

Annotated bibliography on tai chi studies during July, 2008 to May, 2009 for TCHC Members.

Assembled and annotated by Stephanie Taylor, MD PhD

(2009). "Practicing tai chi may help seniors get a better night's sleep." Mayo Clin Womens Healthsource **13**(1): 3.

Au-Yeung, S. S., C. W. Hui-Chan, et al. (2009). "Short-form Tai Chi Improves Standing Balance of People With Chronic Stroke." Neurorehabil Neural Repair **23**(5): 515-22.

BACKGROUND: and **OBJECTIVE:** Our previous findings showed that 4 weeks of intensive Tai Chi practice improved standing balance in healthy seniors. This study set out to investigate whether Tai Chi could improve standing balance in subjects with chronic stroke. **METHODS:** One hundred thirty-six subjects >6 months after stroke were randomly assigned to a control group (n = 62) practicing general exercises or a Tai Chi group (n = 74) for 12 weeks of training. Each week, 1 hour of group practice was supplemented by 3 hours of self-practice. We used a short-form of Tai Chi consisting of 12 forms that require whole-body movements to be performed in a continuous sequence and demands concentration. A blinded assessor examined subjects at baseline, 6 weeks (mid-program), 12 weeks (end-program), and 18 weeks (follow-up). The 3 outcome measures were (1) dynamic standing balance evaluated by the center of gravity (COG) excursion during self-initiated body leaning in 4 directions, (2) standing equilibrium evaluated in sensory challenged conditions, and (3) functional mobility assessed by Timed-up-and-go score. Mixed model repeated-measures analysis of variance was used to examine between-group differences. **RESULTS:** When compared with the controls, the Tai Chi group showed greater COG excursion amplitude in leaning forward, backward, and toward the affected and nonaffected sides ($P < .05$), as well as faster reaction time in moving the COG toward the nonaffected side ($P = .014$) in the end-program and follow-up assessments. The Tai Chi group also demonstrated better reliance on vestibular integration for balance control at end-program ($P = .038$). However, neither group improved significantly in Timed-up-and-go scores. **CONCLUSIONS:** Twelve weeks of short-form Tai Chi produced specific standing balance improvements in people with chronic stroke that outlasted training for 6 weeks.

Bertisch, S. M., C. C. Wee, et al. (2008). "Use of complementary and alternative therapies by overweight and obese adults." Obesity (Silver Spring) **16**(7): 1610-5.

OBJECTIVE: Obesity is associated with higher health-care costs due, in part, to higher use of traditional health care. Few data are available on the relationship between obesity and the use of complementary and alternative medicine (CAM). **METHODS AND PROCEDURES:** We analyzed data on CAM use from the 2002 National Health Interview Survey (NHIS) Alternative Medicine Supplement (n=31,044). We compared the use of CAM overall, within the past 12 months, between normal weight (BMI from 18 to <25), overweight (from 25 to <30), mildly obese (from 30 to <35), moderately obese (from 35 to <40), and extremely obese (>40) adults. For the primary analysis, our multivariable model was adjusted for sociodemographic factors, insurance status, medical conditions, and health behaviors. We performed additional analyses to

explore the association of BMI and the use of seven CAM modalities. RESULTS: We found that adults with obesity have lower prevalence of use of yoga therapy, and similar prevalence of use of several CAM modalities, including relaxation techniques, natural herbs, massage, chiropractic medicine, tai chi, and acupuncture, compared to normal-weight individuals. After adjustment for sociodemographic factors, insurance status, medical conditions, and health behaviors, adults with obesity were generally less likely to use most individual CAM modalities, although the magnitude of these differences were quite modest in many cases. DISCUSSION: Even though adults with obesity have a greater illness burden and higher utilization of traditional medical care, adults with higher BMIs were no more likely to use each of the individual CAM therapies studied. Additional research is needed to improve our understanding of CAM use by adults with obesity.

Bertisch, S. M., C. C. Wee, et al. (2009). "Alternative mind-body therapies used by adults with medical conditions." *J Psychosom Res* 66(6): 511-9.

OBJECTIVE: Mind-body therapies (MBT) are used by 16.6% of adults in the United States. Little is known about the patterns of and reasons for use of MBT by adults with common medical conditions. METHODS: We analyzed data on MBT use from the 2002 National Health Interview Survey Alternative Medicine Supplement (n=31,044). MBT included relaxation techniques (deep breathing exercises, guided imagery, meditation, and progressive muscle relaxation), yoga, tai chi, and qigong. To identify medical conditions associated with use of MBT overall and of individual MBT, we used multivariable models adjusted for sociodemographic factors, insurance status, and health habits. Among users of MBT (n=5170), we assessed which medical conditions were most frequently treated with MBT, additional rationale for using MBT, and perceived helpfulness. RESULTS: We found a positive association between MBT use and several medical conditions including various pain syndromes and anxiety/depression. Among adults using MBT to treat specific medical conditions, MBT was most commonly used for anxiety/depression and musculoskeletal pain syndromes. More than 50% of respondents used MBT in conjunction with conventional medical care, and 20% used MBT for conditions they thought conventional medicine would not help. Overall, we found high rates (68-90%) of perceived helpfulness of MBT for specific medical conditions. DISCUSSION: MBT is commonly used by patients with prevalent medical conditions. Further research is needed to determine the reasons for widespread use of MBT for treatment of specific medical conditions and to evaluate the efficacy of MBT.

Blake, H. and M. Batson (2009). "Exercise intervention in brain injury: a pilot randomized study of Tai Chi Qigong." *Clin Rehabil*.

Objective: To examine the effects of a brief Tai Chi Chuan Qigong ('Qigong') exercise intervention on individuals with traumatic brain injury. Design: A single-centre randomized controlled trial pilot study. Setting: A registered charity day centre in the community. Subjects: Twenty individuals with traumatic brain injury. Intervention: Intervention participants attended a Qigong exercise session for one hour per week over eight weeks. Control participants engaged in non-exercise-based social and leisure activities for the same intervention period. Measures: Outcome was assessed at baseline and post intervention using the General Health Questionnaire-12, the Physical Self-Description Questionnaire and the Social Support for Exercise Habits

Scale, to measure perceived mood, self-esteem, flexibility, coordination, physical activity and social support. Results: Groups were comparable at baseline. After the intervention, mood was improved in the exercise group when compared with controls ($U = 22.0$, $P = 0.02$). Improvements in self-esteem ($Z = 2.397$, $P = 0.01$) and mood ($Z = -2.032$, $P = 0.04$) across the study period were also evident in the exercise group only. There were no significant differences in physical functioning between groups. In view of the sample size, these findings are inconclusive. Conclusions: This study provides preliminary evidence that a brief Qigong exercise intervention programme may improve mood and self-esteem for individuals with traumatic brain injury. This needs to be tested in a large-scale randomized trial.

Callahan, L. F. (2009). "Physical activity programs for chronic arthritis." Curr Opin Rheumatol **21**(2): 177-82.

PURPOSE OF REVIEW: The purpose of this review is to evaluate recent trials and studies of different types of physical activity programs for individuals with chronic arthritis and to discuss recommendations and findings from systematic reviews of physical activity interventions.

RECENT FINDINGS: Recent randomized control trials of different multicomponent land-based, aquatic, Tai Chi, and strength training programs report moderate benefits after intervention and at 6 and 12 months for individuals with various types of chronic arthritis. Reported benefits include increasing physical activity, strength, and balance, improving functional status, reducing symptoms, and enhancing self-efficacy. Recent systematic reviews recommend evidence-based, land-based, aquatic, Tai Chi, and strength training programs for individuals with arthritis.

SUMMARY: There is a preponderance of strong scientific evidence that both aerobic and muscle strengthening exercises, alone or in combination, are safe and moderately effective for individuals with chronic arthritis.

Carpenter, J., B. Gajewski, et al. (2008). "Bayesian data analysis: estimating the efficacy of T'ai Chi as a case study." Nurs Res **57**(3): 214-9.

BACKGROUND: Bayesian inference provides a formal framework for updating knowledge by combining prior knowledge with current data. Over the past 10 years, the Bayesian paradigm has become a popular analytic tool in health research. Although the nursing literature contains examples of Bayes' theorem applications to clinical decision making, it lacks an adequate introduction to Bayesian data analysis. **METHODS:** Bayesian data analysis is introduced through a fully Bayesian model for determining the efficacy of tai chi as an illustrative example. The mechanics of using Bayesian models to combine prior knowledge, or data from previous studies, with observed data from a current study are discussed. **RESULTS:** The primary outcome in the illustrative example was physical function. Three prior probability distributions (priors) were generated for physical function using data from a similar study found in the literature. Each prior was combined with the likelihood from observed data in the current study to obtain a posterior probability distribution. In each case, the posterior distribution showed that the probability that the control group is better than the tai chi treatment group was low. **DISCUSSION:** Bayesian analysis is a valid technique that allows the researcher to manage varying amounts of data appropriately. As advancements in computer software continue, Bayesian techniques will become more accessible. Researchers must educate themselves on applications for Bayesian inference, as well as its methods and implications for future research.

Chang, R. Y., M. Koo, et al. (2008). "The effect of t'ai chi exercise on autonomic nervous function of patients with coronary artery disease." J Altern Complement Med **14**(9): 1107-13.

OBJECTIVE: The objective of this study was to evaluate the effect of t'ai chi (TC) on heart rate variability (HRV) from baseline to 9 months in patients with coronary artery disease (CAD). **DESIGN:** A comparative trial was undertaken comparing the acute and long-term effect of TC on HRV in patients with CAD. **PARTICIPANTS:** Sixty-one (61) subjects with CAD undergoing percutaneous intervention or coronary bypass grafting for a period of more than 1 month were recruited from the clinics of cardiology and cardiovascular surgery at Chia-Yi Christian Hospital, Taiwan. **INTERVENTIONS:** The experimental group (n = 22) practiced weekly 90-minute Yang's style TC for 9 months and the control group (n = 39) continued their normal daily physical activity. **MAIN OUTCOME MEASURES:** HRV was recorded at baseline, 3 months, 6 months, and 9 months in the control group. Resting HRV was recorded before TC exercise and recovery HRV was recorded 30 minutes post TC at the same four time points in the experimental group. **RESULTS:** The change in the normalized low-frequency power, normalized high-frequency power, and the low-/high-frequency power ratio between resting and post-TC was significantly different at 9 months when compared with those at baseline, 3, and 6 months. The mean difference in normalized low-frequency power and the low/high-frequency power ratio changed from positive values at baseline, 3, and 6 months to negative values at 9 months. However, there were no significant differences in resting HRV between the patients in TC and control groups in either time domain or frequency domain HRV indices. **CONCLUSIONS:** The change in heart rate and HRV between resting and post-TC suggested that TC exercise could enhance vagal modulation. The potential beneficial effect of long-term regular TC exercise in patients with CAD merits further investigation.

Chang, Y. F., Y. H. Yang, et al. (2008). "Tai Chi Chuan training improves the pulmonary function of asthmatic children." J Microbiol Immunol Infect **41**(1): 88-95.

BACKGROUND AND PURPOSE: Tai Chi Chuan, a traditional Chinese exercise, is thought to improve cardiopulmonary function in patients with chronic disease. This study investigated the effect of Tai Chi Chuan on the pulmonary function and daily symptoms of asthmatic children. **METHODS:** Thirty asthmatic children were enrolled into the study. Fifteen of the 30 children participated in a 12-week Tai Chi Chuan program and the remaining 15 constituted the control group. Prior to study participation, the pulmonary function of all enrolled children was assessed at rest, after exercise, and after exercise plus iced water. A 3-day symptoms questionnaire was also completed and a score obtained after each pulmonary function test. **RESULTS:** There were no significant differences between the two groups in baseline pulmonary function and severity of asthmatic symptoms before study commencement, at rest, after exercise, or after exercise plus iced water. However, after the 12-week program, children in the Tai Chi Chuan group had a significant improvement in pulmonary function compared to the control group. Although there were no significant differences in post-training symptom scores at rest and after exercise between the two groups, under the stronger challenge of exercise plus iced water, children in the Tai Chi Chuan group had milder symptoms than those in the control group. **CONCLUSION:** Our data show that Tai Chi Chuan can improve the pulmonary function of asthmatic children. However, long-term follow-up is required to determine the impact of Tai Chi Chuan on the severity of asthmatic symptoms.

Chen, K. M., J. N. Lin, et al. (2008). "The effects of a Simplified Tai-Chi Exercise Program (STEP) on the physical health of older adults living in long-term care facilities: a single group design with multiple time points." Int J Nurs Stud **45**(4): 501-7.

BACKGROUND: Studies support the positive effects that Tai Chi has on the physical health of older adults. However, many older adults residing in long-term care facilities feel too weak to practice traditional Tai Chi, and a more simplified style is preferred. **OBJECTIVE:** To test the effects of a newly-developed, Simplified Tai-Chi Exercise Program (STEP) on the physical health of older adults who resided in long-term care facilities. **DESIGN:** A single group design with multiple time points: three pre-tests, one month apart; four post-tests at one month, two months, three months, and six months after intervention started. **SETTINGS:** Two 300-400 bed veteran homes in Taiwan. **PARTICIPANTS:** The 51 male older adults were recruited through convenience sampling, and 41 of them completed six-month study. Inclusion criteria included: (1) aged 65 and over; (2) no previous training in Tai Chi; (3) cognitively alert and had a score of at least eight on the Short Portable Mental Status Questionnaire; (4) able to walk without assistance; and (5) had a Barthel Index score of 61 or higher. Participants who had dementia, were wheel-chair bound, or had severe or acute cardiovascular, musculoskeletal, or pulmonary illnesses were excluded. **METHODS:** The STEP was implemented three times a week, 50 min per session for six months. The outcome measures included cardio-respiratory function, blood pressure, balance, hand-grip strength, lower body flexibility, and physical health actualization. **RESULTS:** A drop in systolic blood pressure ($p=.017$) and diastolic blood pressure ($p<.001$) was detected six months after intervention started. Increase in hand-grip strength from pre to post intervention was found (left hand: $p<.001$; right hand: $p=.035$). Participants also had better lower body flexibility after practicing STEP ($p=.038$). **CONCLUSIONS:** Findings suggest that the STEP be incorporated as a floor activity in long-term care facilities to promote physical health of older adults.

Chen, Y. Y., J. Chiang, et al. (2008). "Cycling and Tai Chi Chuan exercises exert greater immunomodulatory effect on surface antigen expression of human hepatitis B virus." Chin Med J (Engl) **121**(21): 2172-9.

BACKGROUND: Both athletes with intensive exercise and aged people may have weakened immunity against virus infection. This study aimed to evaluate whether people undergoing aerobic exercises including competitive cyclists with moderate training (CMT) and middle-aged people practicing Tai Chi Chuan (TCC) exercise have higher immunity against hepatitis B virus than age-matched sedentary controls including college students (CSC) and middle-aged people (MSC). **METHODS:** Human peripheral blood mononuclear cells from competitive cyclists and sedentary controls were stimulated by phytohemagglutinin (PHA) to prepare conditioned medium (MNC-CM) for the assessment of inhibitory effects on hepatitis B surface antigen (HBsAg) expression in human hepatoma Hep3B cells. **RESULTS:** The inhibitory effects on the relative HBsAg expression of CMT's and TCC's MNC-CM were greater than those of the controls. The CMT's MNC-CM prepared from 5 microg/ml PHA decreased HBsAg expression to 61.5%, whereas that of CSC remained at 83.8%. Similarly, this expression by treatment of TCC group' MNC-CM was 68.4% whereas that of MSC group was 84.3%. The levels of cytokines such as interferon-gamma (IFN-gamma), tumor necrosis factor-alpha (TNF-alpha), IFN-alpha and interleukin-1beta (IL-1beta) in the MNC-CM from the CMT and TCC groups

were greater than those in the controls. Antibody neutralization of CMT's MNC-CM and addition of recombinant cytokines into CSC's MNC-CM indicated that IFN-gamma, TNF-alpha and IFN-alpha had synergistic effects against HBsAg expression. Similar blocking effect was noted in TCC versus MSC groups. CONCLUSION: These results suggest that the immunomodulatory response to suppress HBsAg expression in CMT and TCC with moderate aerobic exercise is greater than that in age-matched sedentary controls.

Chin, A. P. M. J., J. G. van Uffelen, et al. (2008). "The functional effects of physical exercise training in frail older people : a systematic review." *Sports Med* **38**(9): 781-93.

This systematic review describes the effect of exercise training on physical performance in frail older people. Randomized controlled trials were identified from searches in PubMed, EMBASE and CENTRAL from January 1995 through August 2007. Two reviewers independently screened the trials for eligibility, rated their quality, and extracted data. Randomized controlled trials that examined the effects on performance-based measures of physical function among frail older adults were included. The systematic search identified 20 studies, examining 23 different exercise programmes. The methodological quality score (0-9) of the trials ranged from 2 to 7 points. Sixteen of the studies were scored as high quality. There was a large variety in the studies concerning sample size, degree of frailty, types of interventions and types of assessments. The majority of the programmes were facility-based, group-exercise programmes that were performed three times a week for 45-60 minutes. The intervention programmes comprised resistance training (n = 9), Tai Chi training (n = 2), or multi-component training (n = 12). Six of the total selected 20 studies did not find a beneficial exercise effect on functional performance. This systematic review suggests that older adults with different levels of abilities can improve their functional performance by regular exercise training. To determine the most appropriate design of the exercise programme (type, intensity, frequency and duration of exercise) for functional improvement or prevention of loss of function, more high-quality trials are needed in which different training protocols are compared.

Cho, K. L. (2008). "Effect of Tai Chi on depressive symptoms amongst Chinese older patients with major depression: the role of social support." *Med Sport Sci* **52**: 146-54.

