

Tai Chi for Falls Prevention: A Student-led DNP Project

Graham C. Sawicki

Arizona State University

Abstract

Aim: To reduce the fear of falling in an elderly population by teaching ‘Tai Chi for Falls Prevention’ classes twice a week for 12 weeks.

Background & Significance: Falls continue to be the leading cause of injury-related deaths of Arizonans who are 65 years or older - well above the national average. It is predicted that by 2030, national medical spending for this population will total over \$31 billion, yearly. Tai Chi is revered for being a beneficial form of simple, low-impact exercise, which the CDC endorses for its falls risk reduction benefits.

Methods: The intervention consisted of 60-minute classes occurring twice a week for 12 weeks. Participants were English-speaking, between 65-85 years old, and able to ambulate independently. Appropriate pre-screening tools were used before applicants consented. Their Fear of Falling (FoF) was measured using a fall risk perception tool at the beginning, middle, and the end of the project. This ordinal data was analyzed with Friedman ANOVA using SPSS 25

Outcomes/Results: After enrolling five total participants, only three completed the project. This severely limited data analysis of their FoF, resulting in a statistical significance ($p = 0.68$), deeming the intervention ineffective - Despite observable downwards trending FoF scores.

Conclusion: The acceptance of the null hypothesis is attributed to the low enrollment and high attrition rate. Also, the only data measured was quantifiable, subjective data. Future projects could add objective data to reinforce the benefits of Tai Chi. This might reinforce the validity of Tai Chi as a practical recommendation due to its cost-effective simple interventional design and effectiveness for prevention of accidental falls. Increased focus on improved recruitment & retainment strategies should be prioritized for similar projects in the future.

Keywords: accidental falls, falls, fall risk reduction, older adults, Tai Chi, balance, exercise,

Tai Chi for Falls Prevention: A Student-led DNP Project

Accidental falls in any age group can be devastating and have terrible consequences that can lead to outcomes with adverse long-term effects. Falls among the elderly who are 65 years of age and older can have detrimental effects physically and psychologically - both immediately and long-term. Falls are the number one cause of injury in older adults, with a third of this group of individuals falling every year, and half of them will have another fall sometime in the next year. One out of every two 80-year-olds fall every year (STEADI, 2015; Yoo, Kim, Yim, & Jeon, 2016; Gallant, Tartaglia, Hardman, & Burke, 2017; Office of Injury Prevention, 2017).

Problem Statement

A fall is classified as an accidental tumble downwards that is not caused by an external force or a neurological change. Falls have the potential to cause mortalities and create morbidities; morbidities that can steal away someone's independence and rob someone of their quality of life. Internationally, 28-35% of adults older than 65 years of age fall will fall each year (Yoo, Kim, Yim, & Jeon, 2016; Gallant, Tartaglia, Hardman, & Burke, 2017). Assessment and acknowledgment of other causes for falls should be mentioned. These include poor lighting which affects vision, slippery floors, lack of grab bars, etc. Environmental elements such as these contribute to roughly 41% of the risk factors that can instigate falls (Yoo, & et al., 2016). The likelihood of falls increases with age, but the frequency can vary by ethnicity and geographical location (STEADI, 2015). The National Guideline Clearinghouse adapted and released fall assessment and prevention recommendations for elderly adults (NICE, 2004). The recommendations were last updated in 2013, and cover cause and risk identification, multifactorial falls risk assessment, and multilevel interventions, and interpretation of current evidence regarding various interventional methods for preventing falls. Low-intensity exercises

and untargeted group exercises were not listed as a recommended intervention. Brisk walking, as it turns out, should no longer be recommended as a fall prevention measure, as it is not shown to reduce fall risk (NICE, 2013).

Purpose & Rationale

Falls among older adults continue to be a growing burden. The purpose of this proposed project is to highlight the importance of fall prevention in older adults who are 65 years and older while investigating implementing Tai Chi as a method of intervention to reduce the prevalence of falls in this population. In addition, there is a need for improved approaches for fall prevention and the applicability Tai Chi possess as an effective intervention for this at-risk population. The purpose of this paper is to discuss the background and significance of the problem; describe the search process; and the identification of ten research articles related to the addressing this problem.

Background & Significance

Population: Older Adults and Falls.

Accidental falls are linked as the number one most frequent cause of falls in the elderly, which can result in both short-term and long-term injuries which can result in decreased mobility afterward, pain – both chronic or acute, loss of independence, or even death. Gait and balance disorders are the second most frequent cause of falls (Landers, Oscar, Sasaoka, Vaughn, 2016). “Delays in recovery from a fall injury, plus post-fall anxiety, further heighten the risk of subsequent falls due to deconditioning, weakness and acquisition of abnormal gait,” (Plummer & Bradley, 2017, p. 239). Fear of falling has the potential to affect individuals who have and have not fallen, and as older adults get older, their fear of falling is likely to increase with age (Stojanovic, Kocic, Balov, Milenkovic, Savic, & Ivanovic, 2015).

Intervention: Tai Chi

Tai Chi (TC) originates from Chinese tradition over 400 years ago that has rapidly evolved beyond its original martial arts roots into a multiuse tool of diversity and utilization. It has become a popular form of exercise that is well-recognized worldwide and involves full mind-body movements that remain low-impact but high in potential benefits. The literature portrays the benefits having been shown to positively improve strength, aerobic aptitude, balance, quality of life, psychological well-being, and even affect physiological diseases (Lan, Chen, Lai, & Wong, 2013; Gallant, Tartaglia, Hardman, & Burke, 2017). It can be performed both individually, as well as in a social setting and there are different styles and forms to teach Tai Chi, but much of it incorporates the same vital principles with attention on breathing, slow, purposeful movements that include the entire body, and results that improve strength, balance, and flexibility (Wu, Macdonald, & Pescatello, 2016).

A community-based study used Tai Chi to modify fall-risk among older adults older than 65 years but could move about without any assistive walking devices in two senior centers where two individuals were trained from each county area to become a Tai Chi instructor leading each of the classes over 12 weeks. The classes took place two or three times a week with a 45-minute requirement of at-home practice per week as well. Upon completion of the study, participants, on average, showed improvement in their strength, balance, and mobility (Gallant, Tartaglia, Hardman, & Burke, 2017).

Incidence of Falls

In 2016, 42,808 Arizonans 65 years and older visited the emergency department due to falls that were unintentional, costing over \$344.7 million. Of that number, 14,384 of them required inpatient hospitalization, and after averaging six days in the hospital, their totaled

charges were over \$933.6 million. Falls continue to be the leading cause of injury-related deaths of Arizonans 65 or older, and in 2016, 974 deaths occurred as a result (Office of Injury Prevention, 2017). Every second, an older adult experiences an accidental fall somewhere in America. Every 20 minutes, one of them dies as a result of it. It is estimated that by 2030, medical expenses for these older adults at risk for falls will total over \$31 billion each year (STEADI, 2015). The implementation of Tai Chi for falls prevention classes could reduce this high incidence of falls among the elderly who are at an increased risk, especially in Arizona, who vastly outpaces the nation's mortality from accidental falls (Office of Injury Prevention, 2017).

Internal Evidence

The Arizona Falls Prevention Coalition (AFPC) expresses the desire of implementing more 'Tai Chi for Falls Prevention' programs throughout the state of Arizona – of which, currently there is a very limited number available to the elderly interest in Tai Chi for falls prevention. Initiating more instructor-led 'Tai Chi for Falls Prevention' classes throughout the community is a 2018 goal of theirs (Dunn, 2018). In 2013, a systematic review and meta-analysis of 124 randomized controlled trials were investigated after being gathered across several major research databases. The results found that regardless of the style, form, or duration, Tai Chi exercise training is shown to be an effectual technique in significantly reducing the occurrence of falls in older adults (Hu, Chung, Yu, Chen, Yu-Chi, Tsai, & Hu, 2016). A meta-analysis from 2017 acknowledges the reduction of risk of falls and fall-related injuries due to Tai Chi's use short-term, but questions the validity and sustainability of the benefits long-term, however (Lomas-Vega, Obrero-Gaitán, Molina-Ortega, & Del-Pino-Casado, 2017); as did an evidence map reviewing 107 systematic reviews of the evidence regarding health outcomes from Tai Chi, but still indicates promising application (Solloway, Taylor, Shekelle, Miake-Lye, Beroes,

Shanman, & Hempel, 2016). Adverse events mainly have included minor aches, soreness of the body, and stiffness (Wayne, Berkowitz, Litrownik, Buring, & Yeh, 2014).

Current literature strongly suggests the clear benefits and higher outcomes of Tai Chi compared to other more standardized and common fall prevention measures and combined exercise prescriptions which might include brisk walking, physical therapy, and physical exercises that focused on lower limbs (Stevens & Burns, 2015; Yildirim, Ofluoglu, Aydogan, & Akyuz, 2016; Bubela, Sacharko, Chan, & Brady, 2017). Despite the Center for Disease Control & Prevention's endorsement of Tai Chi and its multiple health benefits, awareness of Tai Chi's benefit for falls prevention in the elderly is still not commonly known among healthcare and the community. This stated problem has led to the clinically relevant PICOT question, "In older adults, how does Tai Chi compared to no tai chi affect fear of falling-over time?"

Search Strategy

To order to effectively address this question, a comprehensive and thorough screening of the literature was implemented through the following online databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, and The Cochrane Library, OCLC Worldcat, PubMed, Science Direct, Springer Link, Cochrane Library, and ProQuest Medline, as well as being independently, handpicked by this author.

The population was searched for using the following search terms: *elderly*, *older adult*, *65+ years*, *geriatric*. The outcome was searched for using: *fall* or *falls* and *accidental fall*. The intervention of *Tai Chi*, *tai ji*, *Tai Ji Quan*, *Tai Chi Chuan* was searched. The intervention's focus was used to further narrow the results using these key terms: *fear of falling*, *fear of falls*, and *falls prevention*. All searches were restricted using the following modifiers and limiters when

available: within five years “2013-2018,” limited to “Humans,” and “English” language only, and narrowed by subject age of “65+ years”.

Initially, while using the modifiers listed above, searching with the only “fall OR fall prevention OR falls prevention AND tai chi” yielded 2,933 search results in CINAHL ([Appendix A](#)), 452 results with Online Computer Library Center (OCLC) WorldCat ([Appendix B](#)), 216 with PubMed ([Appendix C](#)), 290 results using ScienceDirect ([Appendix D](#)), 588 results from Springer Link ([Appendix E](#)), 1706 records in Cochrane Library ([Appendix F](#)), 464 with SAGE journals ([Appendix G](#)), and 11,261 results with ProQuest Medline ([Appendix H](#)).

