|  |
| --- |
| **CRITICALLY APPRAISED TOPIC** |

**FOCUSED CLINICAL QUESTION**

|  |
| --- |
| Is the Otago Exercise Program (OEP) or Tai Chi more effective at achieving clinically significant reductions in patients’ risk for falling with knee osteoarthritis (OA), ages 65 and up, and at risk for falls, as measured by the Timed Up and Go (TUG) assessment, 12 months following the initiation of treatment? |

**AUTHOR**

|  |  |  |  |
| --- | --- | --- | --- |
| **Prepared by** | Katie Owens | **Date** | 12/2/19 |
| **Email address** | Katherine\_owens@med.unc.edu |

**CLINICAL SCENARIO**

|  |
| --- |
| During my orthopedic outpatient rotation, I treated a geriatric patient with bilateral knee OA successfully as this patient reached his functional, long-term goal of only 2/10 knee pain while walking his dog. Although this patient’s primary complaint had been addressed, upon evaluation he admitted to experiencing two falls in the past year. According to this patient’s TUG time he was determined to be at risk for falls. As such, I recommended that this patient sign up for the OEP, as I knew this was an evidence-based, falls prevention program. With that being said, I know there are other evidence-based, falls prevention programs available such as Tai Chi. Therefore, I would like to know which evidence-based falls prevention program is more effective at achieving clinically significant reductions in a patients’ TUG times, specifically amongst geriatric individuals, with knee OA, who are at risk for falling. I specifically want to consider geriatric individuals with knee OA as the prevalence of this pathology amongst individuals greater than or equal to 60 years of age is as high as 10% and 13% amongst men and women respectively.1 Additionally, falls occur in greater than 25% of individuals greater than or equal to 65 years of age.2 As both of these conditions are relatively prevalent amongst the geriatric population, it does not seem unlikely that clinicians will frequently encounter geriatric patients, with knee OA who are also at risk for falling. It is important for clinicians to be aware of the effectiveness of falls prevention programs for specific patient populations, as this will help them to make recommendations for an evidence-based falls prevention program that will best serve each patient according to their individual needs. |

**SUMMARY OF SEARCH**

[Best evidence appraised and key findings]

|  |
| --- |
| After searching a number of databases, seven relevant randomized controlled trials and one study utilizing a pre-experimental design were identified which fulfilled the exclusion and inclusion qualifications established.3–10 After assessing the quality and applicability of all of these studies two were selected for appraisal.3,9 The primary findings from the study by Mat Ng, and Tan et al. suggest that the provision of a modified version of the OEP at a tri-weekly frequency for a duration of 30 minutes for a total of 6 months in addition to other falls prevention strategies results in medium to large effect sizes for measures of postural sway and limits of stability.3 Additionally, the study by Fransen, Nairn, and Winstanley et al. found that the provision of Tai Chi at a bi-weekly frequency for a duration of one hour using an intervention period of 12 weeks results in a small to medium effect size on the TUG assessment.9 |

**CLINICAL BOTTOM LINE**

|  |
| --- |
| A modified version of the OEP, with alterations including the provision of follow-up appointments completed within a medical facility and the exclusion of a prescribed walking routine, in combination with a compilation of falls-prevention treatments administered as indicated, is effective at decreasing risk of falls amongst elderly individuals with knee OA, who are considered to be at risk for falling.3 Presently, insufficient evidence exists to recommend Tai Chi as an effective fall prevention program for geriatric individuals, with knee OA, who are at an increased risk for falls.9  |

|  |
| --- |
| ***This critically appraised topic has been individually prepared as part of a course requirement and has been peer-reviewed by one other independent course instructor*** |

*The above information should fit onto the first page of your CAT*

**SEARCH STRATEGY**

|  |
| --- |
| **Terms used to guide the search strategy** |
| **P**atient/Client Group | **I**ntervention (or Assessment) | **C**omparison | **O**utcome(s) |
| Knee osteoarthritisKnee oaKnee arthritisKnee degenerative joint disease | Otago exercise programOtago exercise programmeOep | Tai ChiTai Ji | Fall\* riskUnstead\*Fall\*Accidental Fall\* |

**Final search strategy (history):**

*Show your final search strategy (full history) from PubMed. Indicate which “line” you chose as the final search strategy.*

(((((((knee osteoarthritis) OR knee oa) OR knee arthritis) OR knee degenerative joint disease)) AND (((Otago exercise program) OR otago exercise programme) OR oep)) AND ((tai chi) OR tai ji)) AND ((((fall\* risk) OR unstead\*) OR fall\*) OR accidental fall\*)

0 results yielded from the above search string

((((((knee osteoarthritis) OR knee oa) OR knee arthritis) OR knee degenerative joint disease)) AND (((Otago exercise program) OR otago exercise programme) OR oep)) AND ((((fall\* risk) OR unstead\*) OR fall\*) OR accidental fall\*)

2 results yielded from the above search string

((((((knee osteoarthritis) OR knee oa) OR knee arthritis) OR knee degenerative joint disease)) AND ((tai chi) OR tai ji)) AND ((((fall\* risk) OR unstead\*) OR fall\*) OR accidental fall\*)

9 results yielded from the above search string

**((((((knee osteoarthritis) OR knee oa) OR knee arthritis) OR knee degenerative joint disease)) AND (((Otago exercise program) OR otago exercise programme) OR oep)) AND ((((((fall\* risk) OR unstead\*) OR fall\*) OR accidental fall\*)) OR ((((((((balance) OR stability) OR postural stability) OR postural control) OR postural balance) OR postural equilibrium) OR static balance) OR dynamic balance))**

2 results yielded from the above search string

**((((((knee osteoarthritis) OR knee oa) OR knee arthritis) OR knee degenerative joint disease)) AND ((tai chi) OR tai ji)) AND ((((((fall\* risk) OR unstead\*) OR fall\*) OR accidental fall\*)) OR ((((((((balance) OR stability) OR postural stability) OR postural control) OR postural balance) OR postural equilibrium) OR static balance) OR dynamic balance))**

17 results yielded from the above search string

*In the table below, show how many results you got from your search from each database you searched.*

|  |  |  |
| --- | --- | --- |
| **Databases and Sites Searched** | **Number of results** | **Limits applied, revised number of results (if applicable)** |
| **CINAHL****Web of Science****Cochrane****PEDro** | **1st search string: 1****2nd search string: 16****1st search string: 1****2nd search string: 57****1st search string: 2****2nd search string: 4****1st search (was not able to utilize full search string for this database): 1****2nd search:47** | **48- Applied filters: Articles, Reviews, written in English, completed within the last 10 years** |

## INCLUSION and EXCLUSION CRITERIA

|  |
| --- |
| **Inclusion Criteria** |
| * Patients who are over the age of 65
* Patients diagnosed with knee OA via imagining
* Patients at risk for falls determined via a standardized outcome measure such as the TUG
* Randomized controlled trial
* Systematic reviews
* Meta-analysis
 |
| **Exclusion Criteria** |
| * Studies that are not published in English
* Narrative reviews
* Case studies
* Case series
* Quasi-experimental study
 |