The objective of this study was to determine whether the effects of Tai Chi training on depressive symptoms in Chinese older patients with depression remained statistically significant after social support was controlled. Fourteen community-dwelling older patients from a psychogeriatric outpatient clinic were randomly assigned to either a 3-month Tai Chi intervention with 36 sessions or a wait-list control. Depression was assessed by the Center for Epidemiological Studies Depression Scale (CES-D), whereas social support was measured by the Lubben Social Network Scale (LSNS). By performing multiple regression analyses, we examined whether the effect of group assignment (Tai Chi and control groups) on five measures of depressive symptoms (i.e. the total scores of the CES-D scale, and scores of all its subscales including symptoms related to somatic, negative affect, interpersonal relation, and well-being) remained significant after controlling for age, gender, education, and LSNS. Results indicate that the beneficial impact of Tai Chi on five measures of depressive symptoms remained significant when we adjusted for age, gender, and education. On the other hand, the effect of our intervention disappeared when changes of social support were controlled for. Social support

might be partly responsible for the effect of Tai Chi on depressive symptoms because practicing Tai Chi is a social activity in nature.

Dechamps, A., B. Gatta, et al. (2009). "Pilot study of a 10-week multidisciplinary Tai Chi intervention in sedentary obese women." Clin J Sport Med **19**(1): 49-53.

OBJECTIVE: Alternative approaches to weight control and physical activity are increasingly needed. Numerous factors influence weight management, including the choice of physical exercise. No study has previously examined the therapeutic effect of a multidisciplinary weight management program incorporating Tai Chi (TC) exercises among sedentary obese women. **DESIGN:** Randomized intervention trial with blinded medical provider. **SETTING:** In day hospital consultations. **PARTICIPANTS:** Twenty-one obese women. **INTERVENTION:** All subjects participated in a 10-week weight management program that was part of usual care and included a hypocaloric balanced diet, a weekly physician/psychologist/dietician group session, and an exercise program. For the exercise component, subjects were randomized to either a 2-hour weekly session of TC or a conventional structured exercise program. **MAIN OUTCOME MEASURES:** Changes in weight, body composition, heart rate, blood pressure, mobility scores, mood, Three Factor Eating Questionnaire scores, and General Self-Efficacy. **RESULTS:** The TC arm improved in resting systolic blood pressure, chair rise test, mood, and reduced percent of fat at week 10 and at 6 months follow-up. General self-efficacy was enhanced in both groups and maintained at 30 weeks. **CONCLUSION:** The observed benefits over a 30-week period of a multidisciplinary weight management program incorporating TC exercises on physical functioning mood and dietary restraint need further understanding of how sedentary obese women adhere to physical activity like TC or other alternative exercises.

Deschamps, A., C. Onifade, et al. (2009). "Health-related quality of life in frail institutionalized elderly: effects of a cognition-action intervention and Tai Chi." J Aging Phys Act **17**(2): 236-48.

No previous studies have explored the effects of mind-body approaches on health-related quality of life (HRQoL) in the frail elderly. Cognition and action are an inseparable whole during functioning. Thus, a new intervention-based approach using familiarity-based movements and a nonjudgmental approach of "cognition-action" was proposed and was tested with Tai Chi on HRQoL in frail institutionalized elderly. Fifty-two participants (58% women) age 65-94 took part in a 24-wk Tai Chi (TC) intervention 4 days/wk or a cognition-action (CA) exercise program of 30 min twice a week. Changes in Mini Mental State score, physical (PCS) and mental component (MCS) summaries (SF12); Falls Efficacy Scale (FES); and exercise self-efficacy were explored. PCS improved from 33.6 +/- 6.7 to 51 +/- 4.8 in the TC group and from 30.6 +/- 9.9 to 45.1 +/- 10.2 in the CA group ($p < .001$). MCS of SF-12 ($p < .001$), FES ($p < .001$), and exercise self-efficacy ($p < .01$) were enhanced significantly in both groups. Adapted CA programs and Tai Chi were both efficient in improving HRQoL of frail elderly.

Forbes, D., S. Forbes, et al. (2008). "Physical activity programs for persons with dementia." Cochrane Database Syst Rev(3): CD006489.

BACKGROUND: There is some evidence that physical activity delays the onset of dementia in healthy older adults and slows down cognitive decline to prevent the onset of cognitive

disability. Studies using animal models suggest that physical activity has the potential to attenuate the pathophysiology of dementia. 'Physical activity' refers to 'usual care plus physical activity'. OBJECTIVES: Primary: do physical activity programs maintain or improve cognition, function, behaviour, depression, and mortality compared to usual care in older persons with dementia? Secondary: do physical activity programs have an indirect positive impact on family caregivers' health, quality of life, and mortality compared to family caregivers of older persons with dementia who received usual care alone? Do physical activity programs reduce the use of health care services (e.g., visits to the emergency department) compared to usual care in older persons with dementia and their family caregiver? SEARCH STRATEGY: The trials were identified from searches of the Specialized Register of the Cochrane Dementia and Cognitive Improvement Group, The Cochrane Library, MEDLINE, EMBASE, PsycINFO, CINAHL and LILACS on 9 September 2007 using the search terms: exercise OR "physical activity" OR cycling OR swim* OR gym* OR walk* OR danc* OR yoga OR "tai chi". SELECTION CRITERIA: All relevant, randomized controlled trials in which physical activity programs were compared with usual care for the effect on managing or improving cognition, function, behaviour, depression, and mortality in people with dementia of any type and degree of severity. Secondary outcomes related to the family caregiver(s) included quality of life, mortality, and use of health care services were intended to be examined. DATA COLLECTION AND ANALYSIS: Two reviewers independently assessed the retrieved articles for relevance and methodological quality, and extracted data from the selected trials. These were pooled where appropriate. MAIN RESULTS: Four trials met the inclusion criteria. However, only two trials were included in the analyses because the required data from the other two trials were not made available. Only one meta-analysis was conducted. The results from this review suggest that there is insufficient evidence of the effectiveness of physical activity programs in managing or improving cognition, function, behaviour, depression, and mortality in people with dementia. Few trials have examined these important outcomes. In addition, family caregiver outcomes and use of health care services were not reported in any of the included trials. AUTHORS' CONCLUSIONS: There is insufficient evidence to be able to say whether or not physical activity programs are beneficial for people with dementia.

Gatts, S. (2008). "Neural mechanisms underlying balance control in Tai Chi." *Med Sport Sci* **52**: 87-103.

BACKGROUND AND AIMS: The efficacy of Tai Chi (TC) to improve neuromuscular response characteristics underlying dynamic balance recovery in balance-impaired seniors at high risk for falling was examined during perturbed walking. METHODS: Twenty-two subjects were randomized into TC or control groups. Nineteen subjects (68-92 years, BERG 44 or less) completed the study. TC training incorporated repetitive exercises using TC's essential motor/biomechanical strategies, techniques, and postural components. Control training used axial exercises, balance awareness/education and stress reduction. Groups trained 1.5 h/day, 5 days/week for 3 weeks. After post-testing, controls received TC training. Subjects walked across a force plate triggered to move forward 15 cm at 40 cm/s at heelstrike. Tibialis anterior and medial gastrocnemius responses during balance recovery were recorded from electromyograms. Four clinical measures of balance were also examined. RESULTS: TC subjects, but not controls, significantly reduced tibialis anterior response time from 148.92 +/- 45.11 ms to 98.67 +/- 17.22 ms ($p < 0.004$) and decreased co-contraction of antagonist muscles ($p < 0.003$) of the

perturbed leg. All clinical balance measures significantly improved after TC. CONCLUSIONS: TC training transferred to improved neuromuscular responses controlling the ankle joint during perturbed gait in balance-impaired seniors who had surgical interventions to their back, hips, knees and arthritis. The fast, accurate neuromuscular activation crucial for efficacious response to slips also transferred to four clinical measures of functional balance. Significant enhancement was achieved with 3 weeks of training.

Gillespie, L. D., W. J. Gillespie, et al. (2003). "Interventions for preventing falls in elderly people." *Cochrane Database Syst Rev*(4): CD000340.

BACKGROUND: Approximately 30 per cent of people over 65 years of age and living in the community fall each year; the number is higher in institutions. Although less than one fall in 10 results in a fracture, a fifth of fall incidents require medical attention. **OBJECTIVES:** To assess the effects of interventions designed to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care). **SEARCH STRATEGY:** We searched the Cochrane Musculoskeletal Group specialised register (January 2003), Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to February 2003), EMBASE (1988 to 2003 Week 19), CINAHL (1982 to April 2003), The National Research Register, Issue 2, 2003, Current Controlled Trials (www.controlled-trials.com accessed 11 July 2003) and reference lists of articles. No language restrictions were applied. Further trials were identified by contact with researchers in the field. **SELECTION CRITERIA:** Randomised trials of interventions designed to minimise the effect of, or exposure to, risk factors for falling in elderly people. Main outcomes of interest were the number of fallers, or falls. Trials reporting only intermediate outcomes were excluded. **DATA COLLECTION AND ANALYSIS:** Two reviewers independently assessed trial quality and extracted data. Data were pooled using the fixed effect model where appropriate. **MAIN RESULTS:** Sixty two trials involving 21,668 people were included. Interventions likely to be beneficial: Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes in the community both for an unselected population of older people (4 trials, 1651 participants, pooled RR 0.73, 95%CI 0.63 to 0.85), and for older people with a history of falling or selected because of known risk factors (5 trials, 1176 participants, pooled RR 0.86, 95%CI 0.76 to 0.98), and in residential care facilities (1 trial, 439 participants, cluster-adjusted incidence rate ratio 0.60, 95%CI 0.50 to 0.73) A programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional (3 trials, 566 participants, pooled relative risk (RR) 0.80, 95% confidence interval (95%CI) 0.66 to 0.98) Home hazard assessment and modification that is professionally prescribed for older people with a history of falling (3 trials, 374 participants, RR 0.66, 95% CI 0.54 to 0.81) Withdrawal of psychotropic medication (1 trial, 93 participants, relative hazard 0.34, 95%CI 0.16 to 0.74) Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity (1 trial, 175 participants, WMD -5.20, 95%CI -9.40 to -1.00) A 15 week Tai Chi group exercise intervention (1 trial, 200 participants, risk ratio 0.51, 95%CI 0.36 to 0.73). Interventions of unknown effectiveness: Group-delivered exercise interventions (9 trials, 1387 participants) Individual lower limb strength training (1 trial, 222 participants) Nutritional supplementation (1 trial, 46 participants) Vitamin D supplementation, with or without calcium (3 trials, 461 participants) Home hazard modification in association with advice on optimising medication (1 trial, 658 participants), or in association with an education package on exercise and reducing fall risk (1 trial, 3182 participants) Pharmacological therapy (raubasine-

dihydroergocristine, 1 trial, 95 participants) Interventions using a cognitive/behavioural approach alone (2 trials, 145 participants) Home hazard modification for older people without a history of falling (1 trial, 530 participants) Hormone replacement therapy (1 trial, 116 participants) Correction of visual deficiency (1 trial, 276 participants). Interventions unlikely to be beneficial: Brisk walking in women with an upper limb fracture in the previous two years (1 trial, 165 participants). REVIEWER'S CONCLUSIONS: Interventions to prevent falls that are likely to be effective are now available; less is known about their effectiveness in preventing fall-related injuries. Costs per fall prevented have been established for four of the interventions and careful economic modelling in the context of the local healthcare system is important. Some potential interventions are of unknown effectiveness and further research is indicated.

Gillespie, L. D., M. C. Robertson, et al. (2009). "Interventions for preventing falls in older people living in the community." Cochrane Database Syst Rev(2): CD007146.

BACKGROUND: Approximately 30% of people over 65 years of age living in the community fall each year. OBJECTIVES: To assess the effects of interventions to reduce the incidence of falls in older people living in the community. SEARCH STRATEGY: We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register, CENTRAL (The Cochrane Library 2008, Issue 2), MEDLINE, EMBASE, CINAHL, and Current Controlled Trials (all to May 2008). SELECTION CRITERIA: Randomised trials of interventions to reduce falls in community-dwelling older people. Primary outcomes were rate of falls and risk of falling. DATA COLLECTION AND ANALYSIS: Two review authors independently assessed trial quality and extracted data. Data were pooled where appropriate. MAIN RESULTS: We included 111 trials (55,303 participants). Multiple-component group exercise reduced rate of falls and risk of falling (rate ratio (RaR) 0.78, 95%CI 0.71 to 0.86; risk ratio (RR) 0.83, 95%CI 0.72 to 0.97), as did Tai Chi (RaR 0.63, 95%CI 0.52 to 0.78; RR 0.65, 95%CI 0.51 to 0.82), and individually prescribed multiple-component home-based exercise (RaR 0.66, 95%CI 0.53 to 0.82; RR 0.77, 95%CI 0.61 to 0.97). Assessment and multifactorial intervention reduced rate of falls (RaR 0.75, 95%CI 0.65 to 0.86), but not risk of falling. Overall, vitamin D did not reduce falls (RaR 0.95, 95%CI 0.80 to 1.14; RR 0.96, 95%CI 0.92 to 1.01), but may do so in people with lower vitamin D levels. Overall, home safety interventions did not reduce falls (RaR 0.90, 95%CI 0.79 to 1.03); RR 0.89, 95%CI 0.80 to 1.00), but were effective in people with severe visual impairment, and in others at higher risk of falling. An anti-slip shoe device reduced rate of falls in icy conditions (RaR 0.42, 95%CI 0.22 to 0.78). Gradual withdrawal of psychotropic medication reduced rate of falls (RaR 0.34, 95%CI 0.16 to 0.73), but not risk of falling. A prescribing modification programme for primary care physicians significantly reduced risk of falling (RR 0.61, 95%CI 0.41 to 0.91). Pacemakers reduced rate of falls in people with carotid sinus hypersensitivity (RaR 0.42, 95%CI 0.23 to 0.75). First eye cataract surgery reduced rate of falls (RaR 0.66, 95%CI 0.45 to 0.95). There is some evidence that falls prevention strategies can be cost saving. AUTHORS' CONCLUSIONS: Exercise interventions reduce risk and rate of falls. Research is needed to confirm the contexts in which multifactorial assessment and intervention, home safety interventions, vitamin D supplementation, and other interventions are effective.

Gillum, F. and D. M. Griffith (2009). "Prayer and Spiritual Practices for Health Reasons among American Adults: The Role of Race and Ethnicity." J Relig Health.

Many studies find racial differences in prayer and religious practices, but few reports examine factors that help explain the effects of Hispanic ethnicity or African American race. A national survey conducted in 2002 collected data on 10 non-religious spiritual practices as well as on prayer for health reasons in 22,929 adults aged 18 years and over. We found marked racial and ethnic differences in the use of prayer and other spiritual practices for health reasons. Greater proportions of African Americans and Hispanic Americans than European Americans reported prayer for health reasons. Sociodemographic variables and health status could not explain these differences. Further, among those who reported prayer, African Americans were more likely than European Americans to report being prayed for by others. However, African American women and Hispanic women and men were significantly less likely than European Americans to use other spiritual practices such as meditation and Tai Chi. Surprisingly African American men were just as likely to report these practices as European American men. Sociodemographic variables and health status could not explain these differences.

Goon, J. A., A. H. Aini, et al. (2009). "Effect of Tai Chi exercise on DNA damage, antioxidant enzymes, and oxidative stress in middle-age adults." J Phys Act Health **6**(1): 43-54.

BACKGROUND: The biochemical mechanisms involving oxidative stress to explain the relationship between exercise and healthy aging are still unclear. **METHODS:** Tai Chi participants and matched sedentary volunteers age 45 and above were enrolled. Glutathione peroxidase (GPx), superoxide dismutase (SOD), and catalase (CAT) activities; levels of DNA damage using the comet assay; and malondialdehyde (MDA) and advanced glycation end products (AGE) were determined at 0, 6, and 12 months. **RESULTS:** Tai Chi subjects had decreased normal and increased mildly damaged DNA with elevated GPx activity after 6 months (n=25). Plasma MDA and AGE concentrations decreased significantly after 12 months (n=15) accompanied by increased SOD activity. This may be attributed to the hormesis effect, whereby mild induction of oxidative stress at the first 6 months of exercise resulted in stimulation of antioxidant defenses. These parameters were unchanged in the sedentary subjects in the first 6 months (n=27) except for elevated SOD activity. After 12 months, the sedentary subjects (n=17) had decreased normal DNA and increased severely damaged DNA with unaltered MDA and AGE levels while SOD and GPx activities were significantly elevated. **CONCLUSION:** Regular Tai Chi exercise stimulated endogenous antioxidant enzymes and reduced oxidative damage markers.

Goon, J. A., A. H. Noor Aini, et al. (2008). "Long term Tai Chi exercise reduced DNA damage and increased lymphocyte apoptosis and proliferation in older adults." Med J Malaysia **63**(4): 319-24.

Effect of Tai Chi exercise on the level of DNA damage using the comet assay, lymphocyte viability and frequency of sister chromatid exchange (SCE) were determined in adults aged above 45. Tai Chi participants of 7 years (n=35), showed higher level of normal DNA and lower level of mild and severely damaged DNA as compared to the sedentary subjects (n=35). The former are suggested to have effective DNA repair mechanism as their frequency of SCE was markedly lower. Higher lymphocyte apoptosis and proliferation found in the Tai Chi participants also indicated that the exercise promotes renewal and regeneration of lymphocytes.

Gooneratne, N. S. (2008). "Complementary and alternative medicine for sleep disturbances in older adults." Clin Geriatr Med **24**(1): 121-38, viii.

