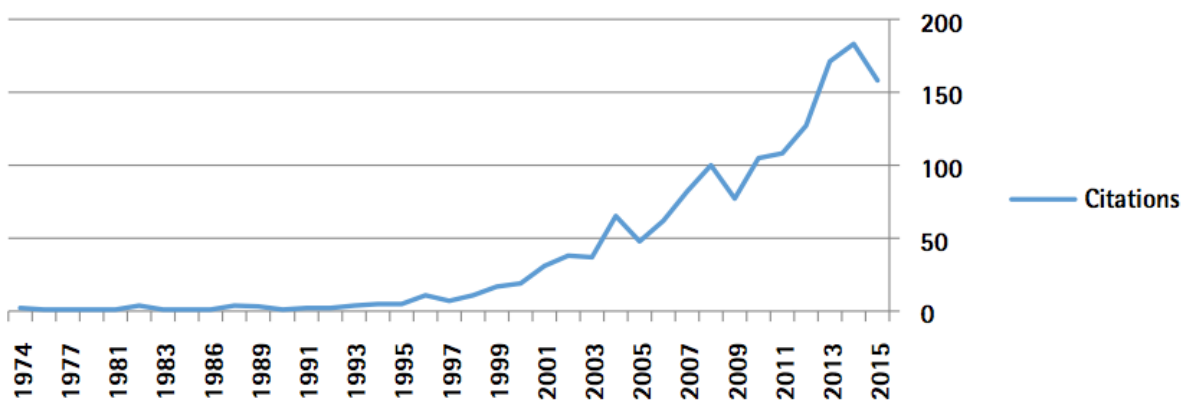
We reviewed the 2014 *Evidence Map of Tai Chi,* which is a "systematic review of systematic reviews" conducted by the Evidence-based Synthesis Program Centre for the US Department of Veterans Affairs.[1] We then conducted a MEDLINE review of systematic reviews and randomized controlled trials (RCTs) published after the evidence map up to October 2015. We assessed the evidence for specific conditions, as well as evidence for general health and fitness benefits, and then classified it into 1 of 5 categories: evidence of benefit was *excellent* if there were many systematic reviews noting consistent evidence of benefit, *good* if there were several systematic reviews that generally showed benefit, *fair* if there were a few systematic reviews that overall showed benefit but that might have included mixed results, and *preliminary* if there were only a few trials or 1 or 2 systematic reviews; *evidence of no direct benefit* was based on systematic reviews that showed no direct benefit for the condition under study (even if a general health benefit might have been documented).

## Main message

Research on tai chi has exploded in the past 45 years. A bibliometric analysis of clinical studies published between 1958 and 2013 found more than 500 studies on tai chi from 21 countries,[5] mostly supported by government funding. The number of articles published on tai chi in PubMed journals has been increasing exponentially (**Figure 1**). In 2015 there were, on average, 15 articles published *each month*.

Evidence was reviewed for general health and fitness and 25 different conditions and then organized

**Figure 1. PubMed tai chi article citations by year:** *January 1974 to October 2015.*



according to the quality of evidence for benefit: excellent, good, fair, preliminary, or evidence of no direct benefit.

***Excellent evidence of benefit.*** There are 5 conditions that had many systematic reviews showing consistent evidence of benefit for tai chi: preventing falls in older adults in the community, osteoarthritis, Parkinson disease, chronic obstructive pulmonary disease (COPD), and cognitive functioning.