**RESULTS OF SEARCH**

**Summary of articles retrieved that met inclusion and exclusion criteria**

*For each article being considered for inclusion in the CAT, score for methodological quality on an appropriate scale, categorize the level of evidence, indicate whether the relevance of the study PICO to your PICO is high/mod/low, and note the study design (e.g., RCT, systematic review, case study).*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author (Year)** | **Risk of bias (quality score)\*** | **Level of Evidence\*\*** | **Relevance** | **Study design** |
| Mat S, Ng CT, Tan PJ, et al. (2018)3 | **PEDro Scale: 7/11** | **1b** | **High:**Relevant inclusion criteria, intervention, and outcome measures* **Inclusion Criteria**: ≥ 65 y/o, with knee OA, and a fall history
* **Intervention:** Modified Otago Exercise Program (minus walking)
* **Frequency:** 30 min, 3x/week, for a total of 6 months
* **Control:** Health counselling and usual care
* **Outcome measures:** Short FES-1, mCTSIB (degrees/s), LOS and frequency of falls obtained at 0 and 6 months
 | Randomized Controlled Trial |
| Liu-Ambrose T, Donaldson MG, Ahamed Y, et al. (2008)4 | **PEDro Scale: 8/11** | **2b**(Approximately 70% follow-up) | **Mod:** Relevant intervention and outcome measures* **Inclusion Criteria:**≥70 y/o, patients at a falls clinic, fall history or TUG >15s or z-score of Physiological Profile Assessment (PPA) score ≥1

**\***Approximately 37% of participants had OA or RA* **Intervention:**Otago Exercise Program
* **Frequency:**30 min, 3x/week, for a total of 6 months (walk 2x/week)
* **Control:**Standard care
* **Outcome measures:**PPA (used for fall risk assessment and includes measures of postural sway) and TUG obtained at 0, 6, and 12 months
 | Randomized Controlled Trial |
| Song R, Lee E-O, Lam P, Bae S-C. (2003)5 | **PEDro Scale: 7/11** | **2b**(Approximately 60% follow-up) | **Mod:**Semi-relevant inclusion criteria, relevant intervention, and semi-relevant outcome measure* **Inclusion Criteria:**Women ≥ 55 y/o, knee OA
* **Intervention:**Sun-style tai chi
* **Frequency:**20 min, 3x/week, for a total of 12 weeks
* **Control:**Standard care
* **Outcome measures:** SLS time with eyes closed at 0 and 12 weeks
 | Randomized Controlled Trial |
| Brismée J-M, Paige RL, Chyu M-C, et al. (2007)6 | **PEDro Scale: 6/11** | **2b**(Approximately 76% follow-up) | **Low:**Semi-relevant inclusion criteria and semi-relevant intervention* **Inclusion Criteria:**≥ 50 y/o, knee OA
* **Intervention:**Yang-style tai chi
* **Frequency:**30 min, 3x/week, for a total of 12 weeks
* **Control:**Provision of health information
* **Outcome measures:**Visual Analog Scale (knee pain) at 0, 3, 6, 9, 12, 15, and 18 weeks
 | Randomized Controlled Trial |
| Ghandali E, Moghadam ST, Hadian MR, Olyaei G, Jalaie S, Sajjadi E. (2016)7 | **Downs and Black checklist: 11/29** | **4** | **Mod:**Relevant inclusion criteria, relevant intervention, and relevant outcome measure * **Inclusion Criteria**: ≥ 60 y/o, knee OA, Berg Balance Scale > 41
* **Intervention:**Yang style tai chi
* **Frequency:**40 min, 2x/week, for a total of 8 weeks
* **Control:**No control group included
* **Outcome measures:** Area and velocity of CoP at 0 and 8 weeks
 | Pre-experimental (Essentially a Case Series Design)   |
| Song R, Roberts BL, Lee E-O, Lam P, Bae S-C. (2009)8 | **PEDro Scale: 6/11** | **2b**(Approximately 79% follow-up) | **Mod:**Semi-relevant inclusion criteria, relevant intervention, and semi-relevant outcome measure* **Inclusion Criteria:**Women≥ 55 y/o, knee OA
* **Intervention:**Sun-style tai chi
* **Frequency:**40-45 min, 2x/week-1st three weeks, 1x/week-remaining 6 months, plus 20 min of daily home-practice also promoted
* **Control:**Educational program geared towards those with arthritis
* **Outcome measures:** Survey of Activities and Fear of Falling the in Elderly at 0 and 6 months
 | Randomized Controlled Trial |
| Fransen M, Nairn L, Winstanley J, Lam P, Edmonds (2007)9 | **PEDro Scale: 9/11** | **1b** | **Mod:**Semi-relevant inclusions criteria, relevant intervention, and relevant outcome measure* **Inclusion Criteria:**59-85 y/o, hip or knee OA
* **Intervention 1:**Sun-style tai chi
* **Intervention 2:**Hydrotherapy
* **Frequency:**1 hr, 2x/week, for 12 weeks
* **Control:**Wait list
* **Outcome measures:**TUG at 0, 12, and 24 weeks
 | Randomized Controlled Trial |
| Wang C, Schmid CH, Hibberd PL, et al. (2009)10 | **PEDro Scale: 9/11** | **1b** | **Low:**Semi-relevant inclusion criteria, relevant intervention, and semi-relevant outcome measure * **Inclusion Criteria:** ≥ 55 y/o, knee OA
* **Intervention:**Yang style tai chi
* **Frequency:**30 min, 2x/week, for 12 weeks, plus 20 min of daily home-practice for entirety of study length (48 weeks) also promoted
* **Control:**Health education and stretching
* **Outcome measure:** Standing balance at 0, 12, 24, and 48 weeks
 | Randomized Controlled Trial |

\*Indicate tool name and score

\*\*Use Portney & Watkins Table 16.1 (2009); if downgraded, indicate reason why

**BEST EVIDENCE**

The following 2 studies were identified as the ‘best’ evidence and selected for critical appraisal. Rationale for selecting these studies were:

|  |
| --- |
| * Effect of modified otago exercises on postural balance, fear of falling, and fall risk in older fallers with knee osteoarthritis and impaired gait and balance: A secondary analysis.3
* Physical activity for osteoarthritis management: a randomized controlled clinical trial evaluating hydrotherapy or Tai Chi classes9

In my review of the literature I was only able to identify two studies regarding the impact of the OEP on older individuals with knee OA’s risk for falling.3,4 The study I selected for critical appraisal is by Mat, Ng, and Tan, et al. and includes my population of interest, a slightly modified version of my intervention of interest, and an outcome which can be used to assess fall risk.3,11–13 However, the study by Mat, Ng, and Tan, et al. only assessed my outcome of interest at 0 and 6 months.3 Although the effects of the OEP on elderly individuals was assessed at 12 months by Liu-Ambrose, Donaldson, and Ahamed, et al., which is a time frame more in-line with my original PICO question, this study included a population which was comprised of only 37% of individuals who had either RA or OA, which I believe results in a study population which is comprised of too few individuals representing my population of interest.4 In order to answer my PICO question, I also needed to select a study assessing the impact of Tai Chi on the fall risks’ of individuals with knee OA as I was unable to identify a study directly comparing the efficacy of the OEP and Tai Chi amongst my population of interest. In order to allow for a comparison of the OEP and Tai Chi’s efficacy in reducing fall risk amongst elderly individuals with knee OA, I aimed to select a second study which included a similar population and outcome assessments to the study completed by Mat, Ng, and Tan, et al.3 The study I decided upon included a population comprised of elderly individuals with hip or knee OA which utilized the TUG as one of their outcome measures.9 Additionally, this study obtained a relatively high quality rating on the PEDro scale.9 Although, this study includes a slightly broader population than the one included in my PICO question, other studies that I identified evaluating the impacts of Tai Chi on those with knee OA were lower quality and utilized outcome measures that were less comparable to those utilized in the first study I selected such as the Visual Analogue Scale for pain rating, Fear of Falling in the Elderly outcome assessment, and timed standing balance 3,5,6,8,10 I considered selecting the study completed by Ghandali, Moghadam, and Hadian et al. for critical appraisal, as it utilized the velocity and area of CoP as outcome measurements which were similar to outcomes assessed in the study completed by Mat S, Ng CT, and Tan PJ, et al.3,7 I decided not to select the study completed by Ghandali, Moghadam, and Hadian et al. as this was a very low-quality study which did not include a control group resulting in outcomes that are less meaningful, as they are not necessarily due to the intervention utilized and may be the result of confounding variables.7 |