Complementary and alternative medicines (CAM) are frequently used for the treatment of sleep disorders, but in many cases patients do not discuss these therapies directly with their health care provider. There is a growing body of well-designed clinical trials using CAM that have shown the following: (1) Melatonin is an effective agent for the treatment of circadian phase disorders that affect sleep; however, the role of melatonin in the treatment of primary or secondary insomnia is less well established. (2) Valerian has shown a benefit in some, but not all clinical trials. (3) Several other modalities, such as Tai Chi, acupuncture, acupressure, yoga, and meditation have improved sleep parameters in a limited number of early trials. Future work examining CAM has the potential to significantly add to our treatment options for sleep disorders in older adults.

Grodin, M. A., L. Piwowarczyk, et al. (2008). "Treating survivors of torture and refugee trauma: a preliminary case series using qigong and t'ai chi." J Altern Complement Med **14**(7): 801-6.

OBJECTIVES: This paper seeks to explore the potential value of qigong and t'ai chi practice as a therapeutic intervention to aid in the treatment of survivors of torture and refugee trauma. **DESIGN:** The common effects of torture and refugee trauma are surveyed with a focus on post-traumatic stress disorder. An alternative theoretical framework for conceptualizing and healing trauma is presented. Evidence is reviewed from the scientific literature that describes how qigong and t'ai chi have been used in studies of the general population to alleviate symptoms that are also expressed in torture survivors. Observations are presented from a combined, simplified qigong and t'ai chi intervention with a convenience sample of four refugee survivors of torture. **RESULTS:** Preliminary observations from four cases and a review of the literature support the potential efficacy of incorporating qigong and t'ai chi into the treatment of survivors of torture and refugee trauma. **CONCLUSIONS:** The incorporation of qigong and t'ai chi into the treatment of torture survivors, within a new framework for healing trauma, merits further investigation.

Hackney, M. E. and G. M. Earhart (2008). "Tai Chi improves balance and mobility in people with Parkinson disease." Gait Posture **28**(3): 456-60.

This pilot study examines the effects of Tai Chi on balance, gait and mobility in people with Parkinson disease (PD). Thirty-three people with PD were randomly assigned to either a Tai Chi group or a control group. The Tai Chi group participated in 20 1-h long training sessions completed within 10-13 weeks; whereas, the control group had two testing sessions between 10 and 13 weeks apart without interposed training. The Tai Chi group improved more than the control group on the Berg Balance Scale, UPDRS, Timed Up and Go, tandem stance test, six-minute walk, and backward walking. Neither group improved in forward walking or the one leg stance test. All Tai Chi participants reported satisfaction with the program and improvements in well-being. Tai Chi appears to be an appropriate, safe and effective form of exercise for some individuals with mild-moderately severe PD.

Hackney, M. E. and G. M. Earhart (2009). "Health-related quality of life and alternative forms of exercise in Parkinson disease." Parkinsonism Relat Disord.

Parkinson disease (PD) reduces health-related quality of life (HRQoL), but exercise may improve HRQoL. This pilot study compared the effects of Tango, Waltz/Foxtrot, Tai Chi and No Intervention on HRQoL in individuals with PD. Seventy-five persons with PD (Hoehn and Yahr I-III) were assigned to 20 lessons of Tango, Waltz/Foxtrot, Tai Chi, or an untreated No Intervention group. Participants completed the PDQ-39 before and after participation in 20 classes or within 13 weeks in the case of the No Intervention group. Two-way repeated measures ANOVAs determined differences between interventions. Tango significantly improved on mobility ($p=0.03$), social support ($p=0.05$) and the PDQ-39 SI ($p<0.01$) at post-testing. No significant changes in HRQoL were noted in the Waltz/Foxtrot, Tai Chi or No Intervention. Tango may be helpful for improving HRQoL in PD because it addresses balance and gait deficits in the context of a social interaction that requires working closely with a partner.

Hall, A., C. Maher, et al. (2009). "The effectiveness of Tai Chi for chronic musculoskeletal pain conditions: A systematic review and meta-analysis." *Arthritis Rheum* **61**(6): 717-724.

OBJECTIVE: To determine whether Tai Chi improves pain, disability, physical performance, and/or health-related quality of life (HRQOL) in people with chronic musculoskeletal pain. **METHODS:** Eight databases were searched for randomized controlled trials (RCTs). Two independent reviewers rated trial quality and extracted trial data. Effect sizes and 95% confidence intervals were calculated for individual trials, and pooled effect sizes were calculated using a random-effects model. **RESULTS:** Seven RCTs were selected for inclusion in the review. Of these, 6 studied people with chronic arthritis and 1 studied people with chronic tension headaches. The trials were typically small and of low methodologic quality. The pooled effect size for arthritic populations on a 0-100 scale was 10.1 (range 6.3-13.9) points for pain reduction, and was 9.6 (range 5.2-14.0) points for disability reduction. Additionally, physical performance and HRQOL outcomes favored the Tai Chi intervention, but of these outcomes, only the level of tension and satisfaction with general health were statistically significant. **CONCLUSION:** The available data on the effect of Tai Chi are sparse and derived principally from low-quality studies. These data suggest that Tai Chi has a small positive effect on pain and disability in people with arthritis. The extent to which it benefits other forms of musculoskeletal pain is unclear.

Hall, A. M., C. G. Maher, et al. (2009). "A randomized controlled trial of tai chi for long-term low back pain (TAI CHI): Study rationale, design, and methods." *BMC Musculoskelet Disord* **10**(1): 55.

ABSTRACT: BACKGROUND: Low back pain persisting for longer than 3 months is a common and costly condition for which many current treatments have low-moderate success rates at best. Exercise is among the more successful treatments for this condition, however, the type and dosage of exercise that elicits the best results is not clearly defined. Tai chi is a gentle form of low intensity exercise that uses controlled movements in combination with relaxation techniques and is currently used as a safe form of exercise for people suffering from other chronic pain conditions such as arthritis. To date, there has been no scientific evaluation of tai chi as an intervention for people with back pain. Thus the aim of this study will be to examine the effects of a tai chi exercise program on pain and disability in people with long-term low back pain. **Methods / Design:** The study will recruit 160 healthy individuals from the community setting to

be randomised to either a tai chi intervention group or a wait-list control group. Individuals in the tai chi group will attend 2 tai chi sessions (40 minutes) / week for 8 weeks followed by 1 tai chi session / week for 2 weeks. The wait-list control will continue their usual health care practices and have the opportunity to participate in the tai chi program once they have completed the follow-up assessments. The primary outcome will be bothersomeness of back symptoms measured with a 0-10 numerical rating scale. Secondary outcomes include, self-reports of pain-related disability, health-related quality of life and global perceived effect of treatment. Statistical analysis of primary and secondary outcomes will be based on the intention to treat principle. Linear mixed models will be used to test for the effect of treatment on outcome at 10 weeks follow up. This trial has received ethics approval from The University of Sydney Human Research Ethics Committee. HREC Approval No.10452 DISCUSSION: This study will be the first trial in this area and the information on its effectiveness will allow patients, clinicians and treatment funders to make informed choices regarding this treatment. Trial Registration: This trial has been registered with Australian New Zealand Clinical Trials Registry. ACTRN12608000270314.

Hall, C. D., T. Miszko, et al. (2009). "Effects of Tai Chi intervention on dual-task ability in older adults: a pilot study." Arch Phys Med Rehabil **90**(3): 525-9.

OBJECTIVE: To determine if a 12-week program of Tai Chi that has been shown to reduce falls incidence in older adults would improve the ability to allocate attention to balance under dual-task conditions. **DESIGN:** Pre-/posttest experimental research design. **SETTING:** Movement studies research laboratory. **PARTICIPANTS:** Community dwelling older adults (N=15; range, 62-85y) participated in either Tai Chi training or health education classes (controls) for 12 weeks. **INTERVENTIONS:** Participants in the Tai Chi group attended a twice-weekly, 1.5-hour class taught by an experienced instructor. The control group attended a biweekly, 1-hour class for lectures on health-related topics. **MAIN OUTCOME MEASURES:** Two cognitive tasks (responding to auditory or visual stimulus as quickly as possible) were performed concurrently while maintaining static balance during the Sensory Organization Test (SOT) and while avoiding obstacles while walking. The percent change in performance relative to the single-task condition was calculated and defined as the dual-task cost. The dual-task cost was calculated for both the postural and cognitive measures. **RESULTS:** There was no improvement in the performance of postural stability or cognitive task under dual-task conditions for the SOT for Tai Chi versus controls. There was no improvement in avoiding obstacles under dual-task conditions for Tai Chi versus controls. **CONCLUSIONS:** Contrary to our hypothesis, the findings of this study did not support a benefit of Tai Chi on the ability to allocate attention to balance under dual-task conditions.

Harmer, P. A. and F. Li (2008). "Tai Chi and falls prevention in older people." Med Sport Sci **52**: 124-34.

BACKGROUND: Considerable research evidence has been accumulated since 1990 that practicing Tai Chi can ameliorate multiple characteristics in older adults that place them at increased risk of falling, including poor balance, loss of strength, limited flexibility, and fear of falling. However, relatively few studies have directly examined the influence of Tai Chi practice on falls in this population. **RESULTS:** Nine randomized controlled trials utilizing Tai Chi (n =

6), or Tai Chi-inspired exercise (n = 3), were published between 1996 and July, 2007. The studies varied considerably on study settings, participant characteristics, sample size, type of Tai Chi intervention, length of intervention and quality of the study design. Of the six studies that used Tai Chi forms, three showed significant improvement in fall-related outcomes. One study using Tai Chi-inspired exercise also had a significant fall-related outcome. **CONCLUSION:** Despite the evidence demonstrating the beneficial influence of Tai Chi practice on known risk factors for falling in older adults, evidence indicating an actual impact on falls-related outcomes is equivocal. More large-scale, longitudinal studies with consistent intervention parameters and clinically meaningful outcome variables are needed to clarify the role of Tai Chi in effective falls prevention programs. The recent development of a standardized, research-to-practice Tai Chi falls prevention program may be an important step in this process.

Hong, Y. (2008). "Preface. The first collection of scientific studies on Tai Chi Chuan." Med Sport Sci **52**: VIII-X.

Hong, Y., W. Mao de, et al. (2008). "Temporal characteristics of foot movement in Tai Chi exercise." Med Sport Sci **52**: 1-11.

The concept of proper foot movement is always emphasized in the practice of Tai Chi. Sixteen experienced Tai Chi practitioners participated in this study. Each subject practiced the whole set of 42-form Tai Chi movements and the performance was video-recorded and analyzed. The study found that Tai Chi is performed with the interchange of seven support patterns and six step directions of the foot. Compared with normal walking, there is a bigger percentage of time spent performing double support and less percentage of time spent performing single support movements in Tai Chi. However, the average duration of each support movement is longer and the change from one type of support to another is slower. In Tai Chi, the duration of steps in each direction is short and there are frequent changes from one direction to another. Tai Chi was found to be more effective than walking in simulating the gait challenges that are encountered in daily activities.

Hui, E. S., J. O. Cheng, et al. (2008). "Benefits of Tai Chi in palliative care for advanced cancer patients." Palliat Med **22**(1): 93-4.

Innes, K. E., T. K. Selfe, et al. (2008). "Menopause, the metabolic syndrome, and mind-body therapies." Menopause **15**(5): 1005-13.

Cardiovascular disease risk rises sharply with menopause, likely due to the coincident increase in insulin resistance and related atherogenic changes that together comprise the metabolic or insulin resistance syndrome, a cluster of metabolic and hemodynamic abnormalities strongly implicated in the pathogenesis and progression of cardiovascular disease. A growing body of research suggests that traditional mind-body practices such as yoga, tai chi, and qigong may offer safe and cost-effective strategies for reducing insulin resistance syndrome-related risk factors for cardiovascular disease in older populations, including postmenopausal women. Current evidence suggests that these practices may reduce insulin resistance and related physiological risk factors for cardiovascular disease; improve mood, well-being, and sleep; decrease sympathetic

activation; and enhance cardiovagal function. However, additional rigorous studies are needed to confirm existing findings and to examine long-term effects on cardiovascular health.

Irwin, M. R., R. Olmstead, et al. (2008). "Improving sleep quality in older adults with moderate sleep complaints: A randomized controlled trial of Tai Chi Chih." *Sleep* **31**(7): 1001-8.

STUDY OBJECTIVES: To determine the efficacy of a novel behavioral intervention, Tai Chi Chih, to promote sleep quality in older adults with moderate sleep complaints. **DESIGN:** Randomized controlled trial with 16 weeks of teaching followed by practice and assessment 9 weeks later. The main outcome measure was sleep quality, as assessed by the Pittsburgh Sleep Quality Index (PSQI). **SETTING:** General community at 2 sites in the US between 2001 and 2005. **PARTICIPANTS:** Volunteer sample of 112 healthy older adults, aged 59 to 86 years. **Intervention:** Random allocation to Tai Chi Chih or health education for 25 weeks. **RESULTS:** Among adults with moderate sleep complaints, as defined by PSQI global score of 5 or greater, subjects in the Tai Chi Chih condition were more likely to achieve a treatment response, as defined by PSQI less than 5, compared to those in health education ($P < 0.05$). Subjects in the Tai Chi Chih condition with poor sleep quality also showed significant improvements in PSQI global score ($P < 0.001$) as well as in the sleep parameters of rated sleep quality ($P < 0.05$), habitual sleep efficiency ($P < 0.05$), sleep duration ($P < 0.01$), and sleep disturbance ($P < 0.01$). **CONCLUSIONS:** Tai Chi Chih can be considered a useful nonpharmacologic approach to improve sleep quality in older adults with moderate complaints and, thereby, has the potential to ameliorate sleep complaints possibly before syndromal insomnia develops. **CLINICAL TRIALS REGISTRATION:** ClinicalTrials.gov Identifier: NCT00118885.

Katz, A. R. (2008). "Reduced falls in the elderly: tai chi or placebo or Hawthorne effect?" *J Am Geriatr Soc* **56**(4): 776-7; author reply 777.

Kerr, C. E., J. R. Shaw, et al. (2008). "Tactile acuity in experienced Tai Chi practitioners: evidence for use dependent plasticity as an effect of sensory-attentional training." *Exp Brain Res* **188**(2): 317-22.

The scientific discovery of novel training paradigms has yielded better understanding of basic mechanisms underlying cortical plasticity, learning and development. This study is a first step in evaluating Tai Chi (TC), the Chinese slow-motion meditative exercise, as a training paradigm that, while not engaging in direct tactile stimulus training, elicits enhanced tactile acuity in long-term practitioners. The rationale for this study comes from the fact that, unlike previously studied direct-touch tactile training paradigms, TC practitioners focus specific mental attention on the body's extremities including the fingertips and hands as they perform their slow routine. To determine whether TC is associated with enhanced tactile acuity, experienced adult TC practitioners were recruited and compared to age-gender matched controls. A blinded assessor used a validated method (Van Boven et al. in *Neurology* 54(12): 2230-2236, 2000) to compare TC practitioners' and controls' ability to discriminate between two different orientations (parallel and horizontal) across different grating widths at the fingertip. Study results showed that TC practitioners' tactile spatial acuity was superior to that of the matched controls ($P < 0.04$). There was a trend showing TC may have an enhanced effect on older practitioners ($P < 0.066$), suggesting that TC may slow age related decline in this measure. To the best of our knowledge,

this is the first study to evaluate a long-term attentional practice's effects on a perceptual measure. Longitudinal studies are needed to examine whether TC initiates or is merely correlated with perceptual changes and whether it elicits long-term plasticity in primary sensory cortical maps. Further studies should also assess whether related somatosensory attentional practices (such as Yoga, mindfulness meditation and Qigong) achieve similar effects.

King, L. A. and F. B. Horak (2009). "Delaying mobility disability in people with Parkinson disease using a sensorimotor agility exercise program." Phys Ther **89**(4): 384-93.

This article introduces a new framework for therapists to develop an exercise program to delay mobility disability in people with Parkinson disease (PD). Mobility, or the ability to efficiently navigate and function in a variety of environments, requires balance, agility, and flexibility, all of which are affected by PD. This article summarizes recent research identifying how constraints on mobility specific to PD, such as rigidity, bradykinesia, freezing, poor sensory integration, inflexible program selection, and impaired cognitive processing, limit mobility in people with PD. Based on these constraints, a conceptual framework for exercises to maintain and improve mobility is presented. An example of a constraint-focused agility exercise program, incorporating movement principles from tai chi, kayaking, boxing, lunges, agility training, and Pilates exercises, is presented. This new constraint-focused agility exercise program is based on a strong scientific framework and includes progressive levels of sensorimotor, resistance, and coordination challenges that can be customized for each patient while maintaining fidelity. Principles for improving mobility presented here can be incorporated into an ongoing or long-term exercise program for people with PD.

Klein, P. J. (2008). "Tai Chi Chuan in the management of Parkinson's disease and Alzheimer's disease." Med Sport Sci **52**: 173-81.

BACKGROUND: Parkinson's disease (PD) and Alzheimer's disease (ALZ) represent later-life onset neurodegenerative disorders that gradually rob those afflicted of their quality of life.

PURPOSE: This chapter offers practice-based recommendations on how instruction and practice of Tai Chi Chuan (TCC) can be adapted for individuals with PD and those with ALZ.

RESEARCH EVIDENCE: Practice of TCC is widely advocated as an exercise option in PD; however, little validating research exists. Even less is known about feasibility of applications of TCC for individuals with ALZ.

CLINICAL IMPRESSIONS: The slow, rhythmic pace of functionally based exercises, internal organ stimulation, flexibility maintenance, balance-training effects, and general health benefits of TCC and Tai Chi-like exercise practice have clinical relevance for both conditions. Falls prevention, tremor reduction and motor control may be of most importance in management of PD. Behavioral and general health benefits as well as slowing of functional and cognitive decline are considerations with ALZ.