*Fall prevention in the community:* There were 14 systematic reviews summarizing trials on fall prevention in older adults living in the community.[6-19] Some looked at multiple interventions including tai chi,[6-14] and others looked specifically at tai chi.[15-19] Reviews consistently found a decreased risk of falls in the tai chi groups, typically associated with improvements in static and dynamic balance. One review identified tai chi as the most cost-effective intervention to prevent falls.[12] In addition, 4 systematic reviews identified that tai chi decreased the fear of falling.[15,19-21] Tai chi was not found to be as beneficial for those needing assisted living, such as visually impaired adults in residential care.[22] This is consistent with a Cochrane review that found most interventions, including all exercise programs, were not effective in preventing falls in frail, institutionalized elderly patients,[23] and with a recent trial that did not show benefit in preclinically disabled adults.[24]

*Osteoarthritis:* There were 10 systematic reviews on osteoarthritis and all found that exercise, including tai chi, was associated with improvements, especially for osteoarthritis of the knee.[25-34] One meta-analysis of trials on tai chi for osteoarthritis found statistically significant improvements in pain ($P=.0005$), stiffness ($P=.04$), and physical function ($P<.00001$).[29] Recent trials have confirmed these findings[35,36] and another trial is under way.[37] Tai chi is now a conditional recommendation of the American College of Rheumatology for osteoarthritis of the hand, hip, and knee.[38]

*Parkinson disease:* There were 8 systematic reviews on tai chi and Parkinson disease.[39-46] The key finding was that people with Parkinson disease who took medication and did tai chi had better mobility and balance outcomes compared with those who took medication alone. Since a study published in the *New England Journal of Medicine*,[47] there has been an increase in clinical trials,[48-52] including a study showing tai chi to be cost-effective.[52] An RCT is under way.[53]

*Chronic obstructive pulmonary disease:* There were 6 systematic reviews on tai chi for asthma and COPD that found improvements in 6-minute walk test results, dyspnea, and forced expiratory volume in 1 second.[54-59] More definitive trials are now under way.[60,61]

*Cognitive functioning:* Five systematic reviews found that tai chi improved cognitive performance.[62-66] A meta-analysis found improved attention ($P<.001$) and processing speed ($P<.001$) in the tai chi group compared with controls.[64] There was a moderate effect size even compared with active controls.[65] These findings were confirmed in recent randomized trials.[67,68]

***Good evidence of benefit.*** There are 4 conditions that had several systematic reviews that generally showed benefit: depression, cardiac rehabilitation, stroke rehabilitation, and dementia.

*Depression:* There were 8 systematic reviews on tai chi and depression.[69-76] Although many trials had small numbers and most were short term, the findings were consistently positive. More recently, a longer trial of 24 weeks with more than 200 participants with obesity and depression showed that the tai chi group had reduced severity of depression ($P<.001$).[77]

*Cardiac and stroke rehabilitation:* There were 6 systematic reviews on tai chi for cardiac rehabilitation.[78-83] Although the initial trials were small, there was a consistent finding of benefit. Tai chi might be particularly helpful for women with coronary artery disease[84,85] and the elderly.[86] Recent trials found increased functional capacity after myocardial infarction[87] and that tai chi was an effective alternative for those who could not attend formal rehabilitation.[88]

There were 5 systematic reviews on tai chi for stroke rehabilitation[89-93]; all had positive findings but trial sizes were small. Studies that have been done since the last systematic review have found a consistent benefit[94,95] and additional trials are planned.[96,97]

*Cognitive impairment and dementia:* There were 2 systematic reviews on tai chi for the treatment of cognitive impairment and dementia that showed improvements in Mini-Mental State Examination scores.[65,98] The Cochrane review of exercise programs for people with dementia concluded that tai chi was better than physical activity for improving executive function.[98] This is consistent with the evidence for improving cognitive capacity in older adults.[62-66] However, achieving this benefit might take time; one recent short-term study of tai chi in those with mild cognitive impairment did not find an improvement.[99]

***Fair evidence of benefit.*** There are 4 conditions that had a few systematic reviews indicating that overall tai chi was effective, but some of the included trials did not show benefit: quality of life for cancer patients, fibromyalgia, hypertension, and osteoporosis.