**SUMMARY OF BEST EVIDENCE**

**(1) Description and appraisal of Effect of Modified Otago Exercises on Postural Balance, Fear of Falling, and Fall Risk in Older Fallers With Knee Osteoarthritis and Impaired Gait and Balance: A Secondary Analysis by Sumaiyah Mat, PhD, Chin Teck Ng, MD, Pey June Tan, BSc, Norlisah Ramli, FRCR, Farhana Fadzli, MRad, Faizatul Izza Rozalli, MRad, Mazlina Mazlan, MRehabMed, Keith D. Hill, PhD, Maw Pin Tan, MD**, **2018**3

|  |
| --- |
| **Aim/Objective of the Study/Systematic Review:** |
| The aim of this study was to determine how risk for falls in addition to fear of falling (FoF) and postural control were impacted following the provision of an altered form of the OEP to elderly individuals with a history of falls, established functional instability, and a diagnosis of knee OA.  |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| A randomized control trial design was used for this study, which was a smaller study completed as part of a larger study, in which randomization to either the OEP or the control group was achieved utilizing a series of random numbers produced by a computer.14 A researcher, unaffiliated with this particular study, was in charge of producing this series of random numbers.14 Safe storage of this information in a non-transparent, closed envelope ensured the concealment of group allotment following randomization.14 Impacts of the two interventions were assessed, by an individual blinded to which interventions participants received upon initiation of the study as well as following six months of treatment.  |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| The prescribed exercise intervention was to be completed within the participants’ home, however outcome assessments and periodic alterations to the exercise program were performed at a hospital (University of Malaya Medical Centre).4 This study takes place in the developing country of Malaysia primarily amongst individuals in the medium to lower income bracket.14 |
| **Participants**[N, diagnosis, eligibility criteria, how recruited**,** type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| Fifty individuals identified from the larger study were able to participate in this smaller study. Qualification criteria stated that participants must have experienced one fall resulting in an injury or two falls, with either scenario needing to have occurred within a year. Additional qualification criteria states that participants must be at least 65 years of age and have a diagnosis of knee OA. Establishment of knee OA was achieved by necessitating one or more of the qualifications for knee OA described by the American College of Rheumatology in concert with knee arthralgia and participants were also required to have a Kellgren-Lawrence grade of at least 2.15,16 Individuals also had to present with functional instability which was established by a time greater than 13.5 seconds on the TUG.17 Individuals incapable of ambulation or diagnosed with a significant psychiatric condition or memory impairment were disqualified from this study. A purposive sampling technique was utilized as patients attending the geriatric and primary care clinics in addition to the emergency department, meeting the aforementioned eligibility criteria, were asked to participate in this study. Participants consisted primarily of females (80.5%) and had an average age of approximately 73 years old. A significant difference was identified between the mean age of the intervention group and the control group, with the control group being younger on average. Additionally, the intervention group demonstrated a significantly greater average fear of falling as measured by the Short FES-I score. Nine individuals dropped out of this study resulting in six-month assessment information available for 41 subjects.  |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| The provision of typical care and instruction from previously established medical providers encompassed the control group intervention.  |
| *Experimental* |
| Experimental group participants all partook in an altered version of the OEP in addition to a personalized compilation of treatments including cardiovascular treatment, the provision of falls information, visual treatment, a house-hold safety evaluation, and an assessment of current medications.14 Exercises prescribed as part of this program were identical to exercises included within the OEP however, walking, an intervention utilized in the original OEP, was eliminated.18 The OEP includes strengthening and balance exercises prescribed at a tri-weekly frequency for a duration of 30 minutes for a 6-month period. Based on patient evaluations, which were performed on a monthly basis for the first three months of the study, physical therapists would select appropriate exercises from an established list of exercises including hip abduction, knee flexion and extension, ankle dorsiflexion and plantarflexion, and squats.4 Sideways, backwards, tandem, heel, toe, and tandem-backwards walking as well as walking with turns, tandem and single leg stance, and sit to stands were also included on this list of exercises.4 Patients were evaluated at the hospital rather than within their homes, which was an additional alteration of the OEP.4 |
| **Outcome Measures**[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| One outcome of interest explored in this study was postural control which was assessed using the Limits of Stability (LOS) testing and the Modified Clinical Test of Sensory Interaction on Balance (mCTSIB). Precision of administration was enhanced through the use of a NeuroCom, which takes postural sway measurements utilizing a force plate. The mCTSIB assessment, which includes the maintenance of standing for 10 seconds during four variable circumstances created utilizing either a hard or pliable surface with the participant’s eyes open or closed, results in an outcome of postural sway measured in degrees per second. Three trials under each balance circumstance were measured and the mean of all of these measurements resulted in the composite mCTSIB, the principal outcome for this study. Maximum and end-point excursion as well as directional control were all outcomes assessed during LOS testing which were expressed as percentages of planned movements completed. Researchers objectively assessed FoF by employing the short-form Falls Efficacy Scale-International (short FES-I). Results of this outcome assessment range from scores of 7 to 28 with a higher score associated with an increased FoF. Symptoms of knee osteoarthritis as well as this disease’s associated impact on quality of life, leisure, athletic engagement, and daily functioning were measured utilizing the Knee injury and Osteoarthritis Outcome Score (KOOS). All 42 questions on this self-report assessment receive a grade 0 to 4, with 4 being indicative of the most significant knee issues.19 Additionally, subsection scores are converted to a 100-point scale with lower scores being indicative of more severe knee issues.19 The occurrence of a fall was noted in a journal by participants and these journals were used to determine rate of falls experienced by participants on a monthly basis. All of the aforementioned outcomes were assessed by a researcher, unaware of which treatment each participant was receiving. The study did not explicitly state where outcome assessments were performed.  |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable. You may summarize results in a table but you must explain the results with some narrative.] |
| Firstly, some significant changes from initial to follow-up measurements within the group receiving the modified OEP intervention were found. Some of the aforementioned changes include statistically significant increases for directional control (P=0.01) and maximal excursion (P=0.03). Another one of the aforementioned changes occurred within the short FES-I outcome, which was found to have significantly (P=0.03) decreased. The last within-group change reported by this study was a statistically significant (P=0.03) decrease in postural sway, during the condition in which participants maintain standing on a pliable surface with their eyes open. A between group analysis was also completed considering the results of the intervention and the control groups. Firstly, composite mCTSIB was found to have a statistically significant (P=0.03) mean difference of -0.20 degrees per second resulting from the difference found between the treatment effects for the experimental and control groups. More simply put, the experimental intervention resulted in a significantly greater decrease in composite mCTSIB as compared to the control group. Additionally, a statistically significant (P=0.03) difference of -1.26 degrees per second between treatment effects of the experimental and control groups, specifically for the mCTSIB condition in which participants maintained standing on a pliable surface with their eyes closed, was found. The mean differences identified by determining the difference between the experimental and control groups’ treatment effects’ for directional control and maximal excursion were found to be 13.49% (P=0.001) and 11.22% (P=0.01) respectively. These results indicated the experimental groups’ directional control and maximal excursion increased by significantly more than the control groups directional control and maximal excursion. A statically significant (P=0.02) mean difference of -5.23 was also found resulting from the difference found between the treatment effect for the experimental and control groups for the Short FES-I outcome measure. This finding indicates that the experimental intervention resulted in a significantly greater decrease in the Short FES-I outcome measure as compared to the control group. The percentage of reported falls for individuals in the control group and individuals receiving the modified OEP were found to be 41.7% and 47.1% respectively. Although not explicitly reported as part of this study’s results, standard effect size of the modified OEP intervention was calculated for measures of postural stability as other research studies, performed on geriatric individuals with osteoarthritis, have employed these outcomes to quantify falls risk.12,13,20 Therefore, knowledge of the effect size of the OEP on these outcome measures will be beneficial in answering my PICO question. Small effect sizes of 0.05 and 0.13 were found for postural sway for the eyes open on a hard surface and eyes closed on a hard surface conditions of the mCTSIB respectively. A medium effect size of 0.48 was found for postural sway for the eyes open on a pliable surface condition. This condition of the mCTSIB was not found to have a statistically significant mean difference suggesting that this study was insufficiently powered to identify a statistical difference for this outcome if one existed. Additionally, a large effect size of 0.88 on postural sway was found for the eyes close on a pliable surface condition. A small to medium effect size of 0.29 was found for end point excursion and large effect sizes of 0.83 and 1.06 were found for maximal excursion and directional control respectively.  |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| Based on the aforementioned findings, the authors conclude that the modified OEP intervention was effective at decreasing FoF and increasing postural stability amongst elderly individuals with knee osteoarthritis, instability with ambulation and balance, and a history of falls. The falls rate outcome lacked the sufficient power required to determine if a significant difference existed between the intervention and control group, but the researchers did note that an increased fall risk has been found to correlated with both poor balance and increased FoF amongst older adults. As such, the researchers conclude that additional research completed over a greater period of time encompassing an increased number of participants must be completed in order to definitively conclude if this modified OEP is effective at reducing the rate of falls amongst the aforementioned population.  |