RECOMMENDATIONS: Strategies of exercise adaptation include use of Tai Chi-like exercise for individuals with ALZ and those in middle or late stages of PD as well as providing instructional resources and training for caregivers and exercise aides to facilitate practice as a part of daily life.

Lam, P., S. M. Dennis, et al. (2008). "Improving glycaemic and BP control in type 2 diabetes. The effectiveness of tai chi." Aust Fam Physician **37**(10): 884-7.

BACKGROUND: This study assessed the effect of tai chi on glycosylated haemoglobin (HbA1c), blood pressure and health status (SF-36) in adults with type 2 diabetes. **METHODS:** A randomised controlled trial of tai chi classes for 6 months versus wait list control for adults with type 2 diabetes and a baseline HbA1c of 7% or more. **RESULTS:** A total of 53 patients were recruited to the study and randomised to tai chi (28) or control group (25). There were improvements in HbA1c; 6 m walk test, and total cholesterol between baseline and follow up but the difference between the two treatment groups was not statistically significant. Health status results showed improvements in three domains for the tai chi group. **DISCUSSION:** There was no significant improvement in metabolic control or cardiovascular risk at follow up compared to the control group. Patients in the tai chi group showed improvements in physical and social functioning.

Lan, C., S. Y. Chen, et al. (2008). "Changes of aerobic capacity, fat ratio and flexibility in older TCC practitioners: a five-year follow-up." *Am J Chin Med* **36**(6): 1041-50.

The objective of this study was to evaluate the 5-year changes of aerobic capacity, fat ratio and flexibility in older Tai Chi Chuan (TCC) practitioners and sedentary controls. Sixty-nine community-dwelling elderly individuals (mean age: 68.6 +/- 6.3 years) completed this study. The TCC group (18 M; 17 F) had been practicing TCC regularly for 6.3 +/- 3.7 years at baseline and continued training in the study interval. The control group (16 M; 18 F) did not participate in any regular exercise program. A graded bicycle exercise testing was conducted at the baseline and at 5-year to evaluate the age-related decline in aerobic capacity. Triceps and subscapular skinfolds, and thoracolumbar flexibility were also measured. At baseline, the TCC group displayed higher peak oxygen uptake $\dot{V}O_{2\text{peak}}$ and thoracolumbar flexibility, and lower fat ratio than the control group. At the 5-year follow-up, the TCC group displayed a smaller decrease in $\dot{V}O_{2\text{peak}}$ than the sedentary group. The annual decrease of $\dot{V}O_{2\text{peak}}$ in TCC men and women was 0.32 and 0.22 ml . kg(-1) . min(-1), respectively. In the control group, the annual decrease of $\dot{V}O_{2\text{peak}}$ was 0.50 and 0.36 ml . kg(-1) . min(-1) in men and women, respectively. The TCC group also showed a smaller increase of body fat ratio, and a less decrease of flexibility than the control group. In conclusion, long-term practice of TCC attenuates the age-related decline of aerobic capacity, and it also reduces the increase of body fat ratio in older individuals. TCC may be prescribed as a conditioning exercise for the elderly to maintain their health fitness.

Lan, C., S. Y. Chen, et al. (2008). "The exercise intensity of Tai Chi Chuan." *Med Sport Sci* **52**: 12-9.

Tai Chi Chuan (TC) is a Chinese conditioning exercise and is well-known for its graceful movement. The exercise intensity of TC depends on its training style, posture and duration. Variation in training approaches result in substantial differences in exercise intensity. We have measured heart rate (HR) and oxygen uptake (VO₂) simultaneously during classical Yang TC practice in 15 male subjects, their heart rate (HR) during TC practice was 58% of the heart rate reserve (HRR), and oxygen uptake (VO₂) was 55% of the peak oxygen uptake (VO_{2peak}). The level of blood lactate immediately after TC practice was 3.8mM, which reflected the level of lactate during TC approximated the onset of blood lactate accumulation (OBLA). In order to evaluate the relative exercise intensity of classical Yang TC, we measured HR responses during

TC practice in 100 subjects with age of 25-80 yrs (M/F: 54/46). They were separated into three groups: young (25-44 y/o), middle-aged (45-64 y/o) and elderly (65-80 y/o). During the TC practice, the mean HR of men was 141 +/- 12, 132 +/- 9 and 120 +/- 10 bpm in the young, middle-aged and elderly groups, respectively. Meanwhile, the mean HR of women was 136 +/- 10, 126 +/- 11 and 115 +/- 12 bpm in the young, middle-aged and elderly groups, respectively. Men practiced TC with mean HR corresponding to 57.8 +/- 3.7, 56.6 +/- 3.4 and 55.1 +/- 3.1% of heart rate reserve (HRR) in the three groups; while that of women corresponding to 52.7 +/- 2.8, 51.5 +/- 2.6, and 50.3 +/- 2.9% of HRR in the three age groups. The results demonstrate that classical Yang TC is an exercise with moderate intensity, and its exercise intensity is similar across different ages in each gender.

Lan, C., S. Y. Chen, et al. (2008). "Tai Chi training for patients with coronary heart disease." Med Sport Sci **52**: 182-94.

Coronary heart disease (CHD) is the leading cause of death in the developed countries and many developing countries. Exercise training is the cornerstone of cardiac rehabilitation program for patients with CHD, and exercise intensities in the 50-70% heart rate reserve have been shown to improve functional capacity. However, recent studies found exercise with lower intensity also displayed benefits to CHD patients, and increased the acceptance of exercise program, particularly unfit and elderly patients. Tai Chi Chuan (TC) is a traditional conditioning exercise in the Chinese community, and recently it has become more popular in the Western societies. The exercise intensity of TC is low to moderate, depending on the training style, posture and duration. Participants can choose to perform a complete set of TC or selected movements according to their needs. Previous research substantiates that TC enhances aerobic capacity, muscular strength, endothelial function and psychological wellbeing. In addition, TC reduces some cardiovascular risk factors, such as hypertension and dyslipidemia. Recent studies have also proved that TC is safe and effective for patients with myocardial infarction, coronary bypass surgery and heart failure. Therefore, TC may be prescribed as an alternative exercise program for selected patients with cardiovascular diseases. In conclusion, TC has potential benefits for patients with CHD, and is appropriate for implementation in the community.

Lan, C., T. C. Su, et al. (2008). "Effect of T'ai chi chuan training on cardiovascular risk factors in dyslipidemic patients." J Altern Complement Med **14**(7): 813-9.

OBJECTIVE: T'ai chi chuan (TCC) is a traditional Chinese exercise and is beneficial for health. Nevertheless, its effect on cardiovascular risk factors in dyslipidemic patients is not clear. The aim of this study was to evaluate the effect of TCC training on coronary heart disease (CHD) risk factors in patients with dyslipidemia. **DESIGN:** This was designed as a case-controlled study. **SETTING:** The study was conducted in a community setting. **SUBJECTS:** Fifty-three (53) patients (males: 24; females: 29) with dyslipidemia completed this study. **INTERVENTIONS:** The TCC group included 28 patients who participated in a 12-month yang TCC training program. The usual-care group included 25 patients who maintained a sedentary lifestyle during this study. **OUTCOME MEASURES:** Exercise testing was conducted at baseline and after 1 year of training. Body composition, lipid profile, fasting glucose and insulin levels, and inflammatory markers were also measured before and after training. **RESULTS:** After training, the TCC group showed an increase in $\dot{V}O_{2peak}$ from 25.2 +/- 4.2 to 27.4 +/- 4.1 mL x kg(1) x min(1); while

the usual-care group displayed a significant decrease from 25.6 +/- 4.9 to 24.1 +/- 4.0 mL x kg(-1) x min(-1). The TCC group also showed a reduction in blood pressure, triglyceride, total cholesterol, low density lipoprotein cholesterol, plasma insulin, homeostasis model assessment index, and high-sensitivity C-reactive protein. Conversely, the usual-care group showed no significant improvement in these cardiovascular risk factors. CONCLUSIONS: A 12-month TCC training program significantly improves aerobic capacity and CHD risk factors in patients with dyslipidemia.

Langhorst, J., W. Hauser, et al. (2008). "[Alternative and complementary therapies in fibromyalgia syndrome]." Schmerz **22**(3): 324-33.

INTRODUCTION: Interdisciplinary S3 level guidelines were devised in cooperation with 8 medical, 2 psychological and 2 patient support groups. Results were elaborated in a multilevel group process. METHODS: On the bases of the "Cochrane Library" (1993-2006), "Medline" (1980-2006), "PsychInfo" (2006) and "Scopus" (2006) controlled studies and meta-analyses of controlled studies were analyzed. RESULTS: Only few controlled studies were found supporting in part the effectiveness of CAM therapies in the treatment of fibromyalgia syndrome. Due to the lack of information on long term efficacy and cost-effectiveness, only limited recommendations for CAM therapies can be given. CONCLUSION: Within a multicomponent therapy setting, selective CAM therapies (acupuncture, vegetarian diet, homeopathy, Tai Chi, Qi Gong, music-oriented and body-oriented therapies) can be recommended for a limited period of time.

Larkey, L., R. Jahnke, et al. (2009). "Meditative movement as a category of exercise: implications for research." J Phys Act Health **6**(2): 230-8.

INTRODUCTION: Meditative Movement (MM) is proposed as a new category of exercise defined by (a) some form of movement or body positioning, (b) a focus on breathing, and (c) a cleared or calm state of mind with a goal of (d) deep states of relaxation. REVIEW: Two forms of exercise meeting this definition, Qigong and Tai Chi, are reviewed to examine health benefits found in the research literature, recap elements that should be assessed in MM research, and suggest where aspects of MM intersect with, and are distinguished from, conventional forms of exercise. RESULTS: Relevant dimensions of the key elements of MM, such as frequency, duration, type of movement, degree of exertion, description of breathing, and achievement of relaxed state are recommended to be clearly described and measured to consistently define the category across studies and clarify how MM may affect health outcomes in similar, and perhaps different, ways than conventional exercise. CONCLUSIONS: If these suggested standards are used, we will gain a better understanding of which elements are necessary for achieving targeted outcomes. Over time, as MM is studied as a category of exercise, research may progress more efficiently to define the domains of physiological and psychological benefit.

Lavizzo-Mourey, R., C. Cox, et al. (2001). "Attitudes and beliefs about exercise among elderly African Americans in an urban community." J Natl Med Assoc **93**(12): 475-80.

Older African Americans are less likely to exercise compared with their white counterparts. Few studies have examined the facilitating factors and barriers to exercise among older African Americans living in urban communities. This study represented the first phase of a program to

develop an exercise intervention in an urban community. Qualitative research was conducted to identify culturally determined attitudes that could be useful in designing an effective exercise program. Five focus groups involving 38 persons from a variety of settings were facilitated by trained professionals. Transcripts were analyzed to identify themes and contrasts among group participants. Contrary to the expectations of the investigative team, focus-group participants: (1) uniformly preferred group exercises compared with exercising at home, (2) rejected walking as a feasible option because of safety concerns, and (3) expressed limited interest in using weights or Eastern exercises such as Tai Chi. Concepts and goals of exercise differed according to the physical capabilities of the participants. The analysis of these focus-group discussions provided valuable insights with regard to the development of our community-based exercise-intervention protocol. These findings may be important in designing effective exercise programs for older African Americans in urban settings.

Lee, E. N., Y. H. Kim, et al. (2008). "Tai chi for disease activity and flexibility in patients with ankylosing spondylitis--a controlled clinical trial." Evid Based Complement Alternat Med **5**(4): 457-62.

We investigated the effects of tai chi on disease activity, flexibility and depression in patients with ankylosing spondylitis (AS). We allocated 40 patients to either a tai chi treatment group or a no-treatment control group. The tai chi group performed 60 min of tai chi twice weekly for eight consecutive weeks and 8 weeks of home-based tai chi, after which the group showed significant improvement in disease activity and flexibility compared to the control group. All outcome measures were significantly lower in the tai chi group than they were during pre-treatment, while they did not change in the control group. These findings suggest that tai chi can improve disease activity and flexibility for patients with AS. Tai chi is an easily accessible therapy for patients and, as such, may be an effective intervention for AS. However, we cannot completely discount the possibility that the placebo effect was responsible for the improvement.

Lee, H. J., H. J. Park, et al. (2009). "Tai Chi Qigong for the quality of life of patients with knee osteoarthritis: a pilot, randomized, waiting list controlled trial." Clin Rehabil **23**(6): 504-11.

Objective: To evaluate the effects of Tai Chi Qigong training on the quality of life and physical function of patients with osteoarthritis of the knee. Design: A preliminary, single-blind, randomized controlled trial. Setting: General community, performed at Hwaseong City Health Center. Participants: Forty-four elderly subjects (mean age, 69.1 +/- 5.4 years) with knee osteoarthritis. Intervention: The patients were randomized (2:1) to: (1) an eight-week Tai Chi Qigong training programme or (2) a waiting list control group. The programme involved eight weeks of group Tai Chi Qigong sessions, with 60 minutes per session twice a week. Main outcome measures: The primary outcome was quality of life measured with the Short Form 36 (SF-36) at baseline and week 8. Secondary outcomes included the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) and 6-m walking time. Results: The training group had statistically significant improvements in the quality of life (changes of SF-36, Qigong versus control: 21.6 +/- 16.8 versus 9.8 +/- 13.6, P<0.05) and 6-m walking test (change in walking time, Qigong versus control: -1.6 +/- 1.7 versus -0.2 +/- 0.8 s, P<0.01). The WOMAC scores in the training group were markedly improved, although the differences were not statistically significant. Conclusions: Tai Chi Qigong training appears to have beneficial effects in

terms of the quality of life and physical functioning of elderly subjects with knee osteoarthritis. However, more rigorous trials are needed to confirm the efficacy of this training for patients with osteoarthritis of the knee.

Lee, H. Y. and K. J. Lee (2008). "[Effects of Tai Chi exercise in elderly with knee osteoarthritis]." Taehan Kanho Hakhoe Chi **38**(1): 11-8.

PURPOSE: This study was to determine whether the Sun-style 24 forms of Tai Chi exercise improve pain, stiffness, disability, knee joint motion, mobility, balance or falling. **METHOD:** Forty-six community-dwelling elderly subjects (mean age, 75.46+/-6.28) voluntarily participated in an intervention group of either 24 forms of Sun-style Tai Chi for 60 min, 2 times per week for 12 weeks or a control group. A non-equivalent pretest-posttest design was used. Independent t-test and ANCOVA were used to examine group differences by using SPSS12.0. **RESULT:** The experimental group had significantly less pain ($F=7.60$, $p=.008$) and stiffness ($t=-3.19$, $p=.003$) than the control group. Also there were significant improvements in knee joint motion on the right knee ($t=2.44$, $p=.019$), left knee ($t=2.30$, $p=.026$), rising time ($F=8.03$, $p=.07$), balance on the left single leg test ($t=2.20$, $p=.033$), and fear of falling ($t=-2.33$, $p=.024$) in the Tai Chi exercise group. No significant group differences were found in disability and falls efficacy. **CONCLUSION:** The Sun-style 24 forms Tai Chi exercise is effective in decreasing pain, stiffness, fear of falling and it improves balance, rising time, and knee joint motion. We suggest a continuing long term intervention to decrease disability and increase efficacy concerning falls.

Lee, L. Y., D. T. Lee, et al. (2009). "Tai Chi and health-related quality of life in nursing home residents." J Nurs Scholarsh **41**(1): 35-43.

PURPOSE: Health-related quality of life (HRQOL) that is good is regarded as the goal of elderly residential care. However, limited evidence exists indicating a promising intervention that can achieve this goal. The aim of this study is to examine the effect of Tai Chi on HRQOL in nursing home residents. **DESIGN:** A nonequivalent pretest-posttest control-group design. **METHODS:** A convenience sample of 139 residents from six nursing homes in Hong Kong was used. The experimental group ($n=66$) joined a 26-week Tai Chi program, while the control group ($n=73$) continued with usual daily activities. The physical and mental components of HRQOL were designated as the dependent variables. Resident satisfaction was considered as a covariate. Doubly multivariate repeated measures analysis of covariance was done to examine the intervention effect. **FINDINGS:** After adjusting for the confounding effect of resident satisfaction, a statistically significant difference ($p<0.05$) in the physical and mental components of HRQOL between the experimental and control groups was found. Findings showed significant improvement in HRQOL after residents practiced Tai Chi. **CONCLUSIONS:** These investigators contribute additional knowledge about the health benefits of Tai Chi among nursing home residents and indicates support for its use in this population to improve HRQOL. **CLINICAL RELEVANCE:** Tai Chi has unique characteristics as a health exercise that is particularly suitable for nursing home residents. The inclusion of Tai Chi exercise in elderly residential care practice is recommended.

Lee, M. S., P. Lam, et al. (2008). "Effectiveness of tai chi for Parkinson's disease: a critical review." Parkinsonism Relat Disord **14**(8): 589-94.

The objective of this review is to assess the effectiveness of tai chi as a treatment option for Parkinson's disease (PD). We have searched the literature using 21 databases from their inception to January 2008, without language restrictions. We included all types of clinical studies regardless of their design. Their methodological quality was assessed using the modified Jadad score. Of the seven studies included, one randomised clinical trial (RCT) found tai chi to be superior to conventional exercise in terms of the Unified PD Rating Scale (UPDRS) and prevention of falls. Another RCT found no effects of tai chi on locomotor ability compared with qigong. The third RCT failed to show effects of tai chi on the UPDRS and the PD Questionnaires compared with wait list control. The remaining studies were either non-randomised (n=1) or uncontrolled clinical trials (n=3). Collectively these data show that RCTs of the tai chi for PD are feasible but scarce. Most investigations suffer from methodological flaws such as inadequate study design, poor reporting of results, small sample size, and publication without appropriate peer review process. In conclusion, the evidence is insufficient to suggest tai chi is an effective intervention for PD. Further research is required to investigate whether there are specific benefits of tai chi for people with PD, such as its potential effect on balance and on the frequency of falls.