Final search results, revising and combining search terms resulting with refinement of the search to, “‘Tai Chi’ OR ‘Tai Ji’ OR ‘Tai Ji Quan’ OR ‘Tai Chi Chuan’ AND ‘fall’ OR falls AND ‘prevention’ AND ‘fear of falling’ OR ‘fear of falls’,” resulted in four applicable search results in CINAHL ([Appendix A](#)), 60 results with OCLC WorldCat ([Appendix B](#)), 50 with PubMed ([Appendix C](#)), 1,740 review & research articles with ScienceDirect ([Appendix D](#)), 11 results from Springer Link ([Appendix E](#)), 43 results in Cochrane Library ([Appendix F](#)), 24 with SAGE journals ([Appendix G](#)), and 939 results with ProQuest Medline ([Appendix H](#)). When unable to select population or age filters or limiters, “elderly OR ‘older adult’ OR ‘65+ years’ OR ‘geriatric’ OR ‘Aged 65+’ OR ‘65 years’,” was added to the keywords being searched. Seventy studies were selected after the searching and screening took place, found from both the database containing the search elements above and hand selected from related sources. 10 final studies were selected for evaluation and synthesis ([Appendix I](#)).

The criteria for exclusion included studies published before 2013, published in a non-English language, or unfinished studies, or reports studying a population younger than 65 years old. Reports that studied the effects of Tai Chi without mention of fall reduction or prevention

were further eliminated. Studies investigating the benefits of Tai Chi in patients with chronic diseases such as a deteriorating neurologic condition or diabetes were excluded. This resulted in ten final studies that were chosen for critical appraisal.

Critical Appraisal & Evidence Synthesis

The ten final studies were quantitative and evaluated with a rapid critical appraisal tool and are displayed in a table below (*Appendix I*). The strength of the studies is high, overall: five systemic reviews (SR), two SR with meta-analysis (MA), two Quasi-Experimental, and one randomized-control trial (RCT). Most of the studies did not report a theoretical framework and most studies and reviews of RCTs took place in community-based settings. The studies evaluating Tai Chi's effectiveness for falls prevention featured samples composed of populations of older adults without chronic illnesses. A handful of studies report bias within sampling without much diversity in the characteristics of their members. Some of the systemic reviews did not mention the sample group characteristics of the studies included in their review. (*Appendix J*).

Bubella et al. reported a moderate increase to perceived balance confidence using the self-reported balance confidence activity-specific balance confidence (ABC) scale, between pre and post scores using the activity-specific balance confidence, “($p = .022$) and moderate effect size and observed power ($\eta_p^2 = 0.217$; observed power = 0.656)” (2017, p. 5). Gallant, Tartaglia, Hardman, & Burke determined that even a novice instructor for a 12 week tai chi program could have a beneficial impact, as significant pre-post improvements were reported among functional mobility and balance (Timed Up and Go ($p < .001$) and Functional Reach ($p < .01$), as well as perceived balance (ABC scores ($p < .01$), (2017). Hu et al. reported tai chi as having significantly reduced fall risk ($OR = 0.70$; 95% confidence interval, 0.59 to 0.84) during

its meta-analysis of ten different trials with 2850 individuals participating. They used the Physiotherapy Evidence Database (PEDro) scale to measure and determine the quality of the randomized controlled trials. Their subgroup analysis also found no evidence of differential effects from training duration or Tai Chi style used (2016). Lomas-Vega & et al. performed a meta-analysis on ten studies and reported Tai Chi as having “high-quality evidence of a medium protective effect for fall incidence over the short term ($IRR = 0.57$; 95% $CI = 0.46, 0.70$) and a small protective effect over the long term ($IRR = 0.87$; 95%; $CI = 0.77, 0.98$)” (2017, p. 2037).

Yildirim, Ofluoglu, Aydogan, & Akyuz compared changes to standing balance, ambulatory balance, fear of falling and mood between two groups - one following ‘combined exercise prescription’ and the other ‘tai chi’. Afterward, differences to pre-post evaluations between the two groups were compared after 12 weeks. Using the Survey of Activities and Fear of Falling in the Elderly (SAFFE) tool, it was determined that there was a greater and much more significant reduction to fear of falling in the group practicing tai chi ($p = 0.002$) (2016).

Most of the studies were led by an instructor certified in Tai Chi training, and a couple of others were led by non-professionals who were volunteers or just moderately trained beforehand. On average, Tai Chi classes took place for about an hour, once or twice a week, ranging 12-16 weeks, with pre- and post- tests and evaluations. Fear of Falling changes was commonly analyzed via the SPSS program. Timed up and go and activity-specific balance scales were commonly for assessment for Tai Chi’s effects upon participant balance (Bubella & et al., 2017; Yildirim, Ofluoglu, Aydogan, & Akyuz, 2016). Attrition rates were generally low for the studies and SRs, when divulged. Strength, mobility, fall incidence, balance, and fear of falling or confidence were mainly tested for and reported.

Tai Chi is well-regarded as being generally very safe, due to its simple, low impact, continuous, sequential movements that doubles as a form of exercise and meditation. Concerning its safety, adverse events (AE) reported during studies using Tai Chi are rare uncommon but do include falls and fall-related injuries. Commonly reported complaints from participants of Tai Chi includes fatigue, muscle soreness, or muscle stiffness (Wayne et al., 2014).

Evidence-Based Practice Model and Conceptual/Theoretical Model

Plan-Do-Study-Act Model

The Plan-Do-Study-Act (PDSA) model (PDSA, 2018) was chosen to guide project development, it is a simple (*Appendix K*) model and is commonly used as a performance improvement project because it measures a change after it has been implemented and is designed is structured well for adjustments to be made after, allowing for the process to repeat again. This method guides the process with four steps: Plan, Do, Study, Act. First, a plan must be drawn up with clear indications for what is to be done, the outcomes desired, and the steps for execution. Next, the test is carried out or executed – during this phase, the observations are recorded. After this step, the results are studied and whether or not the goal was achieved is evaluated. The final stage is the conclusion of what was learned from the conclusion of the effects, including what worked, what did not, and what could be done differently for next time? (PDSA Worksheet, 2018).

The plan would involve using Tai Chi as a method for fall prevention with reducing the incidence of falls, preventing falls, and increasing the confidence of individuals who are afraid of falls. The project could be student-led and would follow much of the same structure, direction, and goals of that in the studies below. The frequency of classes per week, length of each class, and the same age of participants would be replicated. The project would take place in the

community, in an area that does not already have Tai Chi classes for fall prevention already in place. After the project has completed, the data will be collected and studied. Then, during the act phase, conclusions will be made so that adjustments can be made. This model easily allows for repeating of the project with adjustments made afterward.

Self-Efficacy Theory

The entirety of the project is built upon Bandura's Self-Efficacy Theory which is a sub-theory of his Social-Cognitive theory. The Self-Efficacy theory lends itself to what the structure of the Tai Chi for Falls Prevention classes is structured to achieve. This theory presents the notion that the observation of value or efficacy is determined by four main aspects: mastery experience, vicarious experience, verbal persuasion, and somatic or state of emotion. The mastery experience builds upon the perceptions from previous successes that have been accomplished in the past but are similar to the newer behaviors being attempted. With the step-by-step program being followed by the participants, they are more open to each of the newer, more complicated steps because of their mastery of the earlier, similar steps prior. The vicarious experience is based upon the individual's ability to learn by watching others be successful at completing the same actions being attempted by the individual. Being surrounded in a supportive environment that a group class setting provides creates an atmosphere that is encouraging and motivating to the participants of the tai chi classes. With verbal persuasion, reinforcement from others and instructors is both crucial and effective, which is supplied both from the fellow participants and the instructor in this project. Lastly, the somatic and emotional states of each individual must be considered constantly because their physical and emotional statuses are instigated by their perception regarding the undertaking of new behaviors (Brown, Malouff, & Schutte, 2013). By measuring the participant's fear of falling perceptions, the instructor of the

Tai Chi for Falls Prevention classes can adjust the teaching stylings to better meet the needs of the participants.

Project Methods

After IRB After becoming a certified Tai Chi for Falls Prevention instructor through the Tai Chi for Health Institute, I designed my intervention to consist of: 60-minute classes that were held twice a week over 12 weeks in a classroom setting at a not-for-profit hospital's medical office building in an urban Phoenix area. Participants who were considered for recruitment had to be between the ages of 65-85 years of age, English-speaking and able to ambulate without the use of assistive devices. Relevant pre-screening was utilized with reliable tools that whose validity was supported, with permission to use granted beforehand. Before interested applicants were allowed to provide consent, individuals were screened for any pre-existing mental or cognitive impairments using the Montreal Cognitive Assessment-Basic (MoCA-B) tool (*Appendix L*). Their physical activity readiness was determined using the 2018 Physical Activity Readiness Questionnaire (PAR-Q+) (*Appendix M*). The data collected was their falls risk perception, measured using the 'Falls Efficacy Scale-International (English)' (FES-I) (*Appendix N*) at the beginning, middle, and the end of the project. This ordinal data was analyzed using SPSS 25, in which Friedman ANOVA was used for data analysis. All participant-related information and data was safely stored on an encrypted, external flash drive that was only via secure methods only. After completion of the project, the information and any identifying information was properly deleted, removed, and destroyed.

Total expense, excluding commute-related expenses for this project, would have been about \$308 to cover the certification course and related learning materials and supplemental supplies for teaching the Tai Chi classes. No cost for classes space as they were provided via the

connections of the Arizona Falls Prevention Coalition. It should be mentioned that Tai Chi can occur in any public space that is flat and open, such as at a park, library, or home, therefore, additional costs for practice space should not be included in a proposed budget.

Outcomes

The project started on 11/27/18, after minor project delays due to poor public response to recruitment strategies utilized. There was a total enrollment of five participants, each providing their consent after passing the pre-screenings beforehand for a total inclusion into the project of five participants ($n = 5$). After an anticipated attrition rate of two, this project completed without any adverse events 12 weeks later on 2/14/19 with three participants. Because of this low completion rate, data analysis of their FoF was severely limited. After analyzing the three participant's data collected from the three different intervals using Friedman ANOVA analysis, the resulting p -value indicated that the intervention's effects were not significant ($p = .68$). Thus, proving the null hypothesis correct.

Discussion

Though, participant enrollment might have been impeded by non-ideal recruitment strategies in the beginning, the impact was of Tai Chi's benefits was clear and apparent to the participants who completed the project after 12 weeks as indicated by the positive verbal praise that was shared at the project's end. Poor recruitment strategies are considered to be the primary cause of low participant interest/enrollment. The attrition rate, like most long-term projects and studies, was not unexpected as this project's requirements were demanding in its length of time and frequency of classes. As mentioned above, low enrollment that was negatively affected by the project's attrition rate is most likely the cause for the data lacking statistical significance ($p > .05$), but there was an unmistakable downwards trend observed for fear of falling total scores

among all completing participants (*Appendix O*), which indicates this intervention as having clinical significance. After completing the project, the participants were encouraged to seek Tai Chi instructor certifications of their own so that additional Tai Chi for falls prevention classes can be implemented in their own communities. Nine weeks into the project, one of the participants stated as testimonial believing in the effects of the project,

“Over the weekend, I tripped over my dog while trying to settle him when someone was in the yard. I felt myself falling as I instantly regretted everything I did leading up to that point. Miraculously, I maneuvered my feet in a way to recover and catch myself. I didn’t fall, and I know for certain that it is due to these Tai Chi classes.”