*Quality of life for cancer patients:* There were 7 systematic reviews on quality of life for cancer patients, most of which were among those with breast cancer.[100-106] Although results were mixed, in part owing to different outcomes measures, overall there was a positive pooled effect for vitality and mental health

similar to that found with regular exercise. A recent trial showed improved health-related quality of life and biomarkers in breast cancer survivors who did tai chi.[107]

*Fibromyalgia:* There were 4 systematic reviews on fibromyalgia.[108-111] There were different outcomes measured and different trial lengths; some trials did not show benefit. A *New England Journal of Medicine* study showed a positive effect, but the sample size was small.[112] Overall the reviews indicated that people with fibromyalgia who did tai chi reported less pain and had improved function. These benefits were confirmed in recent clinical trials.[113,114] Trial length might explain some of the initial variability. A 6-month trial showed that a decrease in chronic pain appeared only after 4 to 6 months.[113] A 1-year head-to-head trial of aerobic exercise versus tai chi for fibromyalgia is under way.[115] In the meantime, some European countries have started to include tai chi in their fibromyalgia treatment guidelines.[116]

*Hypertension:* There were 4 systematic reviews on hypertension that found tai chi lowered both systolic and diastolic blood pressure; however, this finding was based on trials that had some methodologic weaknesses, and trial sizes were generally small.[117-120] A recent larger trial published in the *American Journal of Cardiology* found that tai chi reduced blood pressure and body mass index in the elderly.[121]

*Osteoporosis:* There were 3 systematic reviews on osteoporosis.[122-124] One review reported reduced rates of decline in bone mineral density (BMD) in postmenopausal women compared with sedentary controls in most included trials, but evidence was limited.[122] Another review reported mixed results.[123] The third review did not report on BMD but found that tai chi did improve balance and so might prevent falls.[124] A recent trial found that the combination of tai chi and resistance training had the best outcome.[125] Again, the length of intervention might be important. A 9-month trial found that those who completed at least 75% of the classes in the tai chi group showed a statistically significant increase in BMD of the femoral head compared with the usual-care group.[126]

***Preliminary evidence of benefit.*** One systematic review on the primary prevention of stroke included 36 studies with more than 2300 participants and found a significant decrease in nonfatal stroke in the group that did tai chi ($P$=.03).[127] A Cochrane review of tai chi for primary prevention of cardiac disease concluded that the results were inconclusive, noting longer-term trials were needed.[128] Two systematic reviews showed that tai chi might be helpful for anxiety.[69,129] One systematic review[130] and 3 recent trials[131-133] suggest tai chi has a beneficial effect on low back pain. One systematic review showed tai chi helped breast cancer patients after surgery, as it consistently improved the mobility of the affected arm.[134] Three trials on tai chi and multiple sclerosis found promising results, especially for improving balance,[135-137] and another trial showed improved quality of life.[138] Preliminary trials have shown a benefit for schizophrenia[139,140] and posttraumatic stress disorder.[141,142] Two trials indicated promising results for attention deficit disorder,[143,144] and a systematic review is planned.[145] Single studies have shown that tai chi was helpful for those with spinal cord injury,[146] for those with traumatic brain injury,[147] and for postsurgical nasopharyngeal cancer patients to increase neck mobility.[148]

***Evidence of no direct benefit.*** There were 3 conditions for which the evidence suggested tai chi might not have a direct benefit: type 2 diabetes, rheumatoid arthritis, and chronic heart failure.

There were 4 systematic reviews on tai chi and diabetes[149-152] showing no effect on hemoglobin $A_{1c}$. A recent trial found no change in fasting glucose levels,[121] but another showed tai chi did improve quality of life.[153] Three systematic reviews on tai chi for rheumatoid arthritis showed no improvement in joint tenderness, pain, or swelling but did find improved range of motion,[154-156] and a recent study found improved quality of life.[157] Two systematic reviews on tai chi for heart failure showed no change in N-terminal pro-brain natriuretic peptide[158,159] but found improved performance outcomes,[159] and another showed improved quality of life.[160]