| **Critical Appraisal** |
| **Validity**[Summarize the internal and external validity of the study. Highlight key strengths and weaknesses. Comment on the overall evidence quality provided by this study.] |
| The internal validity of this study has been slightly compromised as there are a number of aspects specific to this study’s design which may potentially lead to biased results. The shortcomings in study’s design were revealed while using the PEDro scale, on which this study received a score of 7/11, in order to assess the quality of this study. To begin, the utilization of the OEP as an intervention makes it impossible to blind participants and therapists to the intervention which each participant is receiving. Knowledge of the intervention being received and provided in concert with any preconceived notions regarding its effectiveness may lead to the biased provision of treatment and biased responses to outcome measures. Additionally, the internal validity of this study was further compromised by the relatively high drop-out rate, which was determined to be just shy of 20%. This biasing attribute was compounded by the absence of an intention to treat analysis as a significant difference may exist between the individuals who dropped out and individuals remaining in the study. Additionally, the provision of treatments in addition to the modified OEP further decreases the internal validity of this study as it is less clear what amount of intervention effects observed can be attributed to the OEP alone. It is also important to consider the redeeming qualities of this study’s design which serve to increase its internal validity. For example, subjects were randomly assigned to either the experimental or control group resulting in the formation of groups with comparable demographic characteristics. Further, group assignment was appropriately hidden as the randomized group assignments, completed by a researcher unaffiliated with the study, were placed in a safe site in non-transparent, closed envelopes. The internal validity of this study was further improved as the outcome assessments were conducted by an individual who was blinded to group assignment. Furthermore, study results included a comparison between the intervention and control group using the mean difference for all for all of the outcomes assessed including mCTSIB, end-point excursion, maximal excursion, directional control, KOOS, and the Short FES-I. All of the mean values found for each outcome measure were accompanied by their associated standard deviation, except for the composite mCTSIB, for which the median is reported accompanied by the interquartile range. The inclusion criteria of this study is clearly stated thereby increasing this study’s external validity. It should be noted, however, that this study was conducted in Malaysia and as such encompassed primarily Asian individuals. As it has been suggested that Asian individuals, specifically individuals from China, experience falls at a lesser rate than Caucasian individuals, it is unclear how easily one may generalize the results of this study to the US geriatric population as a whole.21 I believe that quality of the evidence produced by this study is moderate. While a randomized controlled trial design was utilized, there were a handful of shortcomings, primarily related to the study’s small sample size and relatively high drop-out rate, which potentially increased the study’s susceptibility to bias. Additionally, the internal validity of this study if further compromised by the inclusion of other interventions in concert with the OEP. Additionally, this study was completed on a slightly narrower population than the population outlined in my PICO question making it difficult to discern if it would be appropriate to apply these results to my population of interest or if the results may only be reliably applied to Asian individuals.  |
| **Interpretation of Results**[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.] |
| I believe that the results of this study suggest that an altered form of the OEP, in conjunction with other indicated falls prevention interventions, improves overall postural sway, the standing on a pliable surface with eyes closed condition of the mCTSIB, maximal excursion, directional control, and fear of falling amongst elderly Malaysian individuals with predetermined balance and ambulation deficits, knee osteoarthritis, and a falls history. While other statistically significant improvements were identified within the experimental group, it is less clear whether these improvements could be attributed to the modified OEP therefore the aforementioned benefits of the modified OEP are based off of the reported statistically significant mean differences. While statistically significant improvements were observed in the aforementioned between group comparisons, it is unclear if the amount of change which occurred is clinically significant, particularly as this study was unable to determine if a statistically significant disparity in rate of falls existed between groups due to the small study population. As such, the standardized effect size of the modified OEP was calculated for postural sway, limits of stability, and fear of falling outcomes. Medium and large effect sizes were found for the standing on a pliable surface with eyes open and the standing on a pliable surface with eyes closed conditions of the mCTSIB respectively as a result of the experimental intervention. Additionally, large effect sizes were found for maximal excursion and directional control as a result of the experimental intervention. Lastly a large effect size was found on the short FES-I as a result of the experimental intervention. These results suggest that the intervention in question results in clinically significant improvements with regards to some components of postural sway and some components of limits of stability which have been associated with falls risk when considering those with osteoarthritis in the geriatric population.11–13 The modified OEP was also found to result in a clinically significant reduction in FoF which is important as decreases in FoF have been correlated with decreases in falls risk.22 Although many of these results are encouraging, shortcomings in this study’s design make me slightly skeptical of the results found. For example, the lack of blinding of the study participants as well as the researchers providing the intervention in combination with the relatively high drop-out rate and the lack of an intention to treat analysis suggest an increase possibility of biased results. It is also important to note that the OEP utilized in this study was a modified version of the original OEP and that this intervention was not applied in isolation. It seems possible that the provision of the additional falls prevention interventions may have the potential to positively impact postural stability and fear of falling, therefore the results of this study cannot entirely be attributed to the provision of the modified OEP. Additionally, as stated in the Validity section, the primary ethnicity of the study population may limit the generalizability of the results of this study.14,21  |
| **Applicability of Study Results**[Describe the relevance and applicability of the study to your clinical question and scenario. Consider the practicality and feasibility of the intervention in your discussion of the evidence applicability.] |
| I believe that this study is moderately relevant to my clinical question as it includes a subpopulation of my population of interest. With that being said, the study population includes primarily Asian individuals which puts into question the generalizability of the study results to my population of interest.14,21 Additionally, the study includes the provision of a slightly modified version of my intervention of interest in combination with a handful of other interventions including an assessment of current medications, cardiovascular treatment, visual treatment, a house-hold safety evaluation, and the provision of falls information. I do not see the inclusion of these other interventions to be a huge barrier to implementation of a similar treatment, as falls information as well as a house-hold safety evaluation may be incorporated into physical therapy treatment and the other interventions may be applied through a referral to an appropriate healthcare professional if and when indicated. The altered OEP utilized within this study would be relatively easy to replicate by simply excluding the encouragement of regular walking. Additionally, the fact that evaluations, performed as part of the altered version of the OEP, were conducted within a medical facility may ease the implementation process as often patients can only receive physical therapy within their home if they are considered to be home-bound, which is clearly not the case with the patient described in my clinical scenario. The implementation of the modified OEP appears to be very practical from a time-commitment standpoint as it requires minimal in-person assessments and the frequency and duration of exercise is not very high. Additionally, the simplicity of the exercises as well as the lack of equipment required makes home performance appear highly feasible.  |