Lee, M. S., E. N. Lee, et al. (2008). "Is tai chi beneficial for improving aerobic capacity? : A systematic review." Br J Sports Med.

Tai chi has been claimed to generate beneficial effects with respect to a wide range of diseases. The purpose of this systematic review was to evaluate evidence from randomized clinical trials testing the effectiveness of tai chi for increasing aerobic capacity. Systematic searches were conducted on fourteen electronic databases without restrictions on population characteristics or the language of publication. The outcome measures considered for inclusion were changes in maximal oxygen consumption as a test for aerobic capacity. Five randomized clinical trials (RCTs) met all inclusion criteria. Three RCTs compared the effects of tai chi with no treatment. The meta-analysis failed to show an effect of tai chi on aerobic capacity compared with sedentary controls [n=151, weight mean difference, ml/kg/min, 0.50, 95% confidence intervals - 1.14 to 2.15, P=0.55]. Two RCTs compared tai chi with conventional physical exercise including brisk, low intensity and moderate intensity walking, and aerobic exercise. The results show that tai chi was not statistically significantly superior to physical exercise. In conclusion, the existing evidence does not suggest that regular tai chi is an effective way of increasing aerobic capacity.

Lee, M. S., M. H. Pittler, et al. (2008). "Tai chi for osteoarthritis: a systematic review." Clin Rheumatol **27**(2): 211-8.

The aim of this study was to evaluate data from controlled clinical trials testing the effectiveness of tai chi for treating osteoarthritis. Systematic searches were conducted on MEDLINE, AMED, British Nursing Index, CINAHL, EMBASE, PsycInfo, The Cochrane Library 2007, Issue 2, the UK National Research Register and ClinicalTrials.gov, Korean medical databases, the Qigong and Energy database and Chinese medical databases (until June 2007). Hand searches included conference proceedings and our own files. There were no restrictions regarding the language of publication. All controlled trials of tai chi for patients with osteoarthritis were considered for inclusion. Methodological quality was assessed using the Jadad score. Five randomised clinical trials (RCTs) and seven non-randomised controlled clinical trials (CCTs) met all inclusion criteria. Five RCTs assessed the effectiveness of tai chi on pain of osteoarthritis (OA). Two

RCTs suggested significant pain reduction on visual analog scale or Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) compared to routine treatment and an attention control program in knee OA. Three RCTs did not report significant pain reduction on multiple sites pain. Four RCTs tested tai chi for physical functions. Two of these RCTs suggested improvement of physical function on activity of daily living or WOMAC compared to routine treatment or wait-list control, whilst two other RCTs failed to do so. In conclusion, there is some encouraging evidence suggesting that tai chi may be effective for pain control in patients with knee OA. However, the evidence is not convincing for pain reduction or improvement of physical function. Future RCTs should assess larger patient samples for longer treatment periods and use appropriate controls.

Lee, M. S., M. H. Pittler, et al. (2008). "Tai chi for Type 2 diabetes: a systematic review." Diabet Med **25**(2): 240-1.

Lee, M. S., M. H. Pittler, et al. (2008). "Tai chi for osteoporosis: a systematic review." Osteoporos Int **19**(2): 139-46.

INTRODUCTION: Tai chi may have beneficial effects with respect to balance, falls and non-vertebral fractures. The purpose of this systematic review was to evaluate evidence from controlled clinical trials testing the effectiveness of tai chi for osteoporosis. **METHODS:** Systematic searches were conducted on 20 electronic databases. The outcome measures considered for inclusion were changes in bone parameters. **RESULTS:** Five randomized clinical trials (RCTs) and two controlled clinical trials (CCT) met all inclusion criteria. In postmenopausal women, one RCT found tai chi to be superior for loss of bone mineral density (BMD) compared with sedentary lifestyle, while two other RCTs found no differences between tai chi and exercises or calcium supplementation for BMD. The meta-analysis showed no significant effect of tai chi on BMD change at the spine compared with no treatment in postmenopausal women. One RCT failed to show favorable effects of tai chi compared with resistance training (RT) for total hip BMD in elderly women. A further RCT compared tai chi with RT on bone metabolism and reported favorable effects compared with RT in the elderly. **CONCLUSION:** The evidence for tai chi in the prevention or treatment of osteoporosis is not convincing. More rigorous research seems warranted.

Lee, Y. C., A. M. Yen, et al. (2009). "The effect of metabolic risk factors on the natural course of gastro-oesophageal reflux disease." Gut **58**(2): 174-81.

BACKGROUND AND AIMS: The effect of metabolic risk factors on the natural course of gastro-oesophageal reflux disease (GORD), which remains elusive, was quantified. **METHODS:** The population included 3669 subjects undergoing repeated upper endoscopy. Data were analysed using a three-state Markov model to estimate transition rates (according to the Los Angeles classification) regarding the natural course of the disease. Individual risk score together with the kinetic curve was derived by identifying significant factors responsible for the net force between progression and regression. **RESULTS:** During three consecutive study periods, 12.2, 14.9 and 17.9% of subjects, respectively, progressed from non-erosive to erosive disease, whereas 42.5, 37.3 and 34.6%, respectively, regressed to the non-erosive stage. The annual transition rate from non-erosive to class A-B disease was 0.151 per person year (95% CI 0.136 to

0.165) and from class A-B to C-D was 0.079 per person year (95% CI 0.063 to 0.094). The regression rate from class A-B to non-erosive disease was 0.481 per person year (95% CI 0.425 to 0.536). Class C-D, however, appeared to be an absorbing state when not properly treated. Being male (relative risk (RR) 4.31; 95% CI 3.22 to 5.75), smoking (RR 1.20; 95% CI 1.03 to 1.39) or having metabolic syndrome (RR 1.75; 95% CI 1.29 to 2.38) independently increased the likelihood of progressing from a non-erosive to an erosive stage of disease and/or lowered the likelihood of disease regression. The short-term use of acid suppressants (RR 0.54; 95% CI 0.39 to 0.75) raised the likelihood of regression from erosive to non-erosive disease.

CONCLUSIONS: Intraoesophageal damage is a dynamic and migratory process in which the metabolic syndrome is associated with accelerated progression to or attenuated regression from erosive states. These findings have important implications for the design of effective prevention and screening strategies.

Leung, E. S. and W. W. Tsang (2008). "Comparison of the kinetic characteristics of standing and sitting Tai Chi forms." Disabil Rehabil **30**(25): 1891-900.

PURPOSE: To compare the kinetic characteristics of Tai Chi forms performed in standing and seated positions. **METHODS:** An experienced Tai Chi master was invited to perform the Tai Chi Qi Qong 18-form while standing and seated. Two force platforms were used to track the centre of pressure (COP) during the Tai Chi movements. Centre of mass (COM) displacement was measured using a video motion analysis system. **RESULTS:** In standing, the maximum COP displacements in the anteroposterior and mediolateral directions ranged from 2.6% to 9.5%, and 0.3% to 29.6% of the subject's height, respectively. The maximum COP displacements in sitting were smaller, with mean displacements of 0.7% and 0.1% of height in the anteroposterior and ML directions, respectively. The subject's COM moved in the vertical direction in slow, coordinated and smooth patterns. **CONCLUSIONS:** The kinetic data on each of the 18 Tai Chi forms studied can guide the choice of suitable Tai Chi forms for balance training. Sitting Tai Chi is recommended for rehabilitating the balance of frail older adults who have difficulty standing. Because of the minimal demands of sitting Tai Chi for balance control, progressing to practice in standing as quickly as possible is recommended.

Li, F., P. Harmer, et al. (2008). "Translation of an effective tai chi intervention into a community-based falls-prevention program." Am J Public Health **98**(7): 1195-8.

Tai chi--moving for better balance, a falls-prevention program developed from a randomized controlled trial for community-based use, was evaluated with the re-aim framework in 6 community centers. The program had a 100% adoption rate and 87% reach into the target older adult population. All centers implemented the intervention with good fidelity, and participants showed significant improvements in health-related outcome measures. This evidence-based tai chi program is practical to disseminate and can be effectively implemented and maintained in community settings.

Li, F., P. Harmer, et al. (2008). "Tai Chi: moving for better balance -- development of a community-based falls prevention program." J Phys Act Health **5**(3): 445-55.

BACKGROUND: This study was designed to develop an evidence- and community based falls prevention program -- Tai Chi: Moving for Better Balance. **METHODS:** A mixed qualitative and quantitative approach was used to develop a package of materials for program implementation and evaluation. The developmental work was conducted in 2 communities in the Pacific Northwest. Participants included a panel of experts, senior service program managers or activity coordinators, and older adults. Outcome measures involved program feasibility and satisfaction. **RESULTS:** Through an iterative process, a program package was developed. The package contained an implementation plan and class training materials (ie, instructor's manual, videotape, and user's guidebook). Pilot testing of program materials showed that the content was appropriate for the targeted users (community-living older adults) and providers (local senior service organizations). A feasibility survey indicated interest and support from users and providers for program implementation. A 2-week pilot evaluation showed that the program implementation was feasible and evidenced good class attendance, high participant satisfaction, and interest in continuing Tai Chi. **CONCLUSIONS:** The package of materials developed in this study provides a solid foundation for larger scale implementation and evaluation of the program in community settings.

Li, J., K. Sharma, et al. (2005). "Feasibility of computer-assisted Tai Chi education." AMIA Annu Symp Proc: 1027.

This study is an initial effort to examine the efficiency of a computer assisted Tai Chi educational model for learning the basics of Tai Chi, a Chinese exercise regime.

Li, J. X., D. Q. Xu, et al. (2008). "Effects of 16-week Tai Chi intervention on postural stability and proprioception of knee and ankle in older people." Age Ageing **37**(5): 575-8.

Li, J. X., D. Q. Xu, et al. (2008). "Tai Chi exercise and proprioception behavior in old people." Med Sport Sci **52**: 77-86.

Eighty subjects aged over 60 participated in this study. Ankle and knee joint kinesthesia were measured in 21 long-term TC practitioners (TC group), 20 long-term swimming/running exercisers (S/R group), and 27 sedentary controls (control group). The results showed that ankle joint kinesthesia significantly differed among the three groups ($p = 0.001$). TC practitioners could detect a significantly smaller amount of motion than could the S/R exercisers ($p = 0.022$) and sedentary counterparts ($p = 0.001$). No significant difference was found between the S/R group and the sedentary control group ($p = 0.701$). For the knee joint, the threshold for detection of passive motion was significantly different in knee extension and flexion. For knee flexion, the TC group showed a significantly smaller mean threshold for detection of passive motion than did the subjects in the control group ($p = 0.026$). There were no significant differences between the S/R group and the control group ($p = 0.312$), the TC group and S/R group ($p = 0.533$). For knee extension, no significant difference was noted among the three groups ($p = 0.597$).

Li, J. X., D. Q. Xu, et al. (2009). "Changes in muscle strength, endurance, and reaction of the lower extremities with Tai Chi intervention." J Biomech **42**(8): 967-71.

This study examines the effects of a 16-week Tai Chi (TC) training program on the muscle strength, endurance, and reaction time of the lower extremities of elderly people. A total of 40 elderly individuals (aged 60 years) completed the study. They were divided into two groups: the TC group (11 men and 11 women) underwent a supervised TC exercise program for 16 weeks, while the control group (9 men and 9 women) received general education for a comparable time period. Pre- and post-intervention measurements were conducted. An isokinetic dynamometer was used to measure the maximum concentric strength and dynamic endurance of the knee flexors and the extensors, and the maximum concentric strength of the ankle plantarflexors and dorsiflexors. The neuromuscular response of the rectus femoris, semitendinosus, gastrocnemius, and anterior tibialis muscles was measured by the onset latency to sudden perturbations using an electromyography system. After 16 weeks, the TC group showed a 19.9% increase in muscle strength of the knee flexors ($p < .000$) that was significantly greater than that in the control group ($p = .046$). There was also a significant decrease in semitendinosus muscle latency (6.6%, $p = .014$) that was significantly shorter than that in the control group ($p = .042$). No significant training effects were found in other measures. These results suggest that improving biomechanical characteristics of lower extremity muscles may need longer TC intervention for elderly people.

Li, J. Y., Y. F. Zhang, et al. (2009). "Quality of Reporting of Randomized Clinical Trials in Tai Chi Interventions--A Systematic Review." Evid Based Complement Alternat Med.

Objectives: To evaluate the reporting quality of published randomized clinical trials (RCTs) in the Tai Chi literature following the publication of the CONSORT guidelines in 2001. **Data sources:** The OVID MEDLINE and PUBMED databases **Review methods:** To survey the general characteristics of Tai Chi RCTs in the literature, we included any report if (i) it was an original report of the trial; (ii) its design was RCT; (iii) one of the treatments being tested was Tai Chi; and (iv) it was in English. In addition, we assessed the reporting quality of RCTs that were published between 2002 and 2007, using a modified CONSORT checklist of 40 items. The adequate description of Tai Chi interventions in these trials was examined against a 10-item checklist adapted from previous reviews. **Results:** The search yielded 31 Tai Chi RCTs published from 2002 to 2007 and only 11 for 1992-2001. Among trials published during 2002-2007, the most adequately reported criteria were related to background, participant eligibility and interpretation of the study results. Nonetheless, the most poorly reported items were associated with randomization allocation concealment, implementation of randomization and the definitions of period of recruitment and follow-up. In addition, only 23% of RCTs provided adequate details of Tai Chi intervention used in the trials. **Conclusion:** The findings in this review indicated that the reporting quality of Tai Chi intervention trials is sub-optimal. Substantial improvement is required to meet the CONSORT guidelines and allow assessment of the quality of evidence. We believe that not only investigators, but also journal editors, reviewers and funding agencies need to follow the CONSORT guidelines to improve the standards of research and strengthen the evidence base for Tai Chi and for complementary and alternative medicine.

Liu, M. and H. So (2008). "[Effects of Tai Chi exercise program on physical fitness, fall related perception and health status in institutionalized elders]." Taehan Kanho Hakhoe Chi **38**(4): 620-8.

PURPOSE: The purpose was to identify the effects of a Tai Chi exercise program on physical fitness, fall related perception and health status among institutionalized elderly. **METHODS:** A quasi-experimental research was carried out with a nonequivalent control group pretest-posttest design. There were 23 subjects in the experimental group and 24 in the control group. The data was gathered by structured questionnaires about fall related perception, and health status. Physical fitness was measured by an exercise therapist with a blind principle. **RESULTS:** At the completion of the 12 weeks Tai Chi exercise program, flexibility ($F=4.50, p=.00$), and ability to balance ($F=3.27, p=.00$) had increased significantly. Fall related perception showed significant improvement in the fear of falling ($F=-3.52, p=.00$). Physical functioning ($F=3.38, p=.00$), role limitation-physical ($F=2.67, p=.01$), role limitation-emotional ($F=2.47, p=.02$). and general health ($F=3.88, p=.00$) in health status showed significant differences between the two groups. **CONCLUSION:** The study findings revealed Tai Chi exercise as a useful nursing intervention for elderly that enhances flexibility and balance, decreases fall related perception and also increases the health status. Further research is warranted to compare the potential effects of Tai Chi exercise and its health benefits from other types of exercise or martial arts.

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Liu, X., Y. D. Miller, et al. (2008). "A preliminary study of the effects of Tai Chi and Qigong medical exercise on indicators of metabolic syndrome, glycaemic control, health related quality of life, and psychological health in adults with elevated blood glucose." Br J Sports Med.

OBJECTIVES: To evaluate the feasibility, acceptability and effects of a Tai Chi and Qigong exercise program in adults with elevated blood glucose. **Design, Setting, and PARTICIPANTS:** A single group pre-post feasibility trial with 11 participants (3 male and 8 female; aged 42-65 years) with elevated blood glucose. **Intervention:** Participants attended Tai Chi and Qigong exercise training for 1 to 1.5 hours, 3 times per week for 12 weeks, and were encouraged to practice the exercises at home. **MAIN OUTCOME MEASURES:** Indicators of metabolic

syndrome (body mass index[BMI], waist circumference, blood pressure, fasting blood glucose, triglycerides, HDL-cholesterol), glucose control (HbA1c, fasting insulin and insulin resistance [HOMA]), health-related quality of life; stress and depressive symptoms. RESULTS: There was good adherence and high acceptability. There were significant improvements in four of the seven indicators of metabolic syndrome including BMI (mean difference -1.05, $p < 0.001$), waist circumference (-2.80 cm, $p < 0.05$), and systolic (-11.64 mm Hg, $p < 0.01$) and diastolic blood pressure (-9.73 mm Hg, $p < 0.001$), as well as in HbA1c (-0.32 %, $p < 0.01$), insulin resistance (-0.53, $p < 0.05$), stress (-2.27, $p < 0.05$), depressive symptoms (-3.60, $p < 0.05$), and the SF-36 mental health summary score (5.13, $p < 0.05$) and sub-scales for general health (19.00, $p < 0.01$), mental health (10.55, $p < 0.01$) and vitality (23.18, $p < 0.05$). CONCLUSIONS: The program was feasible and acceptable and participants showed improvements in metabolic and psychological variables. A larger controlled trial is now needed to confirm these promising preliminary results.

Logghe, I. H., P. E. Zeeuwe, et al. (2009). "Lack of effect of Tai Chi Chuan in preventing falls in elderly people living at home: a randomized clinical trial." *J Am Geriatr Soc* **57**(1): 70-5.