***Tai chi for general health and fitness.*** Tai chi has a number of general health and fitness benefits. There is excellent evidence that tai chi consistently improves balance, demonstrated by 10 systematic reviews[161-170] and 3 recent trials.[171-173] There is excellent evidence from 5 systematic reviews[159,174-177] and 2 recent trials[172,178] that tai chi improves aerobic capacity, especially in those who have been sedentary. There is good evidence that tai chi can improve strength, especially in the lower limbs of adults who have been deconditioned,[159,178-182] and there is preliminary evidence that tai chi might improve flexibility.[163,173,178,182]

In terms of general health, there is fair evidence that tai chi increases overall well-being[69,183-185] and improves sleep.[186,187] Improvements in sleep seem to be associated with reduced cellular inflammatory markers such as C-reactive protein and proinflammatory cytokines.[188-191] There is 1 systematic review that suggests that tai chi might strengthen immune capacity[192] and very preliminary evidence that it might improve kidney function[121,193] and quality of life for hemodialysis patients.[194]

The benefits of tai chi according to the different levels of evidence for specific conditions and general health and fitness are summarized in **Table 2**.[6-19,25-59,62-95,98,100-114,117-127,129-144,146,147,149-194]

**Table 2. Tai chi research:** *Summary of evidence from 120 systematic reviews and recent clinical trials; there is very little evidence for italicized conditions.*

| EXCELLENT EVIDENCE OF BENEFIT | GOOD EVIDENCE OF BENEFIT | FAIR EVIDENCE OF BENEFIT WITH MIXED RESULTS | PRELIMINARY EVIDENCE OF BENEFIT | EVIDENCE OF NO DIRECT BENEFIT |
|---|---|---|---|---|
| **SPECIFIC CONDITIONS** | | | | |
| Preventing falls[6-19]<br>• 14 systematic reviews<br>Osteoarthritis[25-38]<br>• 10 systematic reviews<br>Parkinson disease[39-53]<br>• 8 systematic reviews<br>COPD rehabilitation[54-59]<br>• 6 systematic reviews<br>Improving cognitive capacity[62-68]<br>• 5 systematic reviews | Depression[69-77]<br>• 8 systematic reviews<br>Cardiac rehabilitation[78-88]<br>• 6 systematic reviews<br>Stroke rehabilitation[89-95]<br>• 5 systematic reviews<br>Cognitive impairment and dementia[65,98]<br>• 2 systematic reviews | Quality of life for cancer patients[100-107]<br>• 7 systematic reviews<br>Fibromyalgia[108-114]<br>• 4 systematic reviews<br>Hypertension[117-121]<br>• 4 systematic reviews<br>Osteoporosis[122-126]<br>• 3 systematic reviews | Stroke prevention[127]<br>• 1 systematic review<br>Anxiety[69,129]<br>• 2 systematic reviews<br>Low back pain[130-133]<br>• 1 systematic review<br>Postoperative arm mobility in breast cancer patients[134]<br>• 1 systematic review<br>*Multiple sclerosis*[135-138]<br>*Schizophrenia*[139,140]<br>*PTSD*[141,142]<br>*Attention deficit disorder*[143,144]<br>*After brain and spinal cord injury*[146,147] | Diabetes (eg, $HbA_{1c}$)[149-153]<br>• 4 systematic reviews<br>Rheumatoid arthritis[154-157]<br>• 3 systematic reviews<br>Chronic heart failure[158-160]<br>• 2 systematic reviews |
| **GENERAL HEALTH AND FITNESS BENEFITS** | | | | |
| Balance,[161-173]<br>• 10 systematic reviews<br>Aerobic capacity[159,174-178]<br>• 5 systematic reviews | Strength[159,178-182]<br>• 2 systematic reviews | Well-being[69,183-185]<br>• 4 systematic reviews<br>Sleep[186-191]<br>• 2 systematic reviews | Flexibility[163,173,178,182]<br>• 1 systematic review<br>*Immune capacity*[192]<br>*Kidney function*[121,193,194] | NA |

COPD—chronic obstructive pulmonary disease, $HbA_{1c}$—hemoglobin $A_{1c}$, NA—not applicable, PTSD—posttraumatic stress disorder.