Interested participants, upon completing the project were advised to continue taking Tai Chi classes within and were encouraged to seek instructor certification for the continued development and expansion of available Tai Chi classes throughout their communities for sustainability.

Conclusion

The project’s implications and benefits for falls prevention is not without merit due to its apparent clinical benefits which should not be overshadowed by the data’s lack of statistical significance. To the participants who completed the project to its entirety, there was personal benefit that was stated by all. The Tai Chi was discussed as being both beneficial, easy to perform, and fun. These subjective critiques are worth mention in reviewing the benefits to both the site at which the project took place and the organization this student partnered with. Increased focus for recruitment strategies should be better prioritized by the organization and the project site to more aptly prevent lower enrollment of participants in the future. Also, it is worth highlighting that the only data measured was quantifiable, subjective data. Despite this project’s

lack of interventional validation, current literary evidence does extensively support the health benefits of Tai Chi (Lan, Chen, Lai, & Wong, 2013). Future projects could add objective data to reinforce the benefits of Tai Chi, such as: ‘Sit to Stand’ timing, Balance, Leg-Strength, & Speed of ambulation (Bubella & et al., 2017; Yildirim, Ofluoglu, Aydogan, & Akyuz, 2016). Doing so might reinforce the validity of Tai Chi as a practical recommendation due to its cost-effective, simple interventional design and effectiveness for prevention of accidental falls. Depending on who is asked, this project could still be considered a great success in its potential benefits and should be regarded as a worthwhile first step in a process advocating for more practical falls prevention options for the public.

References

- Brown, L.J., Malouff, J.M., & Schutte, N.S. (2013) Self-Efficacy Theory 89742_Ch02.indd 36 [PDF]. Retrieved from: <http://samples.jbpub.com/9781449689742/Chapter2.pdf>
- Bubela, D., Sacharko, L., Chan, J., & Brady, M. (2017). Balance and functional outcomes for older community-dwelling adults who practice tai chi and those who do not. *Journal of Geriatric Physical Therapy*. doi:10.1519/jpt.0000000000000153
- Chalon, H. (2018, March 20). Personal interview.
- Crawford, D. (2018). Theoretical & conceptual frameworks [PowerPoint slide]. Retrieved from: https://myasucourses.asu.edu/bbcswebdav/pid-17812181-dt-content-rid-119969156_1/xid-119969156_1
- Dunn, S. (2018, January 29). Personal interview.
- Gallant, M., Tartaglia, M., Hardman, S., & Burke, K. (2017). Using Tai Chi to Reduce Fall Risk Factors Among Older Adults: An evaluation of a community-based implementation. *Journal of Applied Gerontology*. Retrieved from <https://doi.org/10.1177/0733464817703004>
- Hu, Y.N., Chung, Y.J., Yu, H.K., Chen, Y.C., Tsai, C.T., & Hu, G.C. (2016). Effect of tai chi exercise on fall prevention in older adults: Systematic review and meta-analysis of randomized controlled trials. *International Journal of Gerontology*, 10(3), 131-136. Retrieved from: <http://dx.doi.org/10.1016/j.ijge.2016.06.002>
- Lan, C., Chen, S., Lai, J., & Wong, A. (2013). Tai chi chuan in medicine and health promotion. *Evidence-Based Complementary and Alternative Medicine*, 2013. Retrieved from: <http://downloads.hindawi.com/journals/ecam/2013/502131.pdf>

- Landers, M., Oscar, S., Sasaoka, J., & Vaughn, K. (2016). Balance Confidence and Fear of Falling Avoidance Behavior Are Most Predictive of Falling in Older Adults: Prospective Analysis. *Physical Therapy*, 96(4), 433-42. Retrieved from: <http://search.ebscohost.com.ezproxy1.lib.asu.edu/login.aspx?direct=true&db=rzh&AN=14179355&site=ehost-live>
- Lomas-Vega, R., Obrero-Gaitán, E., Molina-Ortega, F. J., & Del-Pino-Casado, R. (2017). Tai chi for risk of falls. A meta-analysis. *Journal of the American Geriatrics Society*, 65(9), 2037-2043. doi: 10.1111/jgs.15008
- National Institute for Health and Care Excellence (NICE) (2013). *Falls: assessment and prevention of falls in older people* (NGC:009951). Retrieved from: <https://www.guideline.gov/summaries/summary/46931/falls-assessment-and-prevention-of-falls-in-older-people?q=Falls+assessment+and+prevention+of+falls+in+older+people>
- Office of Injury Prevention (2017). Unintentional falls among Arizonans 65 years and older, 2016 [PDF file]. *ADHS*. Retrieved from <http://azdhs.gov/documents/prevention/tobacco-chronic-disease/healthy-aging/reports-statistics/falls-among-older-az-residents-2016.pdf>
- Plan-Do-Study-Act (PDSA) Worksheet. (2018). *Ihi.org*. Retrieved from: <http://www.ihl.org/resources/Pages/Tools/PlanDoStudyActWorksheet.aspx>
- Plummer, M., Bradley, C. (2017). Tai chi as a falls prevention strategy in older adults compared to conventional physiotherapy exercise: A review. *International Journal of Therapy and Rehabilitation*. 24(6). 239-247. Retrieved on Feb. 5, 2018, from <https://www.magonlinelibrary.com/doi/pdf/10.12968/ijtr.2017.24.6.239>

Solloway, M., Taylor, S., Shekelle, P., Miake-Lye, I., Beroes, J., Shanman, R., & Hempel, S.

(2016). An evidence map of the effect of Tai Chi on health outcomes. *Systematic Reviews*, 5(1), 126. [DOI 10.1186/s13643-016-0300-y](https://doi.org/10.1186/s13643-016-0300-y)

Stopping Elderly Accidents, Deaths & Injuries (STEADI). (2015) STEADI initiative for health care providers. *Centers for Disease Control and Prevention*. Retrieved from:

<https://www.cdc.gov/steady/patient.html>

Stevens, J., Burns, E. (2015). A CDC compendium of effective fall interventions: What works for community-dwelling older adults. (Third ed.). *National Center for Injury Prevention and Control*. Retrieved from [https://arizona-](https://arizona-asu.userservices.exlibrisgroup.com/view/action/uresolver.do?operation=resolveService&package_service_id=10589104780003841&institutionId=3841&customerId=3840)

[asu.userservices.exlibrisgroup.com/view/action/uresolver.do?operation=resolveService&package_service_id=10589104780003841&institutionId=3841&customerId=3840](https://arizona-asu.userservices.exlibrisgroup.com/view/action/uresolver.do?operation=resolveService&package_service_id=10589104780003841&institutionId=3841&customerId=3840)

Stojanovic Z, Kocic M, Balov B, Milenkovic M, Savic N, & Ivanovic S. (2015). Fear of falling. *Praxis Medica*, 44(3), 61-66. Retrieved from:

<https://doaj.org/article/b72fb83f28a84b659b8da4562ce24e24>

Wayne, P., Berkowitz, D., Litrownik, D., Buring, J., & Yeh, G. (2014). What do we really know about the safety of tai chi?: A systematic review of adverse event reports in randomized trials. *Archives of Physical Medicine and Rehabilitation*, 95(12), 2470-2483.

[doi:10.1016/j.apmr.2014.05.005](https://doi.org/10.1016/j.apmr.2014.05.005)

Wu, Y., Macdonald, H., & Pescatello, L. (2016). Evaluating Exercise Prescription and Instructional Methods Used in Tai Chi Studies Aimed at Improving Balance in Older Adults: A Systematic Review. *Journal of the American Geriatrics Society*, 64(10), 2074-

2080. Retrieved from

<http://onlinelibrary.wiley.com.ezproxy1.lib.asu.edu/doi/10.1111/jgs.14242/full>

Yang, G., Wang, L., Ren, J., Zhang, Y., Li, M., & Zhu, Y. Luo, J., Cheng, Y., Li, W., Wayne, P., & Liu, J. (2015). Evidence base of clinical studies on tai chi: A bibliometric analysis. *PLOS ONE*, *10*(3), e0120655. [doi:10.1371/journal.pone.0120655](https://doi.org/10.1371/journal.pone.0120655)










Yildirim, P., Ofluoglu, D., Aydogan, S., & Akyuz, G. (2016). Tai Chi vs. combined exercise prescription: A comparison of their effects on factors related to falls. *Journal of Back and Musculoskeletal Rehabilitation*, *29*(3), 493-501. [doi: 10.3233/BMR-150645](https://doi.org/10.3233/BMR-150645)

Yoo, J., Kim, C., Yim, J., & Jeon, M. (2016). Factors influencing falls in the frail elderly individuals in urban and rural areas. *Aging Clin Exp Res*. *28*(4)687-697. [doi: 10.1007/s40520-015-0469-2](https://doi.org/10.1007/s40520-015-0469-2)

Appendix A

Figure A

CINAHL Database – Search Results Screenshot:

<input type="checkbox"/>	S4	 (fall OR fall prevention OR falls prevention) AND ("Tai Chi" OR "tai ji" OR "Tai Ji quan" OR "Tai Chi Chuan") AND ("elderly" OR "older adult" OR "65+ years" OR "geriatric" OR "Aged 65+" OR "65 years") AND ("fear of falling" OR "fear of falls")	<p>Limiters - Published Date: 20130101-20181231; Human; Age Groups: Aged: 65+ years; Language: English</p> <p>Search modes - Boolean/Phrase</p>	<p> View Results (4)  View Details  Edit</p>
<input type="checkbox"/>	S3	 (fall OR fall prevention OR falls prevention) AND ("Tai Chi" OR "tai ji" OR "Tai Ji quan" OR "Tai Chi Chuan") AND ("elderly" OR "older adult" OR "65+ years" OR "geriatric" OR "Aged 65+" OR "65 years")	<p>Limiters - Published Date: 20130101-20181231; Human; Age Groups: Aged: 65+ years; Language: English</p> <p>Search modes - Boolean/Phrase</p>	<p> View Results (18)  View Details  Edit</p>
<input type="checkbox"/>	S2	 (fall OR fall prevention OR falls prevention) AND ("Tai Chi" OR "tai ji" OR "Tai Ji quan" OR "Tai Chi Chuan")	<p>Limiters - Published Date: 20130101-20181231; Human; Age Groups: Aged: 65+ years; Language: English</p> <p>Search modes - Boolean/Phrase</p>	<p> View Results (40)  View Details  Edit</p>
<input type="checkbox"/>	S1	 fall OR fall prevention OR falls prevention AND tai chi	<p>Limiters - Published Date: 20130101-20181231; Human; Age Groups: Aged: 65+ years; Language: English</p> <p>Search modes - Boolean/Phrase</p>	<p> View Results (2,933)  View Details  Edit</p>