**(2) Description and appraisal of Physical Activity for Osteoarthritis Management: A Randomized Controlled Clinical Trial Evaluating Hydrotherapy or Tai Chi Classes by Marlene Fransen, Lillias Nairn, Julie Winstanley, Paul Lam, and John Edmonds, 2007**9

|  |
| --- |
| **Aim/Objective of the Study/Systematic Review:** |
| This study aimed to establish the efficacy of Tai Chi as compared to aquatic therapy at increasing functional capabilities as well as decreasing arthralgia amongst persons diagnosed with knee or hip OA.  |
| **Study Design**[e.g., systematic review, cohort, randomised controlled trial, qualitative study, grounded theory. Includes information about study characteristics such as blinding and allocation concealment. When were outcomes measured, if relevant]Note: For systematic review, use headings ‘search strategy’, ‘selection criteria’, ‘methods’ etc. For qualitative studies, identify data collection/analyses methods. |
| This study utilized a randomized controlled trial design and researchers evaluating outcomes in this study were unaware if participants were receiving the aquatic, Tai Chi or the control intervention. Randomization was achieved through the production of random number sequences of 30 composed by a computer in a remote location and group assignment was subsequently conveyed to the individuals via phone call, therefore allocation was concealed. Following 12 weeks of intervention, the control group was randomized to participate in either Tai Chi or aquatic therapy for 12 weeks. Prior to the initial randomization process outcome assessments were measured, and again following the first 12 weeks of intervention for all groups. Assessments were measured again following another 12 weeks as this was the study phase during which individuals, initially allocated to the control group, were randomized to and received either the Tai Chi or the aquatic therapy intervention. Outcomes for the individuals initially allocated to the Tai Chi and aquatic therapy groups were also measured at the 24-week time point to assess for any retained effects of their previous 12-week participation in aquatic or Tai Chi exercise.  |
| **Setting**[e.g., locations such as hospital, community; rural; metropolitan; country] |
| Both aquatic therapy and Tai Chi interventions were applied at St George Public Hospital which is located in Sydney Australia.23  |
| **Participants**[N, diagnosis, eligibility criteria, how recruited, type of sample (e.g., purposive, random), key demographics such as mean age, gender, duration of illness/disease, and if groups in an RCT were comparable at baseline on key demographic variables; number of dropouts if relevant, number available for follow-up]Note: This is not a list of the inclusion and exclusion criteria. This is a description of the actual sample that participated in the study. You can find this descriptive information in the text and tables in the article. |
| 152 participants were enrolled in this study who met the qualifications for participation including the presence of knee or hip OA confirmed via compliance with guidelines set forth by the American College of Rheumatology as well as associated knee or hip arthralgia occurring for greater than a year, and age greater than or equal to 59 as well as age less than or equal to 85.16,24 Although individuals with both hip and knee osteoarthritis were included within this study, the vast majority (84%) of studied individuals identified that their most problematic joint was their knee, and the most problematic joint was the joint considered for the purposes of this study. Individuals were not allowed to take part in this study if they were unable to ambulate independently, obtained greater than two bouts of exercise a week, had a significant cardiopulmonary diagnosis, had a diagnosis of lumbar radiculopathy, lacked control of their bowel or bladder, were uncomfortable around water, had previously had a total knee or hip replacement or an arthroscopic procedure to either of these joints, received a recent pain relieving shot for their hip or knee, or experienced uncontrolled seizures. Purposive sampling was performed using a handful of enrolment strategies including referrals provided by nearby physicians, the provision of informational talks regarding the study at community groups comprised primarily of elderly adults, and the creation of newspaper announcements. The resulting study population encompassed 74% females, individuals with an average age of approximately 70 years old, and a majority of individuals (64%) who reported experiencing symptoms of OA for greater than or equal to 6 years. Additionally, all three groups included within this study were analogous with regards to the aforementioned significant demographic variables upon initiation of the study, but significant variances were noted amongst the identified problematic joint as well as the stress outcome within the Depression, Anxiety, and Stress Scale (DASS 21). Over the course of the study 11 individuals dropped out for a variety of reasons and as result outcome assessments were obtained from 141 individuals following 12 weeks of participation their respective interventions.  |
| **Intervention Investigated**[Provide details of methods, who provided treatment, when and where, how many hours of treatment provided] |
| *Control* |
| Individuals within the control group did not engage in any kind of intervention for the first 12 weeks of the total 24-week study period. |
| *Experimental* |
| The experimental intervention lasted for 12 weeks and consisted of participation in bi-weekly, hour-long Tai Chi classes based upon Sun style Tai Chi and led by qualified Tai Chi instructors. A warm-up period of 10 minutes prefaced every Tai Chi class. Additionally, only 15 individuals were allowed to participate in a Tai Chi class at one time. Participation in Tai Chi at home was also encouraged but not measured for this study. Tai Chi classes were held from the beginning of 2004 until late 2005 at St George Public Hospital. Details regarding the aquatic intervention are not included as this intervention and its associated outcomes do not provide relevant information to my CAT.  |
| **Outcome Measures**[Give details of each measure, maximum possible score and range for each measure, administered by whom, where] |
| One outcome assessment included in this study is the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) utilizing the Likert scale.25 This assessment can be used to quantify physical abilities as well as symptoms associated with knee and hip OA with a minimum score of 0 signifying the absence of disability and pain and a maximum score of 100 signifying the highest level of dysfunction and pain.26 Another outcome measure utilized was the Medical Outcomes Study Short Form 12 Health Survey (SF-12) measuring patient perception of their mental and physical health with a result above 50 suggestive of above average overall health perception and a result less than 50 suggestive of less than average overall health perception27,28 Additionally, the Depression, Anxiety, and Stress Scale (DASS21), including subsections which each receive a score from 0 to 42, was utilized in order to obtain an objective assessment of the patients’ mental health.29 Decreasing scores within each subsection suggest improved mental health.29 Assessments, which included patient selection of pre-established overall descriptive ratings regarding the status of their affected joint as well as their perceived efficacy of treatment in relation to their affected joint, were also utilized.30 The TUG assessment was also employed in this study which is a timed outcome measures assessing balance and mobility which includes the performance of transfers from sitting and standing, a short bout of ambulation, and an abrupt 180 degree turn.31,32 Additionally, a time of greater than 13.5 seconds has been established as a cut off score which serves as a marker for geriatric patients, residing in the community, who are considered to be at risk for falling.33 It is also worth noting that a cut off score suggestive of an elderly patient who is at risk for falling, specifically amongst those with hip osteoarthritis, was found to be a time greater than 10 seconds.34 The timed 50-foot walk was also utilized as means to assess functional mobility for which the participants were asked to ambulate for 50 feet utilizing their top speed.35 Lastly functional mobility was assessed using the stair climb assessment for which patients were timed ascending a pre-determined number of stairs.32 The provision of the aforementioned measures was performed by the study supervisor who was unware of which treatments individuals were receiving. The location of where outcome assessments were conducted was not specified.  |
| **Main Findings**[Provide summary of mean scores/mean differences/treatment effect, 95% confidence intervals and p-values etc., where provided; you may calculate your own values if necessary/applicable. Use a table to summarize results if possible.] |