***Excellent safety profile.*** There was 1 systematic review of 153 trials assessing the safety of tai chi[195]; only 50 included adverse event reporting. The most common adverse events were minor and primarily musculoskeletal, such as mild knee and back pain (presumably from misalignment); no intervention-related serious adverse events were reported.

## DISCUSSION

There are more than 500 studies and 120 systematic reviews to assess the benefits of tai chi for 25 different conditions as well as for general health and fitness. The results have varied from excellent, good, fair, and preliminary evidence of benefit to evidence of no direct benefit. The strongest evidence of benefit is for preventing falls in older adults in the community, osteoarthritis, Parkinson disease, COPD rehabilitation, and improving cognitive capacity. The strength of this body of research is that it includes many systematic reviews and meta-analyses and, increasingly, high-quality RCTs. One of the strengths of our research is that we were consistently conservative in our assessments of the quality of evidence. For example, although more than 36 studies have been done on tai chi for the primary prevention of stroke, and a meta-analysis found a statistically significant effect on nonfatal stroke, we still categorized this as preliminary evidence of benefit, as many of the trials were small and the overall effect was small. Tai chi appears to be excellent for balance and reestablishing aerobic capacity in those who have been deconditioned and for preventing or improving many of the common ailments associated with aging.

There are some limitations to this evidence, both from a research and a tai chi perspective. From a research perspective, many of the initial trials were small and had methodologic weakness. A key weakness was the lack of blinding of participants, but this was largely overcome by blinding those analyzing the results. Since tai chi has multiple features (**Table 1**),[3] it is difficult to know what aspect of tai chi has the greatest effect.[2,196] It is also not clear how tai chi works. For example, recent research has examined why tai chi seems to be so good for balance[197-200] and how it helps improve cognitive function.[201-203] Tai chi includes different styles, teachers, lengths, and frequencies. It is unclear whether one style might be better for some conditions than others, if longer classes are better than shorter classes, or whether 2 or more classes a week is optimal. A final limitation

of tai chi research is that trial lengths of 6 to 12 weeks might not be sufficient to assess benefit, especially for chronic conditions. Fortunately, a number of long-term studies are now under way.

From a tai chi perspective, research on this art form to date might not have revealed all of its benefits. In our experience, many people who practise tai chi describe benefits that have not yet been studied—such as improved digestion, warmer hands and feet, and generally feeling younger. Although it is useful to know that benefits can be seen after only a few weeks, those who have practised tai chi for many years would note that benefits continue to accrue even after decades of practice.

A lot more research is under way, including longer, more rigorous clinical trials and assessment of the benefits for other conditions. And there is a lot of interest in understanding how tai chi works at a biochemical level. Early evidence suggests tai chi alters cytokines associated with pain perception,[204] enhances T cells,[205] and affects mononuclear cell functions in patients with cancer.[206] It would be interesting to assess the effect of tai chi on telomere length—an indicator of overall resilience and longevity.[207]

## Case resolution

You empathize with B.G.'s situation and reassure her that there are some things that can be done to improve her health and well-being. You suggest that now that her children have moved out, it is a good time to start something new. You agree that tai chi is a good choice—it is a gentle aerobic activity that also improves balance and strength. You note there is good evidence that tai chi could help her depression and fair evidence that it might help improve her blood pressure. You discuss additional recommendations for her depression, hypertension, and blood sugar levels and arrange to see her again for follow-up.

## Conclusion

Physicians can now provide evidence-based recommendations on tai chi to their patients, understanding that this is an active area of research. As with any exercise program, ongoing medical follow-up for any clinical condition is indicated.

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**Contributors**
Both authors contributed to the literature review and interpretation, and to preparing the manuscript for submission.

**Competing interests**
**Dr Huston** has been practising tai chi for 3 years and assists in a Taoist Tai Chi health recovery class. **Dr McFarlane** has been learning from and teaching Taoist Tai Chi for 21 years and is a medical advisor to the Taoist Tai Chi Society of Canada.

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