Appendix B

Figure B1

Online Computer Library Center WorldCat – Initial Search Results Screenshot:

The screenshot shows the WorldCat search interface. The search bar contains the query: **kw:"fall OR fall prevention OR falls prevention AND tai chi"**. Below the search bar, the search results are displayed for the query: **Search results for 'kw:"fall OR fall prevention OR falls prevention AND tai chi"' > '2013..2018' > 'English' > 'Non-Juvenile'**. The results are sorted by Relevance and show 1-10 of about 452 results. The first four results are:

- Non-pharmacological management of osteoporosis : exercise, nutrition, fall and fracture prevention** by Mehrsheed Sinaki; Michael Pfeifer; eBook : Document . View all formats and languages > Language: English Publisher: Cham, Switzerland : Springer, [2017] View all editions >
- Evidence map of Tai Chi** by Susanne Hempel; Paul G Shekelle; Stephanie L Taylor; Michele R Solloway; Quality Enhancement Research Initia Department of Veterans Affairs. Health Services Research and Development Service.; West Los Angeles VA Medical Synthesis Program Center, eBook : Document : National government publication Language: English Publisher: Washington, DC : Department of Veterans Affairs, Health Services Research & Development Service, [2014]
- The Gale encyclopedia of nursing and allied health** by Jacqueline L Longe; eBook : Document . View all formats and languages > Language: English Publisher: Farmington Hills, Michigan : Gale, [2018] ©2018 View all editions >
- Adult development and aging** by John C Cavanaugh; Fredra Blanchard-Fields Print book . View all formats and languages > Language: English Publisher: Stamford, CT : Cengage Learning, [2015] ©2015 View all editions >

The left sidebar shows the 'Format' section with 'All Formats (452)' selected, and the 'Refine Your Search' section with 'Author' and 'Year' filters.

Figure B2

Online Computer Library Center WorldCat – Final Search Results Screenshot:

The screenshot shows the WorldCat search interface. The search bar contains the query: **kw:"elderly" OR "older adult" OR "65+ years" OR "geriatric" OR "Aged 65" Search**. Below the search bar, the search results are displayed for the query: **Search results for 'kw:"elderly" OR "older adult" OR "65+ years" OR "geriatric" OR "Aged 65+" AND "Tai Chi" OR "tai ji" OR "Tai Ji Cuan" OR "Tai Chi Chuan" AND "fall prevention" OR "fall intervention" OR "fall" OR "fear of falling" OR "fear of falls" OR "Falls prevention"' > '2013..2018'**. The results are sorted by Relevance and show 1-10 of about 60 results. The first result is:

- Non-pharmacological management of osteoporosis : exercise, nutrition, fall and fracture prevention** by Mehrsheed Sinaki; Michael Pfeifer; eBook : Document . View all formats and languages > Language: English Publisher: Cham, Switzerland : Springer, [2017] View all editions >

The left sidebar shows the 'Format' section with 'All Formats (60)' selected, and the 'Refine Your Search' section with 'Author' and 'Year' filters.

Appendix C

Figure C

[PubMed.gov](#) - Search Results screenshot:

Search	Add to builder	Query	Items found
#6	Add	Search (((("elderly" OR "older adult" OR "65+ years" OR "geriatric" OR "Aged 65+" OR "65 years")) AND ("Tai Chi" OR "tai ji" OR "Tai Ji quan" OR "Tai Chi Chuan")) AND ("fall prevention" OR "fall intervention" OR "fall" OR "Falls prevention" OR "falls")) AND ("fear of falling" OR "fear of falls") Filters: published in the last 5 years; Humans; English; Aged: 65+ years	7
#5	Add	Search (((fall) OR falls) AND prevention) AND tai chi Filters: published in the last 5 years; Humans; English; Aged: 65+ years	52
#4	Add	Search (((fall) OR falls) AND prevention) AND tai chi Filters: published in the last 5 years; Humans; Aged: 65+ years	54
#3	Add	Search (((fall) OR falls) AND prevention) AND tai chi Filters: published in the last 5 years; Humans	66
#2	Add	Search (((fall) OR falls) AND prevention) AND tai chi Filters: published in the last 5 years	78
#1	Add	Search (((fall) OR falls) AND prevention) AND tai chi	216

Appendix D

Figure D1

ScienceDirect - Initial Search Results Screenshot:

The screenshot shows the ScienceDirect search interface. At the top left is the ScienceDirect logo. On the right, there are navigation links for Journals, Books, Register, and Sign in, along with a help icon and the ASU Library logo (Arizona State University). The search bar contains the query "fall OR fall prevention OR falls prevention AND tai chi" with a search icon. Below the search bar, filters for Year (2013-2018) and Advanced search are visible. The results section shows 290 results, with options to download selected articles or export, and a sorting option set to relevance | date.

Figure D2

ScienceDirect - Final Search Results Screenshot:

The screenshot shows the ScienceDirect search interface with refined results. The search bar contains the query "'Tai Chi' OR 'tai ji' OR 'tai Ji quan' OR 'Tai Chi Chuan' AND 'fall' OR 'fall prevention'". The results section shows 1,740 results. On the left, there are filters for Years (2013-2018) and Article type (Review articles, Research articles). The main results list includes:

- Preventing falls with Tai Ji Quan: A public health perspective
Open access, Review article
Journal of Sport and Health Science, Volume 3, Issue 1, March 2014, Pages 21-26
Judy A. Stevens, Alexander Voukelatos, Heidi Ehrenreich
Download PDF (358 KB) Abstract Export
- The effect of Chinese martial arts Tai Chi Chuan on prevention of osteoporosis: A systematic review
Open access, Review article
Journal of Orthopaedic Translation, Volume 12, January 2018, Pages 74-84
Tsz Ho Chow, Bo Yee Lee, Adrian Bing Fung Ang, Veronica Yi Ki Cheung, ... Saori Takemura
Download PDF (242 KB) Abstract Export
- Tai Ji Quan, the brain, and cognition in older adults
Open access, Review article
Journal of Sport and Health Science, Volume 3, Issue 1, March 2014, Pages 36-42
Yu Kai Chang, Yu Huiyan Nian, Ai Guo Chen, Liu Yan

Appendix E

Figure E1

Springer Link -Initial Search Results Screenshot:

The screenshot shows the Springer Link search interface. The search bar contains the query: "fall AND OR AND fall AND prevention AND OR AND falls AND prevention AND AND AND tai AND chi". The results show 568 results for this query within English, filtered for the years 2013-2018. The interface includes a search bar, navigation links (Home, Contact Us), a filter for "Include Preview-Only content", and a "Refine Your Search" section with a table for "Content Type".

Content Type	
Article	346
Chapter	203

Sort By: Relevance | Date Published | Page 1 of 29

Show documents published between 2013 and 2018 (Available 1891 - 2018)

Figure E2

Springer Link – Final Search Results Screenshot:

The screenshot shows the Springer Link search interface. The search bar contains the query: "'Tai AND Chi' AND OR AND 'tai AND ji' AND OF 'Tai AND Chi AND Chuan' AND AND AND 'fall' AND OR AND falls AND AND AND 'prevention' AND AND AND 'fear AND of AND falling' AND OR AND 'fear AND of AND falls'". The results show 11 results for this query within English, filtered for the years 2013-2018. The interface includes a search bar, navigation links (Home, Contact Us), a filter for "Include Preview-Only content", and a "Refine Your Search" section with a table for "Content Type".

Content Type	
Article	9
Chapter	2

Sort By: Relevance | Date Published | Page 1 of 29

Show documents published between 2013 and 2018 (Available 1997 - 2016)

Appendix F

Figure F1

Cochrane Library – *Initial Search Results Screenshot:*

Cochrane Library Trusted evidence. Informed decisions. Better health. [Log in / Register](#)

Search Search Manager Medical Terms (MeSH) Browse

Search All Text "fall" **Go** **Save**

OR Search All Text fall prevention [Add to Search Manager](#)

OR Search All Text falls prevention

ANC Search All Text "Tai Chi"

[Search Limits](#) [Search Help](#) Publication Year from 2013 to 2018 (Word variations have been searched) [Clear limits](#)

Clear

All Results (6863) **Cochrane Database of Systematic Reviews : Issue 4 of 12, April 2018**

Cochrane Reviews (1706) Issue **updated daily** throughout month

All

Review

There are **1706** results from **10250** records for your search on "'fall" or fall prevention or falls prevention and "Tai Chi" , Publication Year from 2013 to 2018 in Cochrane Reviews'

Figure F2

Cochrane Library – *Final Search Results Screenshot:*

Wiley Online Library

Cochrane Library Trusted evidence. Informed decisions. Better health. [Log in / Register](#)

Search Search Manager Medical Terms (MeSH) Browse

Search All Text "fall" **Go** **Save**

ANC Search All Text "prevention" [Add to Search Manager](#)

ANC Search All Text "fear"

ANC Search All Text "Tai Chi"

OR Search All Text "Tai Ji" [Do you want to add more lines?](#)

[Search Limits](#) [Search Help](#) Publication Year from 2013 to 2018 (Word variations have been searched) [Clear limits](#)

Clear

All Results (218) **Cochrane Database of Systematic Reviews : Issue 4 of 12, April 2018**

Cochrane Reviews (43) Issue **updated daily** throughout month

All

There are **43** results from **10250** records for your search on "'fall" and "prevention" and "fear" and "Tai Chi" or "Tai Ji" , Publication Year from 2013 to 2018 in Cochrane Reviews'