| Statistically significant (P≤0.05) within-group advances were observed amongst the Tai Chi group at the 12-week follow-up for the WOMAC pain subscale, WOMAC function subscale, and the stair climb assessment with mean improvements in scores of 9.6 (CI: 5.4, 13.7), 10.6 (CI: 5.6, 15.7), and 1.1 seconds (CI: 0.4, 1.8) found respectively. Additionally, a statistically significant (P≤0.05) mean improvement of 4.4 points (CI: 0.2, 8.6) was found amongst the control group for the WOMAC pain subscale but not for the WOMAC function subscale and Stair Climb Assessments. No other within-group statistically significant improvements were observed amongst the remaining outcome assessments for participants who received the Tai Chi intervention, including the TUG, for which a change of 0.2 seconds (CI:-0.2, 0.7) was observed. When considering difference between the treatment effect of Tai Chi and the control intervention, the only significant (P≤0.05) result observed was for the function subscale of the WOMAC with the mean difference being 9.7 (CI: 2.8, 16.7). Compared to participants affected joint status upon initiation of the study, less than half of the individuals in the Tai Chi (46%) and control group (15%) stated that their affect joint felt improved at the 12-week time point. No statistically significant (P≤0.05) mean changes from the 12-week measurement point to the 24-week measurement point were observed for any outcome assessments amongst individuals receiving the Tai Chi intervention. These results suggest retained benefits of the Tai Chi intervention. Statistically significant (P≤0.05) standardized response means were found for the WOMAC function subscale (0.63; CI: 0.50, 0.76), the SF-12 physical subscale (0.25; CI: 0.12, 0.38), the TUG assessment (0.32; CI: 0.19, 0.45), and the Stair Climb assessment (0.36; CI:0.23, 0.49) all in relation to the control group. Additionally, the standard effect size of Tai Chi on the TUG was calculated to be 0.25. The worsening of low back pain was the only negative side effect reported as a result of participation in Tai Chi.  |
| **Original Authors’ Conclusions**[Paraphrase as required. If providing a direct quote, add page number] |
| Tai Chi was deemed a beneficial intervention method when considering participants’ score on the WOMAC specifically with regards to physical function and pain. This ascertain was made based on the fact that significant improvements were observed within the Tai Chi group for these measured outcomes. Additionally, Tai Chi was found to have a significant effect size on the physical function sub score of the WOMAC and when compared to the results of a recently performed meta-analysis, including individuals with knee osteoarthritis and considering the effects of more traditional PT exercise, this intervention appeared to be more effective.  |
| **Critical Appraisal** |
| **Validity**[Summarize the internal and external validity of the study. Highlight key strengths and weaknesses. Comment on the overall evidence quality provided by this study.] |
| This study appears to have relatively high internal validity as evident by its 9/11 PEDro scale score. Randomization was used for group assignment completed at a remote location with the provision of phone calls to participants notifying them of their assigned intervention group following initial assessment. Utilization of this procedure ensured concealment of assigned groups. Additionally, no statistically significant disparities were noted amongst the intervention or control groups initially when considering the chief predictive variables. Furthermore, the head researcher, who measured treatment outcomes, remained unaware of which treatment participants received, further reducing the potential for biased study results. This study also maintained a relatively low drop-out rate for both assessment periods maintaining 93% and 88% of study participants for the 12-week and 24-week assessment periods respectively. Additionally, to mitigate the potentially biasing impact of participants dropping out of the study, an intention to treat analysis was performed. Additionally, the mean difference resulting from the difference found between the treatment effects for the experimental group and control group in combination with associated confidence intervals were reported. The standardized response mean was also reported for each outcome assessment along with its associated confidence interval. All of the aforementioned attributes of this study contribute to its internal validity through the minimization of bias. This study does have two short-comings, which may be inevitable due to the nature of exercise interventions, which include the fact that the researchers and participants were aware of what treatments were being administered and received respectively. Awareness of the treatment being provided may bias the provision of an intervention or the reported effects of an intervention. External validity is increased through the establishment of guidelines for study participation, as was done for this study. Knowledge of specific study population criteria allows for one to make an appropriate determination as to whether the application of study results is appropriate when considering individuals and scenarios outside of the study population. The population utilized for this study was comprised of primarily individuals who have experienced symptoms of OA for six years or greater which may limit the applicability of these results to individuals with less severe knee OA. Additionally, the inclusion of individuals with both hip and knee OA makes it difficult to understand what the impact of Tai Chi is on knee osteoarthritis in isolation. Overall, this is a high quality randomized controlled trial for which the risk for bias appeared to be minimized whenever possible according to aspects assessed using the PEDro scale. Further, the inclusion criteria for the study is clearly stated providing some guidance as to which individuals or other populations these results might be reliability applied to.  |
| **Interpretation of Results**[This is YOUR interpretation of the results taking into consideration the strengths and limitations as you discussed above. Please comment on clinical significance of effect size / study findings. Describe in your own words what the results mean.] |
| Although statistically significant improvements were observed within the Tai Chi group for the WOMAC pain subscale, the WOMAC function subscale, and the stair climb assessment, I do not believe these results are as meaningful as the between-group measurements reported by this study. Changes observed within the Tai Chi group may be attributed to variables other than the intervention applied, such as the passage of time, which is why it is more meaningful to consider the difference between the treatment effect of the Tai Chi and control group interventions. Only the function subscale for the WOMAC was found to have significantly improved when considering the difference observed between the treatment effects of the Tai Chi and control groups. Although this improvement reached statistical significance it is important to consider if this change is clinically significant.Significant standardized response means were found for the function subscale of the WOMAC, the physical subscale of the SF-12, the TUG assessment, and the Stair Climb assessment. With that being said, a medium to large effect size was observed for the function subscale of the WOMAC suggesting that a clinically significant improvement in this outcome may result from the provision of Tai Chi. Conversely, a small to medium effect size was observed for the physical subscale of the SF-12, TUG assessment, and Stair Climb assessment suggesting minimal to no clinically significant effects on these outcomes as a result of Tai Chi.The standard effect size of the TUG was also calculated in order to allow for a more direct comparison between interventions included in my PICO question. The resulting standard effect size was determined to be small to medium suggesting minimal to no clinically significant effect amongst this study population on fall risk resulting from Tai Chi. The results of this study are likely valid due to the high-quality design utilized by study. With that being said, the inclusion of individuals with both hip and knee osteoarthritis make it difficult to determine if these treatment effects would vary amongst a population of individuals exclusively with knee osteoarthritis.  |
| **Applicability of Study Results**[Describe the relevance and applicability of the study to your clinical question and scenario. Consider the practicality and feasibility of the intervention in your discussion of the evidence applicability.] |
| While individuals with both hip and knee OA were included in this study, which varies from the population of individuals with exclusively knee OA described in my PICO question, the majority (84%) of participants recruited identified their knee as their most problematic joint. Therefore, the resulting study population, as opposed to the study population described via inclusion and exclusion criteria, relates well to the population described in my PICO question. The study population, however, was not definitively determined to be at risk for falls, as was the population in my PICO question, making it slightly more difficult to apply the results of this study to my population of interest. The TUG was a measured secondary outcome for this study which increased this study’s relevance to my PICO question, as cut-off scores for the TUG have been demonstrated to correlate with a risk for falling amongst geriatric individuals residing in the community.33 Additionally, this study is relevant to my PICO question as it utilizes Tai Chi as an intervention, which is one of my interventions of interest. I also believe that the intervention applied to the study population is a highly reasonable from a time-commitment standpoint as individuals only had to participate in classes which met bi-weekly for one-hour sessions for a period of 12 weeks. Additionally, no special equipment is required for the provision of this intervention. The only additional requirement for a physical therapist, in order to implement this intervention, would be to attain their Tai Chi certification.  |