OBJECTIVES: To evaluate the effectiveness of Tai Chi Chuan in fall prevention in elderly people living at home with a high risk of falling. DESIGN: Randomized controlled trial. SETTING: Two industrial towns in the western part of the Netherlands. PARTICIPANTS: Two hundred sixty-nine elderly people (average age 77) living at home with a high risk of falling. INTERVENTIONS: The intervention group received Tai Chi Chuan training for 1 hour twice a week for 13 weeks; the control group received usual care. Both groups received a brochure containing general information on how to prevent fall incidents. MEASUREMENTS: Primary outcome was the number of falls over 12 months. Secondary outcomes were balance, fear of falling, blood pressure, heart rate at rest, forced expiratory volume during the first second, peak expiratory flow, physical activity, and functional status. RESULTS: After 12 months, no lower fall risk in the Tai Chi Chuan group was observed than in the control group (adjusted hazard ratio=1.16; 95% confidence interval=0.84-1.60), and there were no significant intervention effects on the secondary outcome measures. CONCLUSION: These results suggest that Tai Chi Chuan may not be effective in elderly people at a high risk of falling who live at home.

Low, S., L. W. Ang, et al. (2009). "A systematic review of the effectiveness of Tai Chi on fall reduction among the elderly." *Arch Gerontol Geriatr* **48**(3): 325-31.

Falls among the elderly is a major public health concern. There has been recent extensive research on the effects of Tai Chi in fall prevention among the elderly. As such, we undertook a systematic review to look for evidence on the effect of this intervention. There were seven randomized controlled trials, which met our objective and inclusion criteria. Our review has shown that Tai Chi has the potential to reduce falls or risk of falls among the elderly, provided that they are relatively young and non-frail. Further review is needed to look into the non-English studies, which assess the effectiveness of Tai Chi on fall reduction.

Lui, P. P., L. Qin, et al. (2008). "Tai Chi Chuan exercises in enhancing bone mineral density in active seniors." *Clin Sports Med* **27**(1): 75-86, viii.

Osteoporosis is a silent, systemic, chronic disease characterized by low bone mass and structural deterioration of bone tissue. Its clinical and public health implications are substantial because of the mortality, morbidity, and medical care cost associated with osteoporotic fractures. Although estrogen-replacement therapy or anti-bone resorptive drugs can prevent postmenopausal bone loss, they also show side effects. Physical activity is a nonpharmacological approach for prevention of osteoporosis. Among different types of physical activities, Tai Chi Chuan (TCC) is a low- to moderate-intensity exercise particularly suitable for the elderly, and has been practiced by Chinese for centuries. This article reviews the benefits of TCC for the prevention of osteoporosis and falls by retarding bone loss, improving neuromuscular coordination, and promoting general health.

Mackintosh, S. (2008). "Hydrotherapy and Tai Chi each provide clinical improvements for older people with osteoarthritis." Aust J Physiother **54**(2): 143.

Mak, J. C., L. Y. Mak, et al. (2009). "Perceptions and attitudes of rehabilitation medicine physicians on complementary and alternative medicine in Australia." Intern Med J **39**(3): 164-9.

BACKGROUND: The growing demand for complementary and alternative medicine (CAM) is undeniable. We report a first study about the attitudes and behaviour of Australian rehabilitation physicians to CAM. **METHODS:** A prospective cross-sectional survey was undertaken to document the prevalence of, knowledge about and referrals to CAM therapies and their perceived effectiveness, by a sample of Australian rehabilitation physicians. **RESULTS:** Thirty-six out of 94 actively practising rehabilitation physicians from the Australasian Faculty of Rehabilitation Medicine, the Royal Australasian College of Physicians, replied to the survey, a response rate of 38%, and 85% reported familiarity with CAM, the most familiar therapies being acupuncture (80%), yoga (74%) and Tai-Chi (72%). CAM referral was reported in 84%, 38% personally used CAM, 94% of patients enquired about CAM therapies, 32% of respondents routinely enquired about CAM use. Age, sex and year of Fellowship were not associated with familiarity, personal use or frequency of patient enquiry about CAM. Those who reported to be very familiar with CAM were more likely to routinely enquire about CAM use ($P = 0.028$) and be more confident in prescribing certain CAM therapies ($P < 0.05$). **CONCLUSION:** Australian rehabilitation physicians report similar CAM referral rates to Canadian physiatrists and Australian general practitioners. The most commonly prescribed therapies were acupuncture, yoga and Tai-Chi. Almost all patients use CAM therapies, but only a minority of rehabilitation physicians enquires about CAM use on a regular basis. The latter may avoid potentially harmful drug interactions, as well as improve the quality of the physician-patient relationship.

Mariano, C. (2008). "A 16-week tai chi programme prevented falls in healthy older adults." Evid Based Nurs **11**(2): 60.

Matthews, M. M. and H. G. Williams (2008). "Can Tai chi enhance cognitive vitality? A preliminary study of cognitive executive control in older adults after A Tai chi intervention." J S C Med Assoc **104**(8): 255-7.

We explored tasks of cognitive and physical performance in 20 older adult subjects after a 10 week Tai chi program in older adults using a pre-to-post test design. Improvement post

intervention was seen in two cognitive measures of executive function and several physical performance measures. Preliminary findings in this non-controlled study suggest the possibility of beneficial effects of Tai chi on cognitive executive function in older adults and support the need to pursue this hypothesis in a randomized controlled trial.

McCain, N. L., D. P. Gray, et al. (2008). "A randomized clinical trial of alternative stress management interventions in persons with HIV infection." J Consult Clin Psychol **76**(3): 431-41.

Research in psychoneuroimmunology suggests that immunosuppression associated with perceived stress may contribute to disease progression in persons with HIV infection. While stress management interventions may enhance immune function, few alternative approaches have yet been tested. This randomized clinical trial was conducted to test effects of three 10-week stress management approaches--cognitive-behavioral relaxation training (RLXN), focused tai chi training (TCHI), and spiritual growth groups (SPRT)--in comparison to a wait-listed control group (CTRL) among 252 individuals with HIV infection. Using repeated measures mixed modeling, the authors found that in comparison to the CTRL group, (a) both the RLXN and TCHI groups used less emotion-focused coping, and (b) all treatment groups had augmented lymphocyte proliferative function. Despite modest effects of the interventions on psychosocial functioning, robust findings of improved immune function have important clinical implications, particularly for persons with immune-mediated illnesses.

Murphy, L. and B. B. Singh (2008). "Effects of 5-Form, Yang Style Tai Chi on older females who have or are at risk for developing osteoporosis." Physiother Theory Pract **24**(5): 311-20.

This study investigated the effects of 5-Form, Yang Style Tai Chi (TC) on balance confidence, balance performance, functional strength, mobility, and incidence of falls among individuals with or at risk for developing osteoporosis. This was a pilot outcomes study in which participants served as their own controls. Thirty-one independent, community-dwelling women (mean age of 67.3 years) attended TC sessions twice a week for 12 weeks and practiced at least 1 day a week on their own. A specific TC instruction video was used to facilitate home practice. Baseline, immediate postintervention, and 6 and 12 months postintervention data were recorded. Outcome measures included the Activities-specific Balance Confidence (ABC) Scale, One-Legged Stance Test (OLST) for both legs, Repeated Chair Stands (RCS), and the Timed Up and Go Test (TUG). Exercise performance and falls were tracked during the study by using daily diaries. Balance performance, functional strength, and mobility significantly improved ($p < 0.05$) immediately postintervention. Most benefits were sustained at 6 months, but only functional strength and mobility remained improved at 12 months postintervention. Most participants reported exercising at the 6- and 12-month follow-up. However, very few individuals continued to practice TC on a regular basis (more than once a week) beyond the 12-week intervention. Balance confidence or incidence of falls did not improve.

Mustian, K. M., O. G. Palesh, et al. (2008). "Tai Chi Chuan for breast cancer survivors." Med Sport Sci **52**: 209-17.

BACKGROUND/AIMS: Treatment for breast cancer produces side effects that diminish functional capacity and quality of life (QOL) among survivors. Tai Chi Chuan (TCC) is a

moderate form of exercise that may improve functional capacity and QOL in these individuals. Women who completed treatment for breast cancer were randomized to receive TCC or psychosocial support therapy for 12 weeks (60 min; three times weekly). **RESULTS:** The TCC group demonstrated significant improvements in functional capacity, including aerobic capacity, muscular strength, and flexibility, as well as QOL; the psychosocial support therapy group showed significant improvements only in flexibility, with declines in aerobic capacity, muscular strength, and QOL. **CONCLUSIONS:** The TCC group exhibited significant improvements in functional capacity and QOL. These data suggest that TCC may enhance functional capacity and QOL among breast cancer survivors.

Ospina, M. B., K. Bond, et al. (2008). "Clinical trials of meditation practices in health care: characteristics and quality." *J Altern Complement Med* **14**(10): 1199-213.

OBJECTIVE: To provide a descriptive overview of the clinical trials assessing meditation practices for health care. **DESIGN:** Systematic review of the literature. Comprehensive searches were conducted in 17 electronic bibliographic databases through September 2005. Other sources of potentially relevant studies included hand searches, reference tracking, contacting experts, and gray literature searches. Included studies were clinical trials with 10 or more adult participants using any meditation practice, providing quantitative data on health-related outcomes, and published in English. Two independent reviewers assessed study relevance, extracted the data, and assessed the methodological quality of the studies. **RESULTS:** Four hundred clinical trials on meditation (72% described as randomized) were included in the review (publication years 1956-2005). Five broad categories of meditation practices were identified: mantra meditation, mindfulness meditation, yoga, t'ai chi, and qigong. The three most studied clinical conditions were hypertension, miscellaneous cardiovascular diseases, and substance abuse. Psychosocial measures were the most frequently reported outcomes. Outcome measures of psychiatric and psychological symptoms dominate the outcomes of interest. Overall, the methodological quality of clinical trials is poor, but has significantly improved over time by 0.014 points every year (95% CI, 0.005, 0.023). **CONCLUSIONS:** Most clinical trials on meditation practices are generally characterized by poor methodological quality with significant threats to validity in every major quality domain assessed. Despite a statistically significant improvement in the methodological quality over time, it is imperative that future trials on meditation be rigorous in design, execution, analysis, and the reporting of results.

Pei, Y. C., S. W. Chou, et al. (2008). "Eye-hand coordination of elderly people who practice Tai Chi Chuan." *J Formos Med Assoc* **107**(2): 103-10.

BACKGROUND/PURPOSE: The objective of this study was to evaluate the effect of motor control from Tai Chi Chuan (TCC) on eye-hand coordination in the elderly. **METHODS:** Forty-two elderly people were recruited into this study. People in the TCC group (n = 22) had been practicing TCC regularly for more than 3 years. The control group (n = 20) comprised healthy and active elderly people. Subjects were asked to stroke target sensors in a test device with computer recording. There were three different target sensor sizes (1 cm, 1.5 cm and 2 cm in diameter) for different tests. For each target stroking, the following were recorded and calculated: start and end positions, duration of movement, pause time, peak velocity, and the time to reach peak velocity. **RESULTS:** The TCC group showed significantly better results in

decrease of displacement ($p = 0.003$), movement time ($p = 0.002$), pause time ($p < 0.001$), number of submovements ($p = 0.001$), and better skewness coefficients ($p < 0.001$) than the control group. However, the difference in the peak velocity of the TCC and control groups did not reach statistical significance ($p = 0.026$). CONCLUSION: The elderly TCC group had better results on the eye-hand coordination test than the control elderly group.

Posadzki, P. and S. Jacques (2009). "Tai chi and meditation: a conceptual (re)synthesis?" J Holist Nurs **27**(2): 103-14.

The aim of this article is to review the literature on Tai Chi and meditation. A coherent construct is developed that includes a comparative analysis and conceptual synthesis of existing theories. The authors discuss a set of assumptions that justify this synthesis; they also argue that this construct would facilitate greater understanding of Tai Chi from the perspective of meditation. Such synthesis may bring "additional" benefits to Tai Chi practitioners as they could recognize that this mind-body technique holds the essence of meditation. Within the scope of this article, the evidence shows a majority of common features when concerning Tai Chi and meditation. These mutual similarities should be taken into account when performing this type of mind-body medicine by patients and/or therapists. Finally, the authors suggest that this inspiring compilation of movements and mindfulness can be used for practical purposes.

Rabinowitz, M. (2008). "The benefits of tai chi." Am J Public Health **98**(12): 2118; autor reply 2118-9.

Reid, M. C., M. Papaleontiou, et al. (2008). "Self-management strategies to reduce pain and improve function among older adults in community settings: a review of the evidence." Pain Med **9**(4): 409-24.

CONTEXT: Self-management strategies for pain hold substantial promise as a means of reducing pain and improving function among older adults with chronic pain, but their use in this age group has not been well defined. OBJECTIVE: To review the evidence regarding self-management interventions for pain due to musculoskeletal disorders among older adults. DESIGN: We searched the Medline and Cumulative Index to Nursing and Allied Health Literature databases to identify relevant articles for review and analyzed English-language articles that presented outcome data on pain, function, and/or other relevant endpoints and evaluated programs/strategies that could be feasibly implemented in the community. Abstracted information included study sample characteristics, estimates of treatment effect, and other relevant outcomes when present. RESULTS: Retained articles ($N = 27$) included those that evaluated programs sponsored by the Arthritis Foundation and other programs/strategies including yoga, massage therapy, Tai Chi, and music therapy. Positive outcomes were found in 96% of the studies. Proportionate change in pain scores ranged from an increase of 18% to a reduction of 85% (median = 23% reduction), whereas change in disability scores ranged from an increase of 2% to a reduction of 70% (median = 19% reduction). Generalizability issues identified included limited enrollment of ethnic minority elders, as well as non-ethnic elders aged 80 and above. CONCLUSIONS: Our results suggest that a broad range of self-management programs may provide benefits for older adults with chronic pain. Research is needed to establish the efficacy of the programs in diverse age and ethnic groups of older adults and

identify strategies that maximize program reach, retention, and methods to ensure continued use of the strategies over time.

Rogers, C. E., L. K. Larkey, et al. (2009). "A review of clinical trials of tai chi and qigong in older adults." West J Nurs Res **31**(2): 245-79.

Initiation and maintenance of physical activity (PA) in older adults is of increasing concern as the benefits of PA have been shown to improve physical functioning, mood, weight, and cardiovascular risk factors. Meditative movement forms of PA, such as tai chi and qigong (TC & QG), are holistic in nature and have increased in popularity over the past few decades. Several randomized controlled trials have evaluated TC & QG interventions from multiple perspectives, specifically targeting older adults. The purpose of this report is to synthesize intervention studies targeting TC & QG and identify the physical and psychological health outcomes shown to be associated with TC & QG in community dwelling adults older than 55. Based on specific inclusion criteria, 36 research reports with a total of 3,799 participants were included in this review. Five categories of study outcomes were identified, including falls and balance, physical function, cardiovascular disease, and psychological and additional disease-specific responses. Significant improvement in clusters of similar outcomes indicated interventions utilizing TC & QG may help older adults improve physical function and reduce blood pressure, fall risk, and depression and anxiety. Missing from the reviewed reports is a discussion of how spiritual exploration with meditative forms of PA, an important component of these movement activities, may contribute to successful aging.

Sannes, T. S., P. J. Mansky, et al. (2008). "The need for attention to dose in mind-body interventions: lessons from t'ai chi clinical trials." J Altern Complement Med **14**(6): 645-53.

OBJECTIVE: The rise in popularity of complementary and alternative medicine (CAM) in the United States has stimulated increasing interest in researching CAM. One challenge to this research is determining the optimal dose of a CAM intervention. T'ai Chi Chuan (TCC) has received considerable attention as a mind-body practice; however, it remains unclear exactly how much TCC practice is necessary to elicit a discernable effect. **DESIGN:** In this review, we selected 19 studies and examined the variation in the number and length of training sessions. Secondary and tertiary aims include examining attendance rates for each intervention and the instructions given to participants regarding home-based practice. The degree to which investigators monitored participants' home-based practice was also examined. **RESULTS:** In the intent-to-treat analyses, the median time of TCC practice was 2877 minutes intended for participants across the selected interventions. Fourteen (14) of the publications provided information about participant attendance in the original publication, 2 provided additional information through further author inquiry, and 3 commented on TCC practice outside of the structured class environment through author inquiry. **CONCLUSIONS:** The data reported are inconsistent in reported attendance and home-based practice rates, making it difficult to speculate on the relationship between the amount of TCC and intervention effects. Further research could contribute to this area by determining the optimal dose of TCC instruction.

Schmitt, K. and R. W. Kressig (2008). "[Mobility and balance]." Ther Umsch **65**(8): 421-6.

Quality of life is strongly associated with the mobility of elderly people. Falls often cause restricted mobility, a decline in activities of daily living and an increased risk of institutionalisation. Frailty, commonly associated with aging, is a biologic syndrome of decreased resistance to stressors, resulting from declines across multiple physiological systems. Changes in mobility and gait constitute part of the frailty syndrome. Since more than one third of persons over the age of 65 fall each year, prevention of falls is very important. Already while taking the patients' history special emphasis should be laid on matters associated with an increased risk of falling, such as the use of more than four medications. To assess mobility several brief tests exist (i.e. Timed up & go [17], Walking while Talking [20]) which immediately yield information regarding mobility and falling risk. Patients with poor performance on such tests or those with a history of several falls should undergo a spatio-temporal gait analysis in order to determine a possible cause as well as suitable interventions. Additionally, the objective measurement of temporo-spatial gait parameters under dual task conditions may detect deficits in cognitive function. Several interventions have been shown to have favourable effects on gait stability and the occurrence of falls. Proprioceptive problems can be partially compensated for by wearing special shoes. Also, different movement exercises such as Tai Chi Chuan, Jaques-Dalcroze eurhythmics and social dancing are associated with better balance and gait safety, and a reduction of falls.