Appendix G

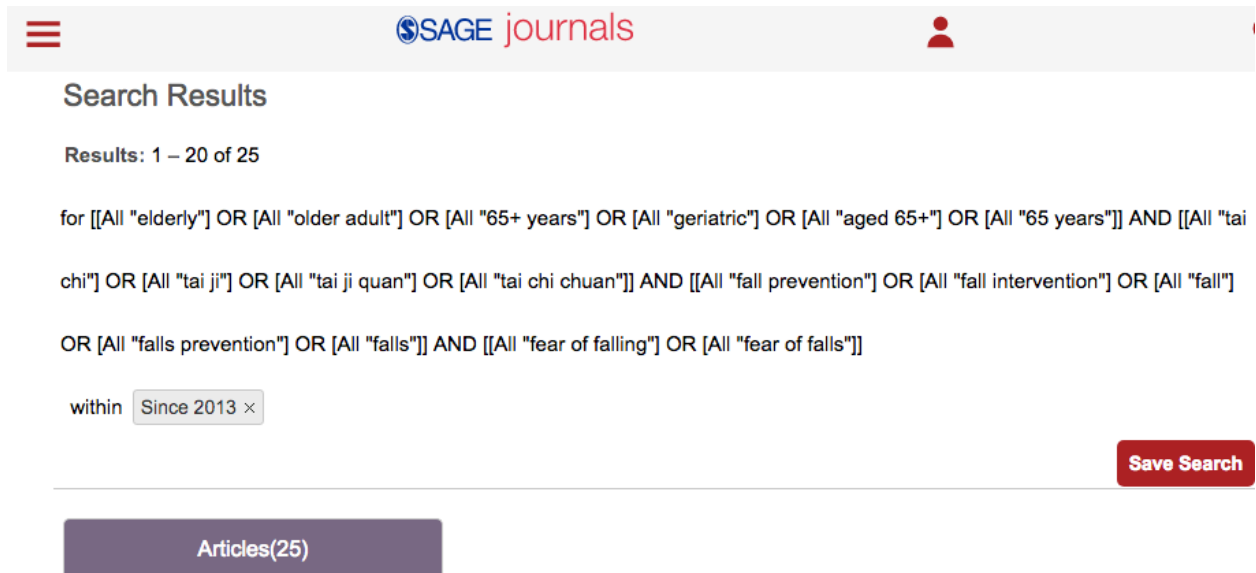
Figure G1

SAGE journals – Initial Search Results Screenshot:



Figure G2

SAGE journals – Final Search Results Screenshot:



Appendix H

Figure H

ProQuest: Medline – Search Results Activity Screenshot:

ProQuest 🔄 📁 👤

All databases > Health & Medicine databases > | Change databases

Basic Search Advanced Search About

Recent Searches

To save a search, select **Save search** from the **Actions** menu. [Learn more](#)

Combine searches: Search [Search tips](#)

Examples: 1 AND 3 or "6"
(1 AND 3) OR (1 AND 2)
3 NOT treatment

Items selected: 0 ✖ Delete Save Show all details 📄 Export all searches ▼

	Set ▼	Search	Databases	Results	Actions ▼
<input type="checkbox"/>	S5	Ⓜ "Tai Chi" OR "Tai Ji" OR "Tai Ji Quan" OR "Tai Chi Chuan" AND "fall" OR falls AND "prevention" AND "fear of falling" OR "fear of falls" ✓ Limits applied	MEDLINE®	939*	Actions ▼
<input type="checkbox"/>	S4	Ⓜ "Tai Chi" OR "Tai Ji" OR "Tai Ji Quan" OR "Tai Chi Chuan" AND "fall" OR falls AND "prevention" AND "fear of falling" OR "fear of falls" ✓ Limits applied	MEDLINE®	952*	Actions ▼
<input type="checkbox"/>	S3	Ⓜ fall OR (fall prevention) OR (falls prevention) AND (tai chi) OR (tai ji) OR (tai chi chuan) OR (tai ji quan) AND (fear of falling) ✓ Limits applied	MEDLINE®	11,261*	Actions ▼
<input type="checkbox"/>	S2	Ⓜ fall OR (fall prevention) OR (falls prevention) AND (tai chi) ✓ Limits applied	MEDLINE®	11,261*	Actions ▼
<input type="checkbox"/>	S1	Ⓜ fall OR fall prevention OR falls prevention AND tai chi	MEDLINE®	238,404*	Actions ▼

* Duplicates are removed from your search, but included in your result count. ⓘ

* Duplicates are removed from your search and from your result count.

Appendix I

Table 1

Quantitative Evaluation Table:

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
Bubela, D., Sacharko, L., Chan, J., & Brady, M. (2017). Balance and functional outcomes for older community-dwelling adults who practice tai chi and those who do not.	Inferred: social cognitive therapy	Design: A quasi-experimental comparative pre- and post- test design purpose: This study considers the effects of community-based Tai Chi programs on participants' gross motor ability in areas known to contribute collectively to fall risk, namely, strength, balance, functional mobility, and fear of falling.	IG: Tai Chi = 16 CG: no TC n =group of 14 adults, (SD) age = 71.2 (6.1) years Sample: Subjects had to be community dwelling and English-speaking, 55 years or older, who ambulated independently w/ or w/o an	IG: TC Training Group AR: 100% CG: no TC AR: 93% IV1: Age DV1: functional strength DV2: Mobility DV3: Balance DV4: Fear of Falling	Pre- & post- test measures of: DV1: <ul style="list-style-type: none"> handheld dynamometry (HHD) knee extension strength five-time sit to stand (FTSTS) DV2: <ul style="list-style-type: none"> Timed Up and Go [TUG] test & Fifty-Foot Walk Test) DV3: <ul style="list-style-type: none"> Functional Reach & Berg Berg Balance Scale DV4:	<ul style="list-style-type: none"> SPSS15 with an α level of .05 Cohen's d values were calculated to determine the effect sizes of changes Comparison of the 2 groups over the training period through mixed ANOVA 2x2 mixed analysis of variance 	Age: (SD) age of persons participating in the Tai Chi group was 80.4 (6.8) years, (P = .00), (SD) = 71.2 (6.1) years. Balance - Knee Strength: IG compared to CG, significant differences in the right knee extension strength (P = .042) & mod es & observed power ($\eta^2 =$	S: LOE: I <ul style="list-style-type: none"> TC significantly increasing force production & improves functional lower extremity strength in older adults The results of this study support the CDC's endorsement of Tai Chi as a means of fall prevention in older community-dwelling adults. W: <ul style="list-style-type: none"> limitations in both sample and design. Sample size of both groups were small –

Key: α – alpha; **ABC / ASBS** – Activity-specific balance confidence; **AE** - adverse events; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Longterm ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Shortterm; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			assistive device. Setting: local senior citizen center		<ul style="list-style-type: none"> • ABC 		0.183; observed power = 0.543). Confidence: IG vs CG: (P = .022) & modes and observed power ($\eta^2 = 0.217$; observed power = 0.656).	lack of randomization and use of convenience sampling led to the creation of groups with characteristics
Gallant, M., Tartaglia, M., Hardman, S., & Burke, K. (2017). Using Tai Chi to Reduce Fall Risk Factors Among Older Adults: An evaluation of a community-based	Inferred: descriptive theory	Design: A quasi-experimental comparative pre- and post- test design Purpose: to examine the effectiveness of the shorter 12-week TCMBB program when taught by trained community members, instead of experienced instructors.	N= 131 individuals n= 126 completed Evaluated pre&post: 97 AR= 92.3% Sample: community dwelling adults aged 65 and above, who could walk with ease with or without	IV1: age IV2: sex IV3: race/ethnicity IV4: Ed. IV5: Income IV6: Chronic Conditions DV1: Fall-related Measures DV2: Functional mobility & Balance	<ul style="list-style-type: none"> • IV1-5: self-report • IV6: Health background DV1: <ul style="list-style-type: none"> • self-reported fall history • FoF • <i>Monthly Falls</i> • Recent falls (w/i 6 mo's) DV2 <ul style="list-style-type: none"> • TUG • Functional reach • Activities-specific balance scale scores 	<ul style="list-style-type: none"> • SPSS:23 • <u>Chi-square and two-tailed t-tests</u> • Cronbach's alpha: .04 • <u>Wilcoxon signed rank test</u> 	<ul style="list-style-type: none"> • Timed Up and Go (p < .001) • Functional Reach (p < .01) • ABC scores (p < .01) 	S: LOE: <ul style="list-style-type: none"> • There were significant pre-post improvements in all outcome variables. W: <ul style="list-style-type: none"> • There was not a significant difference of fall rates between the before and after groups. • FoF: _____??

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC Tai Chi**; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
implementa tion.			assistive devices. Of the total group of 131 participants, 126 (96%) participated in the evaluation procedures, and complete pre–post data were obtained from 97 (77%) of these participants. Setting: nine programs were held in two senior centers, two community/r ecreation centers, and	DV3: Confidence	DV3: ABC scale			

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC Tai Chi**; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			two assisted living/senior housing facilities in three counties across New York state.					
Hu, Y.N., Chung, Y.J., Yu, H.K., Chen, Y.C., Tsai, C.T., & Hu, G.C. (2016). Effect of tai chi exercise on fall prevention in older adults: Systematic review and meta-analysis of randomized controlled trials	Inferred: predictive theory	Design: SR and MTA Purpose: To synthesize the latest trial reports with the older data, we have performed this systematic review and meta-analysis of all randomized controlled trials of the effectiveness of Tai Chi on the risk of falls among older adults.	N= 10 studies n= 2850 total participants IGs= 1540 CGs= 1310 *sample sizes ranging from 59 to 684 participants. * mean age of all participants: 68-84 years. IC: (1) the type of trial was a randomized	IV1: DI <6mo IV2: DI >6mo IV3: TC style: Sun IV4: TC style: Yang DV1: effect of Tai Chi exercise on the risk of falls in older adults DV2: risk of falls (portrayed by odds ratio)	<ul style="list-style-type: none"> • PEDro Scale: • <u>Physio-therapy Evidence Database scale.</u> 	Forest Plots <u>Random effects meta-analysis</u>	<ul style="list-style-type: none"> • In the two subgroups, the effect of Tai Chi exercise on prevention of fall risks were 0.80 (95% CI, 0.66 to 0.96; <6 months) and 0.52 (95% CI, 0.38 to 0.71; 6 months). Then, the trials were grouped according to the Tai Chi style used. The effect of 	S: LOE: I <ul style="list-style-type: none"> • TC has a significant protective effect on fall risk among older adults. • W: <ul style="list-style-type: none"> • potential incompleteness of the evidence reviewed. • data for outcome measures were self-reported [subj. to bias] • lack of training variables as a subgroup

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			controlled trial (2) participants were older adults (age \geq 65 yrs); (3) one of the interventions was a form of Tai Chi exercise training (4) the outcomes included falls EC: $<$ 6 on PEDro score was cutoff for high-quality studies				Tai Chi exercise on the prevention of fall risks was measured as 0.57 (95% CI, 0.33 to 0.99) for the Yang style, 0.79 (95% CI, 0.62 to 0.99) for the Sun style, and 0.68 (95% CI, 0.50 to 0.93) for the modified or unspecified style • TC showed a significant reduced risk of falls (odds ratio $\frac{1}{4}$ 0.70; 95% confidence interval, 0.59 to 0.84).	