**SYNTHESIS AND CLINICAL IMPLICATIONS**

[Synthesize the results, quality/validity, and applicability of the two studies reviewed for the CAT. Future implications for research should be addressed briefly. Limit: 1 page.]

|  |
| --- |
| Outcomes relevant to the aforementioned PICO question, are those with an established association with falls risk. As fall risk has been associated with postural stability and the TUG assessment amongst geriatric individuals with knee OA, postural sway, limits of stability, and TUG times were primary outcomes of interest amongst the two studies reviewed.11–13,32–34. Individuals receiving the altered OEP improved by statistically significantly more than the control group when considering composite mCTSIB, the standing on a pliable surface with eyes closed portion of the mCTSIB, direction control, and maximal excursion.3 Conversely, individuals receiving the Tai Chi intervention did not experience a significantly greater decrease in TUG times as compared to the control group.9 The variability of outcome measures used to assess falls risk necessitated the use of standard effect size in order to compare the effectiveness of the Tai Chi and altered OEP interventions.3,9 This statistic seems reasonable to use as the study populations were similar with regards to study participants’ age, gender, and primary diagnosis.3,9 The modified OEP was found to have a large standard effect size on the standing on a pliable surface with eyes closed condition the mCTSIB and a medium standard effect size on the standing on a pliable surface with eyes open condition of the mCTSIB.3 The altered OEP was also found to have a large effect size on some measures of limits of stability including maximal excursion and directional control.3 Conversely, the Tai Chi intervention was only found to have small to medium effect size on the TUG.9 When considering these results, it appears as if the modified OEP is far more effective at achieving clinically meaningful improvements with regard to fall risk reduction amongst geriatric individuals with knee OA. 3,9 Is it important to review the statistical results of these studies with some consideration given to the quality of the studies, as a higher quality study will have increased validity. When considering the two studies appraised, they both appear to provide relatively high quality evidence as they are both ranked level 1b on the Levels of Evidence table by Portney and Watkins as they utilize a randomized controlled trial design and lost less than 20% of participants to follow up.3,9,36 These studies’ were also assessed utilizing the PEDro scale which did bring to light some differences in quality between the two studies which may impact the respective validity of the results found.3,9 The study by Mat, Ng, and Tan et al. appeared to be a slightly lower quality study as compared to the study by Fransen, Nairn, and Winstanley et al. with a comparatively higher number of drop outs and absence of an intention to treat analysis.3,9 Additionally, within the study by Mat, Ng, and Tan et al. the provision of additional falls prevention strategies produces results which cannot be solely attributed to the modified OEP.3 Due to these differences the study by Fransen, Nairn, and Winstanley et al. appears to have slightly improved internal validity and consequently the results of this study may be more confidently attributed to the intervention utilized.3,9 Applicability of these studies to the PICO question posed should also be considered.3,9 The study by Mat, Ng, and Tan et al. appears to be slightly more applicable to my PICO question as the study population includes elderly individuals, at risk for falls, with knee OA, all of which are all specified attributes of my population of interest.3 Although the intervention utilized in this study is a slightly modified version of the OEP, the exercises prescribed as well as performance of exercise at home are both aspects consistent with the original OEP.3,4 Additionally, this study measured outcomes after 6 months as opposed to the 12-month time point as was stated in my PICO question.3 The study population included within the study considering the Tai Chi intervention slightly varied from the population included within my PICO question, as individuals had either hip or knee OA and did not have an established risk for falls.9 The intervention applied, however, mirrored that which was stated in my PICO question.9 Outcomes were measured for this study at the 12- and 24-week time-points decreasing the applicability of these study results to my PICO question.9The variation that exists between these two study’s’ populations, durations of treatment, quality, and outcome measures utilized make it difficult to compare results.3,9 As such, future research should be conducted which directly compares the efficacy of the OEP and Tai Chi in decreasing fall risk amongst elderly individuals with knee OA. It would be of benefit to conduct a study which is adequately powered to detect a significant difference in fall rates between groups during the study period, if one exists.  |

**REFERENCES**

[List all references cited in the CAT]