Schmitt, N. M., J. Schmitt, et al. (2009). "The role of physical activity in the prevention of osteoporosis in postmenopausal women-An update." *Maturitas* **63**(1): 34-8.

CONTEXT AND OBJECTIVE: Osteoporosis causes an increase in bone fragility. Its clinical significance mainly refers to (hip) fractures secondary to (low or moderate) trauma. In Europe and North America about 6% of men and 21% of women aged 50-84 years are classified to have osteoporosis. Although it is well accepted that exercise is essential for the management of osteoporosis, the exact role of physical activity in the primary and secondary prevention of osteoporotic fractures is still controversial. **METHODS:** The MEDLINE database and reference lists of selected publications were systematically searched for randomized controlled trials and prospective cohort studies, respectively, published since January 2000 regarding the association of physical activity and osteoporosis in postmenopausal women. **RESULTS:** Two prospective cohort studies indicate the clinical relevance of this association by showing an inverse relationship between physical activity and the risk of hip fracture. There is convincing evidence that physical activity effectively slows bone loss in postmenopausal women in a dose-dependent manner. Exercise programs may increase bone mineral density. **CONCLUSION:** In order to maximize the goals of public health most effective, individually adapted, intense, high impact exercise programs are needed. However, they may be complicated to communicate and adherence on the population level may be hard to achieve. These programs must be weighed against popular and applicable existing programs (e.g. aerobic classes, Tai Chi, and walking) which appear to be easier to adhere to but appear to be less effective in the prevention of osteoporotic fractures in the individual postmenopausal women.

Shen, C. L., C. R. James, et al. (2008). "Effects of Tai Chi on gait kinematics, physical function, and pain in elderly with knee osteoarthritis--a pilot study." *Am J Chin Med* **36**(2): 219-32.

Our previous study has demonstrated that 6 weeks of Tai Chi exercise significantly improves knee pain and stiffness in elderly with knee osteoarthritis. This study also examines the effects of Tai Chi exercise on gait kinematics, physical function, pain, and pain self-efficacy in elderly with knee osteoarthritis. In this prospective, pretest-posttest clinical trial, 40 men and women (64.4±8.3 years) diagnosed with knee osteoarthritis participated in 6 weeks of instructed Tai Chi training, 1 hour/session, 2 sessions/week. The following measures were taken at baseline and the conclusion of the intervention: (a) gait kinematics including stride length, stride frequency, and gait speed quantified using video analysis, (b) physical function, (c) knee pain, and (d) pain self-efficacy. Data were analyzed using repeated MANCOVA, MANOVA, ANOVA and Wilcoxon tests. After 6 weeks of Tai Chi exercise, stride length ($p=0.023$; 1.17±0.17 vs. 1.20±0.14 m), stride frequency ($p=0.014$; 0.91±0.08 vs. 0.93±0.08 strides/s), and consequently gait speed ($p<0.025$; 1.06±0.19 vs. 1.12±0.15 m/s) increased in the participants. Physical function was significantly improved ($p<0.001$) and knee pain was significantly decreased ($p=0.002$), while no change was observed in pain self-efficacy. In conclusion, these findings support that Tai Chi is beneficial for gait kinematics in elderly with knee osteoarthritis, and a longer term application is needed to substantiate the effect of Tai Chi as an alternative exercise in management of knee osteoarthritis.

Sjosten, N., S. Vaapio, et al. (2008). "The effects of fall prevention trials on depressive symptoms and fear of falling among the aged: a systematic review." *Aging Ment Health* **12**(1): 30-46.

Firstly, to explore whether depressive symptoms and fear of falling have been used as outcome measures in fall prevention trials. Secondly, to determine the effects of fall prevention trials on these variables among the aged. A literature search covering various medical databases was conducted to identify randomised controlled trials regarding the effects of fall prevention programmes on depressive symptoms and fear of falling among the aged. The studies were classified according to the intervention method (single/multifactorial) and study results (positive/negative) regarding depressive symptoms or fear of falling. Methodological quality was assessed in relation to blinding at outcome assessment, follow-up and whether intention-to-treat analysis was used. Depressive symptoms were used as an outcome measure in eight and fear of falling in 21 studies. A multifactorial approach seems the most effective method in reducing fear of falling, while some single methods such as Tai Chi also seem beneficial. Little evidence was found relating to the effects of fall prevention trials on depressive symptoms. Fear of falling may be reduced by fall prevention programmes. More studies assessing the effects on depressive symptoms, especially among the depressed aged are needed.

Sleet, D. A., D. B. Moffett, et al. (2008). "CDC's research portfolio in older adult fall prevention: a review of progress, 1985-2005, and future research directions." *J Safety Res* **39**(3): 259-67.

PROBLEM: Falls are a leading cause of mortality and morbidity among adults age 65 and older. Population models predict steep increases in the 65 and older population bands in the next 10-15 years and in turn, public health is bracing for increased fall rates and the strain they place on health care systems and society. To assess progress in fall prevention, the Centers for Disease Control and Prevention conducted a research portfolio review to examine the quality, relevance, outcomes and successes of the CDC fall prevention program and its impact on public health.

METHODS: A peer review panel was charged with reviewing 20 years of funded research and conducting a SWOT (strengths, weaknesses, opportunities, and threats) analysis for extramural and intramural research activities. Information was collected from grantees (via a survey instrument), staff were interviewed, and progress reports and products were reviewed and analyzed. **RESULTS:** CDC has invested over \$24,900,000 in fall-related research and programs over 20 years. The portfolio has had positive impacts on research, policies and programs, increasing the public health injury prevention workforce, and delivering effective fall prevention programs. **DISCUSSION:** Public health agencies, practitioners, and policy makers recognize that while there are some evidence-based older adult fall prevention interventions available, many remain unused or are infeasible to implement. Specific recommendations across the public health model, include: additional research in gathering robust epidemiologic data on trends and patterns of fall-related injuries at all levels; researching risk factors by setting or sub-population; developing and testing innovative interventions; and engaging in translation and dissemination research on best practices to increase uptake and adoption of fall prevention strategies. CDC has responded to a number of suggestions from the portfolio review including: funding translation research of a proven Tai Chi fall intervention; beginning to address gaps in gender, ethnic, and racial differences in falls; and collaborating with partner organizations who share in CDC's mission to improve public health by preventing falls and reducing fall-related injuries. **IMPACT ON INDUSTRY:** Industry has an opportunity to develop more accessible and usable devices to reduce injury from falls (for example, hip protectors and force reducing flooring). By implementing effective, evidence-based interventions to prevent falls and reduce injuries from falls, significant decreases in health care costs can be expected.

Song, R., S. Ahn, et al. (2009). "[Effects of Tai Chi exercise on cardiovascular risk factors and quality of life in post-menopausal women]." J Korean Acad Nurs **39**(1): 136-44.

PURPOSE: Natural menopause resulting in the decline in endogenous estrogen concentrations is responsible for an increased risk of coronary heart disease in postmenopausal women. The purpose of the study was to examine the effects of a 6-month Tai Chi exercise program on cardiovascular risk factors and quality of life in post-menopausal women. **METHODS:** A quasi-experimental design with pretest and posttest measures was used. The participants in the study, 29 women in the Tai Chi group and 31 in the control group, were enrolled for 6 months. **RESULTS:** After 6 months of Tai Chi exercise, total cholesterol (M=213 to 185), LDL-cholesterol (M=135 to 128), and their 10 yr cardiovascular disease risk (M=2.62 to 2.27) had improved significantly for the Tai Chi participants compared to the control group. Total scores for quality of life along with the sub-dimensions of health perception and mental functioning were also significantly higher in the Tai Chi participants. **CONCLUSION:** Tai Chi exercise favorably affected cardiovascular health and quality of life in post-menopausal women after 6 months. Additional rigorous studies are needed to examine long term effects on the prevention of cardiovascular disease in this population.

Straus, S. (2008). "A 16-week tai chi programme prevented falls in healthy older adults." Evid Based Med **13**(2): 54.

Taylor-Piliae, R. E. (2008). "The effectiveness of Tai Chi exercise in improving aerobic capacity: an updated meta-analysis." Med Sport Sci **52**: 40-53.

PURPOSE: To determine if Tai Chi exercise is effective in improving aerobic capacity. **METHODS:** A computerized search of seven databases was conducted using the mesh term 'Tai Ji', published between January 1, 2000, and June 1, 2007, in order to update a previous meta-analysis examining the effect of Tai Chi on aerobic capacity. Effect sizes (ESs) and 95% confidence intervals were calculated using D-STAT software. The ES for each study was weighted by the sample size and pooled variance. The effects of Tai Chi exercise on aerobic capacity were calculated including study design, gender, age, and type of comparison group. **RESULTS:** A total of 170 citations were obtained, with 7 new studies meeting the inclusion criteria and added to studies from the previous meta-analysis. Large significant effects of Tai Chi on aerobic capacity were found for subjects enrolled in the cross-sectional studies (ES = 1.33), in both women and men (1.09 and 0.86, respectively), among adults > or =55 years old (ES = 1.07), and when comparing sedentary subjects with those in Tai Chi exercise groups (ES = 0.99). Small to moderate effects, though nonsignificant, were found for subjects enrolled in the experimental studies (ES = 0.38), adults <55 years old (ES = 0.16), and when comparing subjects participating in other physical activity with those in Tai Chi exercise groups (ES = 0.45). **CONCLUSIONS:** Tai Chi exercise is effective in improving aerobic capacity when practiced long term. Middle-aged and older women and men benefit most, with greater gains seen among those initially sedentary. Tai Chi can be recommended as an alternative aerobic exercise, particularly among sedentary adults > or =55 years old.

Thornton, E. W. (2008). "Tai Chi exercise in improving cardiorespiratory capacity." Med Sport Sci **52**: 54-63.

INTRODUCTION/PURPOSE: To evaluate evidence relating to effects of Tai Chi on cardiovascular outcomes, with emphasis on randomised control designs. **PROCEDURE:** Studies reviewed in 2004 were re-examined, together with more recent controlled trials of Tai Chi relating to cardiovascular outcome. The analysis provided comment on problems associated with randomised control design, including sources of bias in such trials. **RESULTS:** With a single exception, data support reduction of baseline systolic/diastolic blood pressure (BP). While there may be positive bias in these studies, data are from diverse ethnic groups, different gender, age, and level of functional ability. There are no data relating to BP reactive change to subsequent stressors. Few studies consider potential mediating mechanisms through which Tai Chi may provide these benefits. **IMPLICATIONS:** Caution is advocated in using randomised controlled trials as the only effective type of study. Such designs are difficult to conduct and effective trials are more likely given a better understanding of the mediating mechanism(s) through which benefits may be derived. It is currently unclear how changes in BP are derived. Some data indicate a shift to increased vagal relative to sympathetic dominance and there may be other potential physiological mediators. No study has examined relationships between potential psychological gains such as self-efficacy and BP change, or individual differences in outcomes.

Tsai, P. F., C. Beck, et al. (2009). "The effect of tai chi on knee osteoarthritis pain in cognitively impaired elders: pilot study." Geriatr Nurs **30**(2): 132-9.

This article reports a pilot study of the effect of tai chi (TC), a pharmacological adjunct and mild aerobic exercise, on osteoarthritic knee pain in elders with cognitive impairment (CI). The TC program included a warm-up, 12-form Sun-style TC, and a cool-down period, for a total of 20-40

minutes per session, twice a week for 15 weeks. The results showed no significant differences in knee pain after the TC intervention in 7 elders with CI. However, more minutes of TC attendance were related to improved pain scores (Spearman's $\rho = .78$, $P < .05$). Greater accuracy in TC performance was also correlated with improvements in pain scores (Spearman's $\rho = .70$, $P = .08$). Of 4 elders who participated in TC practice regularly (more than 20 sessions), 3 showed clinically important improvements, but 3 elders who participated in no sessions or only a few sessions showed no improvement.

Tsai, P. F., C. Beck, et al. (2009). "The effect of tai chi on knee osteoarthritis pain in cognitively impaired elders: pilot study." *Geriatr Nurs* **30**(2): 132-9.

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Tsang, T., R. Orr, et al. (2008). "Effects of Tai Chi on glucose homeostasis and insulin sensitivity in older adults with type 2 diabetes: a randomised double-blind sham-exercise-controlled trial." *Age Ageing* **37**(1): 64-71.

BACKGROUND: a large proportion of adults with type 2 diabetes remain sedentary despite evidence of benefits from exercise for type 2 diabetes. Simplified Yang Tai Chi has been shown in one study to have no effect on insulin sensitivity in older adults. However, a modified Tai Chi form, Tai Chi for Diabetes (TCD) has recently been composed, claiming to improve diabetes control. **METHODS:** subjects were randomised to Tai Chi or sham exercise, twice a week for 16 weeks. Primary outcomes were insulin resistance 72 h post-exercise (HOMA2-IR), and long-term glucose control (HbA(1c)). **RESULTS:** thirty-eight subjects (65 +/- 7.8 years, 79% women) were enrolled. Baseline BMI was 32.2 +/- 6.3 kg/m(2), 84% had osteoarthritis, 76% hypertension, and 34% cardiac disease. There was one dropout, no adverse events, and median compliance was 100 (0-100)%. There were no effects of time or group assignment on insulin resistance or HbA(1c) (-0.07 +/- 0.4% Tai Chi versus 0.12 +/- 0.3% Sham; $P = 0.13$) at 16 weeks. Improvement in HbA(1c) was related to decreased body fat ($r = 0.484$, $P = 0.004$) and improvement in insulin resistance was related to decreased body fat ($r = 0.37$, $P = 0.03$) and central adiposity ($r = 0.38$, $P = 0.02$), as well as increased fat-free mass ($r = -0.46$, $P = 0.005$). **CONCLUSIONS:** TCD did not improve glucose homeostasis or insulin sensitivity measured 72 h after the last bout of exercise. More intense forms of Tai Chi may be required to produce the body composition changes associated with metabolic benefits in type 2 diabetes.

Tsang, T., R. Orr, et al. (2007). "Health benefits of Tai Chi for older patients with type 2 diabetes: the "Move It For Diabetes study"--a randomized controlled trial." Clin Interv Aging 2(3): 429-39.

Older adults with type 2 diabetes have mobility impairment and reduced fitness. This study aimed to test the efficacy of the "Tai Chi for Diabetes" form, developed to address health-related problems in diabetes, including mobility and physical function. Thirty-eight older adults with stable type 2 diabetes were randomized to Tai Chi or sham exercise, twice a week for 16 weeks. Outcomes included gait, balance, musculoskeletal and cardiovascular fitness, self-reported activity and quality of life. Static and dynamic balance index (-5.8 +/- 14.2; p = 0.03) and maximal gait speed (6.2 +/- 11.6%; p = 0.005) improved over time, with no significant group effects. There were no changes in other measures. Non-specific effects of exercise testing and/or study participation such as outcome expectation, socialization, the Hawthorne effect, or unmeasured changes in health status or compliance with medical treatment may underlie the modest improvements in gait and balance observed in this sham-exercise-controlled trial. This Tai Chi form, although developed specifically for diabetes, may not have been of sufficient intensity, frequency, or duration to effect positive changes in many aspects of physiology or health status relevant to older people with diabetes.

Tsang, W. W. and C. W. Hui-Chan (2008). "Sensorimotor control of balance: a Tai Chi solution for balance disorders in older subjects." Med Sport Sci 52: 104-14.

BACKGROUND/AIMS: In addition to environmental factors, deteriorating sensorimotor control of balance will predispose older adults to falls. Understanding the aging effects on sensorimotor control of balance performance is important for designing fall prevention programs for older adults. How repeated practice of Tai Chi can improve limb joint proprioception, integration of neural signals in the central nervous system for balance control, and motor output at the level of knee muscles is discussed in this chapter. **RESULTS:** Our previous studies showed that elderly Tai Chi practitioners performed significantly better than elderly nonpractitioners in (1) knee joint proprioception, (2) reduced or conflicting sensory situations that demand more visual or vestibular contributions, (3) standing balance control after vestibular stimulation without visual input, (4) voluntary weight shifting in different directions within the base of support, (5) single-leg stance during perturbations of the support surface, and (6) knee extensor and flexor muscle strength. In a prospective study, we further showed that 4 weeks of daily Tai Chi practice but not general education produced significant improvement in balance performance. **CONCLUSION:** The requirements of Tai Chi for accurate joint positioning and weight transfer involving smooth coordination of neck, trunk, upper and lower limb movements, make it particularly useful for improving the sensorimotor control of balance in the elderly. Because Tai Chi can be practiced any time and anywhere, and is well accepted by older people in both the East and now the West, it is especially suited to be a key component of a low-costing community-based fall prevention program alongside with education about environmental factors.

Wahbeh, H., S. M. Elsas, et al. (2008). "Mind-body interventions: applications in neurology." Neurology 70(24): 2321-8.

OBJECTIVE: Half of the adults in the United States use complementary and alternative medicine with mind-body therapy being the most commonly used form. Neurology patients often turn to their physicians for insight into the effectiveness of the therapies and resources to integrate them into their care. The objective of this article is to give a clinical overview of mind-body interventions and their applications in neurology. **METHODS:** Medline and PsychInfo were searched on mind-body therapies and neurologic disease search terms for clinical trials and reviews and published evidence was graded. **RESULTS:** Meditation, relaxation, and breathing techniques, yoga, tai chi, and qigong, hypnosis, and biofeedback are described. Mind-body therapy application to general pain, back and neck pain, carpal tunnel syndrome, headaches, fibromyalgia, multiple sclerosis, epilepsy, muscular dysfunction, stroke, aging, Parkinson disease, stroke, and attention deficit-hyperactivity disorder are reviewed. **CONCLUSIONS:** There are several conditions where the evidence for mind-body therapies is quite strong such as migraine headache. Mind-body therapies for other neurology applications have limited evidence due mostly to small clinical trials and inadequate control groups.