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
Lomas-Vega, R., Obrero-Gaitán, E., Molina-Ortega, F. J., & Del-Pino-Casado, R. (2017). Tai chi for risk of falls. A meta-analysis	Inferred: predictive theory	Design: SR and MTA Purpose: To analyze the effectiveness of tai chi for falls prevention	N= 10 RCTs PC: Older adult population and at-risk adults. The age of participants ranged from 56 to 98 years old. IC: (1) randomized controlled trials (RCTs) (2) analyzing the effect of tai chi (not combined with other intervention) (3) on incidence of falls, incidence of injurious	IV: time points DV1: incidence of falls, short term (<12mo) DV2: incidence of falls, long-term (>12mo) DV3: incidence of injurious falls, short-term DV4: incidence of injurious falls, long-term DV5: Time to first fall	<ul style="list-style-type: none"> • GRADE – measured quality of evid. DV: <ul style="list-style-type: none"> • incidence rate ratio (IRR) for falls incidence • hazard ratio (HR) for time to first fall. 	random-effects model for estimating pooled effects Publication bias was assessed using a funnel plot The Q test was used for heterogeneity analysis and was completed by calculating the degree of inconsistency (I^2) Comprehensive Meta-analysis Software 3.3.070	<ul style="list-style-type: none"> • fall incidence ST: (IRR = 0.57; 95% CI = 0.46, 0.70) • Small protective effect over the long term (IRR = 0.87; 95% CI = 0.77, 0.98) 	S: LOE: I <ul style="list-style-type: none"> • In at-risk adults and older adults, tai chi practice may reduce the rate of falls and injury-related falls over the short term (<12 months) by approximately 43% and 50% W: <ul style="list-style-type: none"> • Tai chi practice may not influence time to first fall in these populations. • Low quality evidence used • The most relevant shortcoming in this evaluation was a high risk of attrition bias in two studies and in the long-term follow-up of one study.

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			falls or time to first fall (4) compared to usual care or other therapies different from tai chi EC:			pooled effect was estimated using the trim and fill method		
Plummer, M., Bradley, C. (2017). Tai chi as a falls prevention strategy in older adults compared to conventional physiotherapy exercise: A review	“The PICOS framework (Population, Intervention, Comparison, Outcome and Study) was used”	Design: SR and MTA Purpose: 1. To clarify for which population Tai Chi is most effective 2. To identify the optimal type, duration and intensity of Tai Chi for falls prevention 3. To confirm whether Tai	N= 4 RCTs included in MTA IC: ■ Published between 2005 and 2015 ■ Published worldwide but written in the English language ■ Randomised controlled trials (RCTs)	IV1: Population IV2: tai chi type IV3: duration IV4: intensity DV1: falls incidences DV2: mobility DV3: balance DV4: functional status/disability	<ul style="list-style-type: none"> • DV1: incidence rate ratio (IRR) • DV2: Performance Orientated Mobility Assessment Scores (POMA) • DV3: Berg Balance Score • DV4: <ul style="list-style-type: none"> - Groningen Activity Restriction Scale (GARS) - Physical Performance Scores (PPS) 	DV5: The methodological quality of the four papers included in this review was assessed using the CASP tool for RCTs.	Only ¼ of the studies produced sig effects in favor of Tai Chi for fall prevention. Variation in falls incidences across RCTs may be due to Tai Chi style/delivery methods, with all authors using a different form of Tai Chi.	S: LOE: I <ul style="list-style-type: none"> • There is some evidence for positive effects in pre-frail individuals; however, more research is needed to confirm this W: although Tai Chi is effective for reducing falls in the population aged 65 and over, the body of evidence does not conclude this effect to be significant.

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
		Chi is more effective in falls prevention than current physiotherapy programmes and therefore become a more inherent aspect of falls prevention programmes.	<ul style="list-style-type: none"> ■ Male and female participants aged 65 years and over ■ Compares Tai Chi to conventional physiotherapy ■ Measures a reduction in falls as an outcome. 	DV5: methodological Quality Appraisal	<ul style="list-style-type: none"> • DV5: Critical Appraisal Skills Programme (CASP) tool • hazard ratio (HR) for time to first fall. 			<ul style="list-style-type: none"> ■ Although a worldwide search was conducted, only articles written in English language were included in the search criteria, limiting the body of evidence to be appraised ■ A search of unpublished research was not conducted, which again may limit the validity of this review.
Solloway, M., Taylor, S., Shekelle, P., Miakel-Lye, I., Beroes, J., Shanman, R., & Hempel, S. (2016). An	Inferred: explanatory theory	<p>Design: SR of SRs</p> <p>Purpose: In order to provide a broad overview of the research evidence that has been published to date, we conducted a systematic review of systematic</p>	<p>N= 107 SRs N=5 SRs focused on BC/FOF</p> <p>IC: * Systematic reviews of the effects of Tai Chi for any clinical</p>	<p>IV: healthcare-related settings</p> <p>DV1: patient health outcomes</p> <p>DV2: duration and</p>	<ul style="list-style-type: none"> • Evidence Map • Bubbleplot • PRISM checklist 	• Meta-Analysis	<ul style="list-style-type: none"> • 15/107 SRs were regarding Fall prevention • 27/107 SRs were regarding balance • 42 % reported on the presence or 	<p>S: LOE: I?</p> <p>W:</p> <ul style="list-style-type: none"> • 42% reported on the presence or absence of adverse events • firm conclusions cannot be drawn due to

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
evidence map of the effect of Tai Chi on health outcomes		reviews of the effects of Tai Chi on health outcomes	indication were eligible for inclusion. *Systematic reviews of adult participants or unspecified age groups regardless of their health status were eligible for inclusion in the review EC: -systematic reviews exclusively focusing on children and adolescents - Systematic reviews of provider outcomes,	follow-up point DV3:			absence of adverse events • “Five systematic reviews focused on balance confidence/fear of falling and the largest included six RCTs. One reported a positive effect for Tai Chi compared to usual care, exercise, or education (SMD 0.47; 95 % CI 0.30, 0.63; 4 RCTs)”	methodological limitations in the original studies and/or an insufficient number of existing research studies. • evidence maps cannot provide definitive answers about the effectiveness of an intervention.

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			acceptance, prevalence, use, costs, study design features, or intervention features not reporting patient health outcomes					
Wayne, P., Berkowitz, D., Litrownik, D., Buring, J., & Yeh, G. (2014). What do we really know about the safety of tai chi?: A systematic review of adverse event reports in randomized trials	Inferred: Prescriptive theory	Design: SR Purpose: evaluate the frequency and type of AE occurrences in randomized controlled trials (RCTs) of TC for all populations. A secondary aim is to evaluate the consistency and quality of AE monitoring protocols used in the included trials.	N= 50 RCTs n= PC: avg. age of study participants was 65 years old (median 69 y; range, 11-102y) IC: RCTs that were published in English and used TC as an intervention.	IV1: Study Focus IV2: Intervention type DV1: AEs reported DV2: AEs not reported DV3: AE monitoring protocol	<ul style="list-style-type: none"> • AE reporting protocol: CONSORT Extension checklist of 10 rec's when reporting harms in RCTs • Systematic searching by the 2 authors 	Descriptive stat's	<ul style="list-style-type: none"> • 18/50 reported detailed synthesis of safety • 0/50 reported serious AEs • 15/50 minor aches/pains of lower ext's • 6/50 reported back/spine pain, of which one was severe • 100 (65%) included no mention of either AE 	S: LOE: I <ul style="list-style-type: none"> • Based on a small number of less-biased studies, TC is unlikely to result in serious AEs, • Reported AEs were typically minor and expected and primarily musculoskeletal related (eg, knee and back pain) • no intervention-related serious AEs were reported W:

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			EC: no monitoring protocol or adverse events listed				monitoring protocols or AE reports, • additional 3 studies only mentioned an AE protocol but no AE report. • Of the 50 eligible studies that included an explicit AE report • only 18 trials included an explicit monitoring protocol, which provides a more reliable framework for interpreting the validity of AE reports.	<ul style="list-style-type: none"> only included trials published in the English language. study only used descriptive statistics and narrative summaries of AE reports d/t the small number of studies and the heterogeneity of both interventions & controls
Wu, Y., Macdonald, H., &	Inferred: Predictive Theory	Design: SR	N= 26 RCTs n= 3247 participants	IV1: Ex Rx Methods	• IV1: Ex Rx Methods	• Downs & Black checklist	• Reporting rate of mov't principles	S: LOE: I

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC Tai Chi**; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
Pescatello, L. (2016). Evaluating Exercise Prescription and Instructional Methods Used in Tai Chi Studies Aimed at Improving Balance in Older Adults: A Systematic Review		Purpose: To develop an evaluation instrument to determine to what extent Tai Chi interventions aimed at imp. the balance of older adults disclosed their exercise prescription (Ex Rx) and instructional methods and met best-practice exercise recommendations for balance imp.	(mostly women) 27 interventions identified/ reviewed CG: 1613 IG: 1634 PC: participants aged 60 and older w/o debilitating disease EC: •not RCTs (n=23) •Participant s had severe debilitating disease (n=8) •Article was not published	IV1 Defined: Integration of the components of freq., intensity, time, type, volume, & progression principle for TC practice IV2: Instructional Methods of TC IV2 Defined: Dev. To determine to what extent TC interventions aimed at imp. The balance of older adults	1. Freq. of Tai chi practice (sessions/week) 2. Time or duration of each TC session 3. Length of TC intervention (weeks) • IV2: Instructional Methods Evaluation Tool (TaCIE) - Fundamental to TC practice - Specific to TC practice - Modifiable/controllable in TC intervention	(augmented version): used for methodologic al study quality assessment • SPSS 21 • 2-tailed sig. level was (P</.05) • Descriptive Stat's Unpaired t-tests	marginally correlated w/ balance imp's s/p TC (r=0.35, P=.08) • The mean reporting rate for the IV1 was (92.6+/-19.2%) • Mean reporting rate for IV2 (41.1+/-18%) • P<.001	• Balance was significantly improv. In 19/27 interventions W: • Intervention features specific to IV2 were poorly reported and weren't customized for the purpose of balance improv.