|  |
| --- |
| Bibliography1. Zhang Y, Jordan JM. Epidemiology of osteoarthritis. *Clin Geriatr Med* 2010;26(3):355-369. doi:10.1016/j.cger.2010.03.001.2. Bergen G, Stevens MR, Burns ER. Falls and Fall Injuries Among Adults Aged ≥65 Years - United States, 2014. *MMWR Morb. Mortal. Wkly. Rep.* 2016;65(37):993-998. doi:10.15585/mmwr.mm6537a2.3. Mat S, Ng CT, Tan PJ, et al. Effect of modified otago exercises on postural balance, fear of falling, and fall risk in older fallers with knee osteoarthritis and impaired gait and balance: A secondary analysis. *PM R* 2018;10(3):254-262. doi:10.1016/j.pmrj.2017.08.405.4. Liu-Ambrose T, Donaldson MG, Ahamed Y, et al. Otago home-based strength and balance retraining improves executive functioning in older fallers: a randomized controlled trial. *J. Am. Geriatr. Soc.* 2008;56(10):1821-1830. doi:10.1111/j.1532-5415.2008.01931.x.5. Song R, Lee E-O, Lam P, Bae S-C. Effects of tai chi exercise on pain, balance, muscle strength, and perceived difficulties in physical functioning in older women with osteoarthritis: a randomized clinical trial. *J. Rheumatol.* 2003;30(9):2039-2044.6. Brismée J-M, Paige RL, Chyu M-C, et al. Group and home-based tai chi in elderly subjects with knee osteoarthritis: a randomized controlled trial. *Clin. Rehabil.* 2007;21(2):99-111. doi:10.1177/0269215506070505.7. Ghandali E, Moghadam ST, Hadian MR, Olyaei G, Jalaie S, Sajjadi E. The effect of Tai Chi exercises on postural stability and control in older patients with knee osteoarthritis. *J Bodyw Mov Ther* 2017;21(3):594-598. doi:10.1016/j.jbmt.2016.09.001.8. Song R, Roberts BL, Lee E-O, Lam P, Bae S-C. A randomized study of the effects of t’ai chi on muscle strength, bone mineral density, and fear of falling in women with osteoarthritis. *J. Altern. Complement. Med.* 2010;16(3):227-233. doi:10.1089/acm.2009.0165.9. Fransen M, Nairn L, Winstanley J, Lam P, Edmonds J. Physical activity for osteoarthritis management: a randomized controlled clinical trial evaluating hydrotherapy or Tai Chi classes. *Arthritis Rheum.* 2007;57(3):407-414. doi:10.1002/art.22621.10. Wang C, Schmid CH, Hibberd PL, et al. Tai Chi is effective in treating knee osteoarthritis: a randomized controlled trial. *Arthritis Rheum.* 2009;61(11):1545-1553. doi:10.1002/art.24832.11. Alencar MA, Arantes PMM, Dias JMD, Kirkwood RN, Pereira LSM, Dias RC. Muscular function and functional mobility of faller and non-faller elderly women with osteoarthritis of the knee. *Braz. J. Med. Biol. Res.* 2007;40(2):277-283. doi:10.1590/S0100-879X2006005000058.12. Petrella M, Neves TM, Reis JG, Gomes MM, Oliveira RDR de, Abreu DCC de. Postural control parameters in elderly female fallers and non-fallers diagnosed or not with knee osteoarthritis. *Rev Bras Reumatol* 2012;52(4):512-517.13. Khalaj N, Abu Osman NA, Mokhtar AH, Mehdikhani M, Wan Abas WAB. Balance and risk of fall in individuals with bilateral mild and moderate knee osteoarthritis. *PLoS One* 2014;9(3):e92270. doi:10.1371/journal.pone.0092270.14. Tan PJ, Khoo EM, Chinna K, Hill KD, Poi PJH, Tan MP. An individually-tailored multifactorial intervention program for older fallers in a middle-income developing country: Malaysian Falls Assessment and Intervention Trial (MyFAIT). *BMC Geriatr.* 2014;14:78. doi:10.1186/1471-2318-14-78.15. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthrosis. *Ann. Rheum. Dis.* 1957;16(4):494-502. doi:10.1136/ard.16.4.494.16. Altman R, Asch E, Bloch D, et al. Development of criteria for the classification and reporting of osteoarthritis. Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis Rheum.* 1986;29(8):1039-1049. doi:10.1002/art.1780290816.17. Barry E, Galvin R, Keogh C, Horgan F, Fahey T. Is the Timed Up and Go test a useful predictor of risk of falls in community dwelling older adults: a systematic review and meta-analysis. *BMC Geriatr.* 2014;14(1):14. doi:10.1186/1471-2318-14-14.18. Batchelor FA, Hill KD, Mackintosh SF, Said CM, Whitehead CH. Effects of a multifactorial falls prevention program for people with stroke returning home after rehabilitation: a randomized controlled trial. *Arch. Phys. Med. Rehabil.* 2012;93(9):1648-1655. doi:10.1016/j.apmr.2012.03.031.19. Knee Injury and Osteoarthritis Outcome Score | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/knee-injury-and-osteoarthritis-outcome-score. Accessed November 25, 2019.20. Alencar MA, Arantes PMM, Dias JMD, Kirkwood RN, Pereira LSM, Dias RC. Muscular function and functional mobility of faller and non-faller elderly women with osteoarthritis of the knee. *Braz. J. Med. Biol. Res.* 2007;40(2):277-283. doi:10.1590/s0100-879x2007000200016.21. Kwan MM-S, Close JCT, Wong AKW, Lord SR. Falls incidence, risk factors, and consequences in Chinese older people: a systematic review. *J. Am. Geriatr. Soc.* 2011;59(3):536-543. doi:10.1111/j.1532-5415.2010.03286.x.22. Tinetti ME, Kumar C. The patient who falls: “It’s always a trade-off”. *JAMA* 2010;303(3):258-266. doi:10.1001/jama.2009.2024.23. St George Hospital | South Eastern Sydney Local Health District. Available at: https://www.seslhd.health.nsw.gov.au/st-george-hospital. Accessed December 1, 2019.24. Altman R, Alarcón G, Appelrouth D, et al. The American College of Rheumatology criteria for the classification and reporting of osteoarthritis of the hip. *Arthritis Rheum.* 1991;34(5):505-514. doi:10.1002/art.1780340502.25. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *J. Rheumatol.* 1988;15(12):1833-1840.26. Western Ontario and McMaster Universities Osteoarthritis Index | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/womac-osteoarthritis-index-reliability-validity-and-responsiveness-patients. Accessed November 26, 2019.27. Short Form 12 item (version 2) Health Survey | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/short-form-12-item-version-2-health-survey. Accessed November 26, 2019.28. Gandhi SK, Salmon JW, Zhao SZ, Lambert BL, Gore PR, Conrad K. Psychometric evaluation of the 12-item short-form health survey (SF-12) in osteoarthritis and rheumatoid arthritis clinical trials. *Clin. Ther.* 2001;23(7):1080-1098. doi:10.1016/s0149-2918(01)80093-x.29. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav. Res. Ther.* 1995;33(3):335-343. doi:10.1016/0005-7967(94)00075-u.30. Bellamy N, Kirwan J, Boers M, et al. Recommendations for a core set of outcome measures for future phase III clinical trials in knee, hip, and hand osteoarthritis. Consensus development at OMERACT III. *J. Rheumatol.* 1997;24(4):799-802.31. Timed Up and Go | RehabMeasures Database. Available at: https://www.sralab.org/rehabilitation-measures/timed-and-go. Accessed September 2, 2019.32. Piva SR, Fitzgerald GK, Irrgang JJ, Bouzubar F, Starz TW. Get up and go test in patients with knee osteoarthritis. *Arch. Phys. Med. Rehabil.* 2004;85(2):284-289. doi:10.1016/j.apmr.2003.05.001.33. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. *Phys. Ther.* 2000;80(9):896-903. doi:10.1093/ptj/80.9.896.34. Arnold CM, Faulkner RA. The history of falls and the association of the timed up and go test to falls and near-falls in older adults with hip osteoarthritis. *BMC Geriatr.* 2007;7:17. doi:10.1186/1471-2318-7-17.35. Grace EM, Gerecz EM, Kassam YB, Buchanan HM, Buchanan WW, Tugwell PS. 50-foot walking time: a critical assessment of an outcome measure in clinical therapeutic trials of antirheumatic drugs. *Br J Rheumatol* 1988;27(5):372-374. doi:10.1093/rheumatology/27.5.372.36. Portney, Watkins. Levels of Evidence. 2009. Available at: https://sakai.unc.edu/access/content/group/868c2df3-91ec-44e1-8cbe-7a4fd0671a7d/Evaluation%20tools/Levels%20of%20Evidence%20\_Portney%20\_%20Watkins%202009\_.pdf. Accessed December 1, 2019. |