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; TC Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			in English (n=4) • Tai Chi combined w/ other tx's (n=4) • Reports used same experimental data (n=4) • Purpose was not balance improvement (n=4) • Non-tai chi exercise (n=2)	DV1: Balance				
Yang, G., Wang, L., Ren, J., Zhang, Y., Li, M., & Zhu, Y. Luo, J.,	Inferred:	Design: SR Purpose: "to systematically summarize all available clinical	N=507 n=464	IV1: TC IV2: Chronic Disease(s)	Data Extraction: • 2 authors (GYG & JPL) designed a structured data extraction form:	• SPSS 17.0	• (94.1%) reported positive effects of TC • 5.1% studies reported	S: • majority of studies found positive effects of TC (477/507, 94.1%) • 20/460 studies had no drop outs or withdrawals

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; TC Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
Cheng, Y., Li, W., Wayne, P., & Liu, J. (2015). Evidence base of clinical studies on tai chi: A bibliometric analysis.		evidence on Tai Chi... to provide current state of evidence in support of the application of Tai Chi for healthcare, and to identify limitations and priorities for further clinical research.”	Many practiced 2-3 1 hr sessions/week for 12 weeks	DV1: Psychological Outcomes DV2: Satisfaction DV3: compliance Dv4: safety Dv5 physical performance	<ul style="list-style-type: none"> • (1) Pub. info., including: <ul style="list-style-type: none"> - Pub. yr, - study design, - language, - country, - funding • Dis./cond.: <ul style="list-style-type: none"> - Studies about disease prevention, health pro. or preservation were specially recorded. • Tai Chi intervention: <ul style="list-style-type: none"> -Styles -method of learning & practicing -qual’s of Tai Chi instructors. • If Tai Chi was applied in 		uncertain effects <ul style="list-style-type: none"> • 0.8% studies reported negative effects. • No serious adverse events related to TC were reported. 	W: <ul style="list-style-type: none"> • 46 studies (46/507, 9.1%) reported incidence of health-related events (i.e. falls, fracture, angina & others) • Some bias in testing the effects of TC on sampling that is primarily healthy

Key: *α* – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
					combination with other therapies, • Outcomes & overall conclusions: -All outcomes were extracted directly, then classified into different categories. If quality of life was reported, the measurement was also extracted if available. -overall authors' conclusions (positive, negative or unclear).			
Yildirim, P., Ofluoglu, D., Aydogan,	Inferred: prescriptive theory	Design: RCT= single-blind Purpose:	n=60 PC: Sixty older Turkish adults aged	IV1: Group 1	• all participants were evaluated using general systemic	• SPSS 15.0 • Chi-square test: analyze differences	• A total of 48 participants completed the study	S: LOE: II • It can be concluded that Tai Chi may be a more

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
S., & Akyuz, G. (2016). Tai Chi vs. combined exercise prescription : A comparison of their effects on factors related to falls		To compare the effect of Tai Chi and combined exercise prescription that consists of three main components of an exercise prescription on static balance, dynamic balance, fear of falling and mood.	55–76 were randomly assigned to: *Group 1- Tai Chi exercise *Group 2 - CEP AR = 20% DI : Exercise was performed three times a week over a period of 12 weeks. Setting : Style: Yang-Style TC IC : cognitively intact, older than 55 y/o, and had never been in any exercise	IV1 Defined: Tai Chi IV2: Group 2 IV2 Defined: CEP DV1: Dynamic Balance DV2: SLS-EO measurements DV3: SLS-EC measurements DV4: SAFFE measurements DV5: GDS measurements	examination of the cardiovascular, neurological, and musculoskeletal system. Body weight and height were also measured for each subject • Pre- & post- test questionnaire Single Leg-Stance-Eyes Open (SLS-EO) • Single Leg-Stance Eyes Closed (SLS-EC) • computerized balance assessment/measurements (CBA) • Timed Up and Go (TUG) test	between the two groups for demographic data. • Kolmogorov-Smirnov: normality of continuous variables. • Wilcoxon test: intragroup comparisons • Mann-Whitney U test: comparison of data obtained	➤ 27 in Group 1 ➤ 21 in Group 2 • SLS-EO ($p < 0.05$), SLS-EC ($p < 0.05$), BBS ($p < 0.05$), & TUG ($p < 0.05$). • statistically significant improvements in the SAFFE, BDS, & GDS scores between the before & after in Group 1 (all $p < 0.05$). • In Group 2, only significant differences in BBS & TUG scores between	successful exercise intervention for factors-related to falls in older people W : • a short intervention follow-up period and the lack of a third control group not assigned to an exercise program

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; TC Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
			program including Tai Chi in the six months prior to the intervention	DV6: BDS measurements	<ul style="list-style-type: none"> • Berg Balance Scale (BBS) • Survey of Activities and Fear of Falling in the elderly (SAFFE) • Geriatric Depression Scale (GDS) • Beck Depression Scale (BDS) 		before & after the training evaluation ($p < 0.05$). <ul style="list-style-type: none"> • scores in all other clinical balance, fear of falling, & mood scales did not improve compared to the baseline in Group 2 (all $p < 0.05$). • No sig. difference between the 2 groups at the beginning of the study for the assessment values for both eyes-opened & closed ($p > 0.05$). After training, only 	

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Citation:	Theory/ Conceptual Framework	Design/Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis (stats used)	Findings/ Results	Decision for practice
							mild improv's in Group 1 – but not statistically significant ($p > 0.05$). • Group Comparison of balance control, fear of falling, & mood parameters: a sig. difference observed in Group 1 for SLS-EO ($p < 0.05$) & SAFFE scores ($p < 0.05$) • There were no serious adverse events reported	

Key: α – alpha; **ABC** – Activity-specific balance confidence; **AE** - adverse events; **BC** – balance confidence; **CBS** - community-based setting; **CEP** – Combined Exercise Prescription; **CCT** - clinically controlled trial; **CG** - control group; **DI** - duration of intervention; **DV** - dependent variable; **EC** - exclusion criteria; **ES** – effect size; **IG** - intervention group; **IC** - inclusion criteria; **IV** - independent variable; **FoF** - Fear of Falling; **LOE** – Level of Evidence; **LT** – Long-term ; **mo** - month(s); **MTA** - meta analysis; **N** - number of studies; **n** - number of participants; **PC** - population characteristics; **RCT** - randomized control trial; **S** - strengths; **SD** – standard deviation **SR** - systematic review; **ST** – Short-term; **TC** Tai Chi; **TCMBB** -Tai Chi: Moving for Better Balance; **TUG** – Timed Up & Go test; **Tx** – treatment; **W** - weaknesses

Appendix J

Table 2

Synthesis Table:

Studies		Bubela, D., et al.	Gallant, M., et al.	Hu, Y. N., et al.	Lomas-Vega, R., et al.	Plummer, M., et al.	Solloway, M., et al.	Wayne, P., et al.	Wu, Y., et al.	Yang, G., et al.	Yildirim, P., et al.
Study Design	Year	2017	2017	2016	2017	2017	2016	2014	2016	2015	2016
	LOE	IV	IV	I	I	I	I?	I	I	I	II
	Design	Quasi-XP	quasi-XP	SR & MTA	SR & MTA	SR	Evidence Map of SRs	SR	SR	SR?	RCT
	Studies Reviewed	n/a		10	10	4 rcts	107 SRs	153 RCTs	26 RCTs	507	n/a
	Length (weeks)	16	12	6-12mo	12-26	n/a	n/a	6-52	19.7	~12	12
	Length of Class (hrs)	n/a	n/a	n/a	1	n/a	n/a	20-120 min	56.5 min.	~1-2	
	Freq/week	n/a	n/a	n/a	1-3	n/a	n/a	1-5	2.8	~2-3	3
	Community-based			x	x	n/a	n/a	x	x		
	Measured AEs			-	x		n/a	33%		x	x
	Bias	X	Poss.	x	3.4%	n/a	n/a	-			
Sample	Sample Size	16/14	131	2850	1432	1383	n/a		3247		60
	Mean Age (years)	80.4/71.2		68-84	56 to 98		n/a	65			62.37/63
Measured	Neg. Events			0		n/a	n/a			0.8%	0
	ASBCS	x	x								
	BBS	X									x
	BDS										x
	Fall Incidence				X	x					
	Fear of Falling	X									x
	FFWT	x									

Key: **0** – No change; **ASBCS** – Activity-Specific Balance Confidence Scale; **BBS** – Balance Berg Scale; **BDS** – Beck Depression Scale; **FFWT** – Fifty-Foot Walk Test; **GARS** - Groningen Activity Restriction Scale; **GDS** - Geriatric Depression Scale; **LOE** - Level of evidence; **PPS** - Physical Performance Scores; “/” - indicates that study did not mention; **SLS-EC** – Single leg stance eyes closed; **SLS-EO** - Single Leg-Stance-Eyes Open; **POMA** - Performance Orientated Mobility Assessment Scores; **SAFFE** - Survey of Activities and Fear of Falling in the elderly; **TC** – Tai Chi; **TCMBB** - TC Moving for Better Balance **TUG** – Timed up & go; **X** - Indicates yes;

	Five-time Sit to Stand	x								
	Functional Reach	X	x							
	GARS					X				
	GDS									x
	Knee Extension Strength	x								
	PPS					X				
	SAFFE									x
	SLS-EC									x
	SLS-EO									x
	Time to first fall				X					x
	TUG	x	X							x
Outcomes	Balance					-	x			inc
	Confidence	Inc.	Inc.	Inc			x			Inc.
	Fall Rate		0		-	-				
	Mobility		Inc			-				
	Strength	Inc.	Inc				x			
	Other...			X	X					X
	Sig. Adverse Events - reported			0	0			X		0

Key: **0** – No change; **ASBCS** – Activity-Specific Balance Confidence Scale; **BBS** – Balance Berg Scale; **BDS** – Beck Depression Scale; **FFWT** – Fifty-Foot Walk Test; **GARS** - Groningen Activity Restriction Scale; **GDS** - Geriatric Depression Scale; **LOE** - Level of evidence; **PPS** - Physical Performance Scores; “/” - indicates that study did not mention; **SLS-EC** – Single leg stance eyes closed; **SLS-EO** - Single Leg-Stance-Eyes Open; **POMA** - Performance Orientated Mobility Assessment Scores; **SAFFE** - Survey of Activities and Fear of Falling in the elderly; **TC** – Tai Chi; **TCMBB** - TC Moving for Better Balance **TUG** – Timed up & go; **X** - Indicates yes;

Appendix K

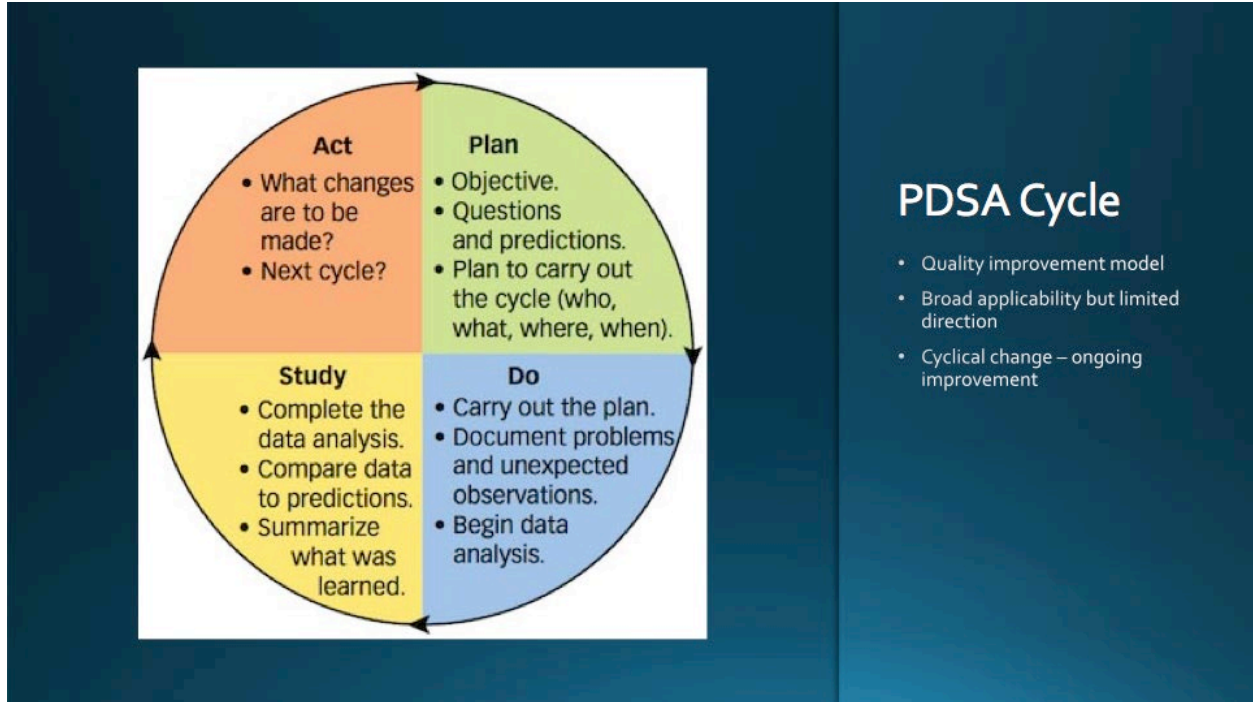


Fig. 1. Walter Stewart’s PDSA Cycle – Contains 4 stages: Plan, Do, Study, Act (Crawford, 2018).

Appendix L

MONTREAL COGNITIVE ASSESSMENT (MOCA-B)		ID: !!!!!!!!!!!!!!!	
BASIC		*%& !!!!! *(\$!!!!!)+,-./0 !!! 1"-.\$ "#\$%& !!!!! (1)* %*-\$.\$) /0 !!!!!!!!!!!!!!!	
EXECUTIVE FUNCTION		SCORE	START TIME
		(/1)	
IMMEDIATE RECALL	ROSE CHAIR HAND BLUE SPOON	No point	
Perform 2 trials even if 1 st trial is successful	1 st trial		
	2 nd trial		
FLUENCY	Name maximum numbers of FRUITS in 1 minute	N	Items
1..... 2..... 3..... 4..... 5..... 6.....		2 points if N=13 or more	
7..... 8..... 9..... 10..... 11..... 12.....		1 point if N=8-12	
13..... 14..... 15..... 16..... 17..... 18.....		0 point if N=7 or less	
		(/2)	
ORIENTATION	<input type="checkbox"/> time (± 2 hr) <input type="checkbox"/> day <input type="checkbox"/> month <input type="checkbox"/> year <input type="checkbox"/> place <input type="checkbox"/> city	(/6)	
CALCULATION	Provide 3 ways to pay using 1 dollar coins, 5 dollar and 10 dollar bills for an object that costs exactly \$3.00 (3 points if 3 ways, 2 points if 2 ways, 1 point if 1 way, 0 point if no correct way)	(/3)	
1. 2. 3.			
ABSTRACTION	To what category these objects belong? (e.g. orange - banana = fruit) <input type="checkbox"/> train - boat <input type="checkbox"/> north - south <input type="checkbox"/> drum - flute	(/3)	
DELAYED RECALL	ROSE CHAIR HAND BLUE SPOON	(/5)	
Recall with No cue	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Recall with category cue	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
Recall with multiple choice cue	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		
VISUOPERCEPTION	scissors T-shirt banana lamp candle watch cup leaf key spoon	3 points if N=9-10 2 points if N=6-8 1 point if N=4-5 0 point if N=0-3	(/3)
Identify drawings. No more than 60 seconds. See complementary sheet.			
NAMING	Identify animals. See complementary sheet. <input type="checkbox"/> zebra <input type="checkbox"/> peacock <input type="checkbox"/> tiger <input type="checkbox"/> butterfly	(/4)	
ATTENTION	Name the numbers in circles. See complementary sheet. 1 5 8 3 9 2 0 3 9 4 0 2 1 6 8 7 4 6 7 5	ERROR !!!	(/1)
		No point if 2 errors or more	
Name the numbers in circles & squares: 3 8 5 1 3 0 2 9 2 0 4 9 7 8 6 1 5 7 6 4		ERROR !!!	(/2)
See complementary sheet. 1 5 8 3 9 2 0 3 9 4 0 2 1 6 8 7 4 6 7 5		2 points if 2 errors or less 1 point if 3 errors 0 point if 4 errors or more	END TIME
Adapted by : Parunyou Julayanont MD Copyright : Z. Nasreddine MD		Final Version June 04, 2014	
TOTAL SCORE (/30)		Add 1 point if education < 4 year AND add 1 point if # errors	
TOTAL TIME: !!!!!!sec			

Fig. 2. MoCA-B Page (1 of 2).

Appendix M

2018 PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

The health benefits of regular physical activity are clear; more people should engage in physical activity every day of the week. Participating in physical activity is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or No	YES	NO
1) Has your doctor ever said that you have a heart condition <input type="checkbox"/> OR high blood pressure <input type="checkbox"/> ?	<input type="checkbox"/>	<input type="checkbox"/>
2) Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?	<input type="checkbox"/>	<input type="checkbox"/>
3) Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months? (Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).)	<input type="checkbox"/>	<input type="checkbox"/>
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)? PLEASE LIST CONDITION(S) HERE:	<input type="checkbox"/>	<input type="checkbox"/>
5) Are you currently taking prescribed medications for a chronic medical condition? PLEASE LIST CONDITION(S) AND MEDICATIONS HERE:	<input type="checkbox"/>	<input type="checkbox"/>
6) Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? (Please answer NO if you had a problem in the past, but it does not limit your current ability to be physically active). PLEASE LIST CONDITION(S) HERE:	<input type="checkbox"/>	<input type="checkbox"/>
7) Has your doctor ever said that you should only do medically supervised physical activity?	<input type="checkbox"/>	<input type="checkbox"/>

If you answered NO to all of the questions above, you are cleared for physical activity. Go to page 4 to sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow International Physical Activity Guidelines for your age (www.who.int/dietphysicalactivity/en/).
- You may take part in a health and fitness appraisal.
- If you are over the age of 45 and NOT accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.
- If you have any further questions, contact a qualified exercise professional.

If you answered YES to one or more of the questions above, COMPLETE PAGES 2 AND 3.

⚠ Delay becoming more active if:

- ✓ You have a temporary illness such as a cold or fever, it is best to wait until you feel better.
- ✓ You are pregnant – talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at www.eparmedx.com before becoming more physically active.
- ✓ Your health changes – answer the questions of Pages 2 and 3 of this document and/or talk to your doctor or a qualified exercise professional before continuing with any physical activity program.

Figure 3. 2018 PAR-Q+ (Page 1).

Appendix N

Fear of Falling – Measurement Tool

	Activities	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned
1	Cleaning the house (e.g. sweep, vacuum, dust)	1	2	3	4
2	Getting dressed or undressed	1	2	3	4
3	Preparing simple meals	1	2	3	4
4	Taking a bath or shower	1	2	3	4
5	Going to the shop	1	2	3	4
6	Getting in or out of a chair	1	2	3	4
7	Going up or down stairs	1	2	3	4
8	Walking around in the neighborhood	1	2	3	4
9	Reaching for something above your head or on the ground	1	2	3	4
10	Going to answer the telephone before it stops ringing	1	2	3	4
11	Walking on a slippery surface (e.g. wet or icy)	1	2	3	4
12	Visiting a friend or relative	1	2	3	4
13	Walking in a place with crowds	1	2	3	4
14	Walking on an uneven surface (e.g. rocky ground, poorly maintained pavement)	1	2	3	4
15	Walking up or down a slope	1	2	3	4
16	Going out to a social event (e.g. religious service, family gathering, or club meeting)	1	2	3	4
TOTAL Score					/64

Figure 4. Fear of Falling measurement tool: Falls Efficacy Scale-International

Appendix O

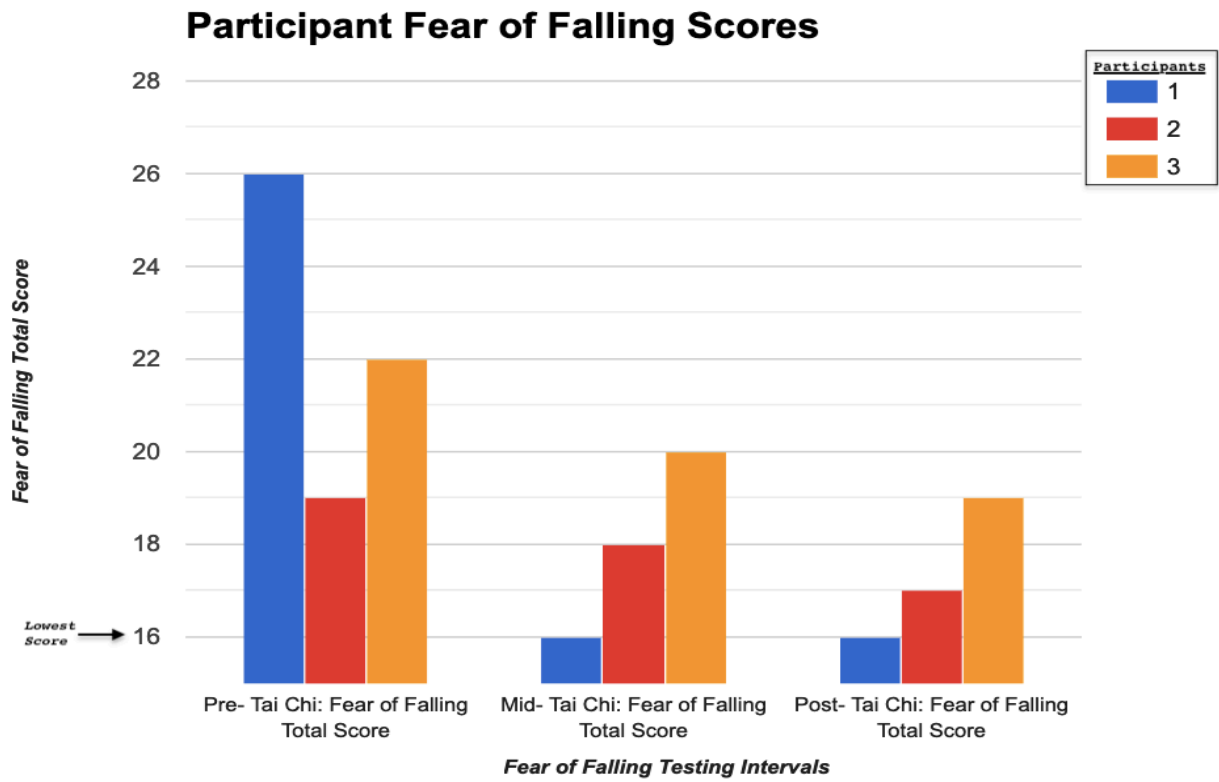


Figure 5. Participant Fear of Falling Total Scores.