Wall, R. B. (2008). "Teaching Tai Chi with mindfulness-based stress reduction to middle school children in the inner city: a review of the literature and approaches." *Med Sport Sci* **52**: 166-72.

Tai Chi (TC) is the focus of a growing body of literature both qualitative and empirical. Yet there is a paucity of literature on teaching TC to either adolescents or children ages 10-13 presumably because of the level of attention and concentration TC requires. In the pediatric setting, TC appears best combined with other practice activities like mindfulness-based stress reduction (MBSR) that complement the practice of TC, sustain interest and synergistically enhance the benefits TC has been shown to produce in older populations. The literature on the effects of (MBSR) practices with children and teens are also limited. However, the corpus of TC studies suggests significant benefits could be transgenerational if presented in novel ways and taught in developmentally appropriate approaches to children. This chapter explores combining MBSR exercises with TC as one practice that can potentially accomplish this synergy. The chapter includes recommendations for a course design based on two projects created by the author integrating TC and MBSR for ages 11-14 in the inner city of Boston, Mass., USA.

Wang, C. (2008). "Tai Chi improves pain and functional status in adults with rheumatoid arthritis: results of a pilot single-blinded randomized controlled trial." *Med Sport Sci* **52**: 218-29.

BACKGROUND/AIMS: Rheumatoid arthritis (RA) is a serious health problem resulting in significant morbidity and disability. Tai Chi may be beneficial to patients with RA as a result of effects on muscle strength and 'mind-body' interactions. To obtain preliminary data on the effects of Tai Chi on RA, we conducted a pilot randomized controlled trial. Twenty patients with functional class I or II RA were randomly assigned to Tai Chi or attention control in twice-weekly sessions for 12 weeks. The American College of Rheumatology (ACR) 20 response criterion, functional capacity, health-related quality of life and the depression index were assessed. **RESULTS:** At 12 weeks, 5/10 patients (50%) randomized to Tai Chi achieved an ACR 20% response compared with 0/10 (0%) in the control ($p = 0.03$). Tai Chi had greater improvement in the disability index ($p = 0.01$), vitality subscale of the Medical Outcome Study Short Form 36 ($p = 0.01$) and the depression index ($p = 0.003$). Similar trends to improvement were also observed for disease activity, functional capacity and health-related quality of life. No

adverse events were observed and no patients withdrew from the study. CONCLUSION: Tai Chi appears safe and may be beneficial for functional class I or II RA. These promising results warrant further investigation into the potential complementary role of Tai Chi for treatment of RA.

Wang, C., C. H. Schmid, et al. (2008). "Tai Chi for treating knee osteoarthritis: designing a long-term follow up randomized controlled trial." BMC Musculoskelet Disord **9**: 108.

BACKGROUND: Knee Osteoarthritis (KOA) is a major cause of pain and functional impairment among elders. Currently, there are neither feasible preventive intervention strategies nor effective medical remedies for the management of KOA. Tai Chi, an ancient Chinese mind-body exercise that is reported to enhance muscle function, balance and flexibility, and to reduce pain, depression and anxiety, may safely and effectively be used to treat KOA. However, current evidence is inconclusive. Our study examines the effects of a 12-week Tai Chi program compared with an attention control (wellness education and stretching) on pain, functional capacity, psychosocial variables, joint proprioception and health status in elderly people with KOA. The study will be completed by July 2009. METHODS/DESIGN: Forty eligible patients, age > 55 yr, BMI < or = 40 kg/m² with tibiofemoral osteoarthritis (American College of Rheumatology criteria) are identified and randomly allocated to either Tai Chi (10 modified forms from classical Yang style Tai Chi) or attention control (wellness education and stretching). The 60-minute intervention sessions take place twice weekly for 12 weeks. The study is conducted at an urban tertiary medical center in Boston, Massachusetts. The primary outcome measure is the Western Ontario and McMaster Universities (WOMAC) pain subscale at 12 weeks. Secondary outcomes include weekly WOMAC pain, function and stiffness scores, patient and physician global assessments, lower-extremity function, knee proprioception, depression, self-efficacy, social support, health-related quality of life, adherence and occurrence of adverse events after 12, 24 and 48 weeks. DISCUSSION: In this article, we present the challenges of designing a randomized controlled trial with long-term follow up. The challenges encountered in this design are: strategies for recruitment, avoidance of selection bias, the actual practice of Tai Chi, and the maximization of adherence/follow-up while conducting the clinical trial for the evaluation of the effectiveness of Tai Chi on KOA. TRIAL REGISTRATION: ClinicalTrials.gov identifier: NCT00362453.

Wang, J. H. (2008). "Effects of Tai Chi exercise on patients with type 2 diabetes." Med Sport Sci **52**: 230-8.

This study investigated the effects of Tai Chi exercise on the levels of blood glucose, insulin and insulin receptors of patients with type 2 diabetes. Twelve subjects aged 58-75 years old (66.5 +/- 8.5 years) with type 2 diabetes participated in the study. They were trained with the protocol of Tai Chi exercise for 8 weeks. Blood glucose, serum insulin, and insulin receptor activity were measured before and after the 8-week intervention and immediately after a single bout exercise of Tai Chi after the protocol. The results showed that by 8 weeks of Tai Chi exercise, the blood glucose decreased ($p < 0.05$), while high- and low-affinity insulin receptor numbers (r_1 , r_2) and low-affinity insulin receptor binding capacity (R_2) increased. Serum insulin increased ($p < 0.05$) but was still within the normal range. After the single bout Tai Chi exercise, blood glucose, high- and low-affinity insulin receptor numbers (r_1 , r_2), and their binding capacity (R_1 , R_2) increased

($p < 0.05$), while serum insulin did not change. The 8-week Tai Chi intervention therefore showed benefits on health status of patients with type 2 diabetes.

Wang, Y. (2008). "Tai Chi exercise and the improvement of mental and physical health among college students." Med Sport Sci **52**: 135-45.

BACKGROUND/AIMS: Physical exercise has positive effects on the body as well as on the mind. The purpose of this study was to examine the effects of Tai Chi exercise on college students' perceptions of their physical and mental health. A 3-month Tai Chi intervention (1 h, twice/week) was administered to 30 college students. The SF-36v2 health survey questionnaire was employed to evaluate the mental health dimension (MHD) and physical health dimension (PHD) before and after the intervention by means of a paired t test ($p < 0.05$). PHD including physical functioning, role physical, bodily pain, general health, and MHD including social functioning, role mental/emotion function, vitality, and perceptions of mental health were assessed. **RESULTS:** Physical measures of bodily pain and general health, and mental measures of role mental/emotion function, vitality, and mental health were significantly improved after Tai Chi intervention. When the overall PHD or MHD scores were evaluated, the MHD increased significantly. **CONCLUSIONS:** Tai Chi exercise had positive effects on the self-assessed physical and mental health of college students. Scores on the MHD appeared to be particularly sensitive to change. Colleges/universities might consider offering Tai Chi as a component of their ongoing physical activity programs available to students.

Wayne, P. M. and T. J. Kaptchuk (2008). "Challenges inherent to t'ai chi research: part II--defining the intervention and optimal study design." J Altern Complement Med **14**(2): 191-7.

Although a growing body of clinical research has begun to evaluate the efficacy and safety of t'ai chi as a therapeutic tool for a variety of health conditions, little attention has been devoted to evaluating "how" t'ai chi is scientifically studied, and the advantages or limitations of different methodological approaches. In a companion to this paper (Part I), we argued that t'ai chi is a complex, multicomponent intervention, which poses unique challenges regarding the distinction of specific versus nonspecific effects and limitations regarding the use of reductionistic research frameworks. In this second, companion paper, we discuss additional obstacles inherent in precisely defining the t'ai chi intervention in an experimental paradigm. These challenges include t'ai chi's pluralism, the concept of t'ai chi dosage, and long- versus short-term evaluations of t'ai chi's efficacy and safety. To address these challenges, and with a goal to provide complete and unbiased evidence, we propose a pluralistic methodological approach to clinical research that includes controlled randomized trials of fixed protocols, community-based pragmatic trials, cross-sectional studies of long-term practitioners, and studies that integrate qualitative methods.

Wayne, P. M. and T. J. Kaptchuk (2008). "Challenges inherent to t'ai chi research: part I--t'ai chi as a complex multicomponent intervention." J Altern Complement Med **14**(1): 95-102.

In this, the first of 2 companion papers, we present a framework for viewing t'ai chi as a complex, multicomponent intervention that integrates numerous physical, cognitive, and ritualistic components. We discuss how the richness and complexity of t'ai chi poses challenges related to the traditional distinction between specific versus nonspecific effects, the development

and interpretation of valid sham controls, and more generally, to the reductionist causal approach of attributing observed outcomes to single, independent component factors. We also discuss parallels between t'ai chi research and the emerging field of whole systems research, and how t'ai chi research may benefit from the use of an ecologic framework. In a second, companion paper, we discuss additional challenges inherent in defining the t'ai chi intervention itself, and more comprehensively outline the benefits and limitations of commonly used clinical research designs to evaluate the efficacy and safety of t'ai chi.

Wong, A. M. and C. Lan (2008). "Tai Chi and balance control." *Med Sport Sci* **52**: 115-23.

Balance function begins to decline from middle age on, and poor balance function increases the risk of fall and injury. Suitable exercise training may improve balance function and prevent accidental falls. The coordination of visual, proprioceptive, vestibular and musculoskeletal system is important to maintain balance. Balance function can be evaluated by functional balance testing and sensory organization testing. Tai Chi Chuan (TC) is a popular conditioning exercise in the Chinese community, and recent studies substantiate that TC is effective in balance function enhancement and falls prevention. In studies utilizing functional balance testing, TC may increase the duration of one-leg standing and the distance of functional reach. In studies utilizing sensory organization testing, TC improves static and dynamic balance, especially in more challenging sensory perturbed condition. Therefore, TC may be prescribed as an alternative exercise program for elderly subjects or balance-impaired patients. Participants can choose to perform a complete set of TC or selected movements according to their needs. In conclusion, TC may improve balance function and is appropriate for implementation in the community.

Wong, A. M., Y. C. Pei, et al. (2009). "Is Tai Chi Chuan effective in improving lower limb response time to prevent backward falls in the elderly?" *Age (Dordr)*.

To evaluate the training effect of Tai Chi Chuan (TCC) in postural control and backward fall prevention in the elderly, balance assessment and visually guided lower limb response time were analyzed in a case-control study conducted in a community setting. Thirty-one elderly subjects (mean age: 68.2 +/- 6.8 years) participated in the TCC group, 30 community-dwelling elderly subjects with matched age and body composition served as the elderly control group, with 13 young adults (mean age: 27.5 +/- 3.8 years) serving as young controls. The TCC group had practiced TCC regularly five times per week, for over 30 min per day for at least 4 years. Lower limb response time were measured using a computerized dance machine that we developed, which contains two blocks during testing: single and dual feet. The motor planning of the latter is more complex than the former. Postural control was assessed by computerized posturography (Smart Balance Master). Compared to the elderly controls, the TCC group demonstrated significantly better balance performance in sway-referenced support, which is more challenging. Moreover, the TCC group had better dual feet response than the elderly controls in the forward-backward, forward-right and forward-left directions. Practicing TCC may improve motor responses and postural control in the elderly, particularly in more challenging situations. Subjects showed better postural responses to unexpected perturbation in the forward-backward and forward-sideways direction than sideways or backward-sideways directions, which may have clinical relevance.

Wu, G. (2008). "Age-related differences in Tai Chi gait kinematics and leg muscle electromyography: a pilot study." Arch Phys Med Rehabil **89**(2): 351-7.

OBJECTIVE: To compare the biomechanic features of Tai Chi gait by elders with those by young adults, and with those of normative gait. **DESIGN:** Cross-sectional study. **SETTING:** Laboratory-based testing. **PARTICIPANTS:** Young (n=6; 3 women) and old (n=6; 5 women) Tai Chi practitioners. **INTERVENTION:** All subjects had practiced Tai Chi for at least 4 months. **MAIN OUTCOME MEASURES:** Spatial, temporal, and leg muscle electromyography during Tai Chi gait and normative gait. **RESULTS:** The primary age-related differences in Tai Chi gait were during single stance, with elders having significantly shorter single-stance time (-50%), less lateral displacement (-30%), knee flexion (-42%), hip flexion (-39%), activation time in the tibialis anterior (-13%), soleus (-39%), and tensor fascia lata (TFL) (-21%), activation magnitude in the tibialis anterior (-39%), and coactivation time of the tibialis anterior and soleus (-47%). Compared with normative gait, elders during Tai Chi gait had significantly larger knee (139%) and hip (66%) flexions, longer duration (90%-170%) and higher magnitude (200%-400%) of the tibialis anterior, rectus femoris, and TFL muscle activities, and longer duration of coactivation of most leg muscle pairs (130%-380%). **CONCLUSIONS:** The elders practice Tai Chi gait in higher posture than younger subjects. The Tai Chi gait poses significantly higher challenges to elder's balance and muscular system than does their normative gait.

Wu, G. (2008). "Muscle action pattern and knee extensor strength of older Tai Chi exercisers." Med Sport Sci **52**: 30-9.

BACKGROUND/AIMS: Tai Chi (TC) practice has been shown to improve leg muscle strength among elders. This study examined the leg muscle action patterns during a typical TC movement, and their relationship with knee extensor strength and knee flexion angle in single leg stance. **METHODS:** Surface electromyography of four leg muscles and knee movement were recorded from 5 female elderly TC practitioners while performing a TC movement and normal walking, respectively. The maximum knee extensor strength was also measured. The duration and magnitude of electromyography were compared between the TC movement and walking, and were correlated with the knee extensor strength and knee flexion angle. **RESULTS:** Ankle dorsiflexors and knee extensors were activated significantly longer and higher during the TC movement than during walking. The duration and magnitude of all four leg muscles during the TC movement were positively correlated with the knee extensor strength and knee flexion angle, and these correlations were stronger than during walking. **CONCLUSION:** The TC movement puts more demand on ankle dorsiflexors and knee extensors that are not otherwise heavily recruited during walking. The degree of knee flexion during single leg stance of the TC movement may be a key element for improving leg muscle strength.

Wu, G. and D. Millon (2008). "Joint kinetics during Tai Chi gait and normal walking gait in young and elderly Tai Chi Chuan practitioners." Clin Biomech (Bristol, Avon) **23**(6): 787-95.

BACKGROUND: Tai Chi Chuan is becoming a popular exercise among elders. This study measured the inter-segmental forces and moments at the lower extremity joints during a Tai Chi gait as compared to those during normal walking gait, in both apparently healthy young and elderly Tai Chi Chuan practitioners. **METHODS:** Three-dimensional inter-segmental joint

reaction force and moment were computed using the Inverse Dynamic Approach based on the kinematics and ground reaction force measurements in a laboratory setting in six young (two females, mean age 28; SD 6 years) and six elderly (five females, mean age 72; SD 8 years) subjects who had previous training of Yang style Tai Chi Chuan. FINDINGS: The results showed significant gait differences in both age groups, with significantly smaller peak compressive forces, larger peak shear forces in the ankle, knee and hip joints, and larger peak moments in the knee and hip joints during Tai Chi gait as compared to normal gait. Moreover, the peak shear force was oriented more in the medial-lateral direction at the ankle and knee joints, and the peak moment was in the frontal plane at the knee and hip joints. The results also showed significant age differences, with significantly smaller peak shear forces in all three joints in the elderly group than in the young group during Tai Chi gait. INTERPRETATION: Tai Chi gait has an increased shear force and frontal plane torque at lower extremity joints than normal gait. The shear force at all three lower extremity joints during Tai Chi gait is lower in the elderly subjects than young subjects. This data suggest that, in Tai Chi Chuan training, elderly people with degenerative joint diseases in the lower extremity should use caution when practicing Tai Chi Chuan.

Wu, G. and X. Ren (2009). "Speed effect of selected Tai Chi Chuan movement on leg muscle activity in young and old practitioners." Clin Biomech (Bristol, Avon) **24**(5): 415-21.

BACKGROUND: Tai Chi Chuan is becoming a popular exercise for improving balance and preventing falls in the elderly. To date, there is no quantitative study investigating the effect of Tai Chi Chuan movement speed on leg muscle function. This study investigated the effect of Tai Chi Chuan exercise performed at different speed on leg muscle activity characteristics in both young and old Tai Chi Chuan practitioners. METHODS: Surface electromyography of six leg muscles and kinematics of lower extremity joints were measured in young and old subjects during Tai Chi Chuan practice at fast, normal, and slow speed, respectively. The magnitude and duration of activation, and durations of isometric, concentric and eccentric actions of each muscle were compared among three speeds and between two groups. FINDINGS: The activation duration of all six leg muscles was significantly longer at slower speed than at faster speed ($P < 0.039$). The durations of isometric, concentric and eccentric actions were either longer at the slower speed or did not change with speed for all six leg muscles. The action of knee extensor was primarily isometric at slower speed ($P = 0.004$), and increased significantly to concentric and eccentric at faster speed ($P < 0.031$). The activation magnitude of posterior leg muscles increased with speed ($P < 0.009$). The old subjects had significantly shorter activation duration and lower activation magnitude in several leg muscles than the young, but similar speed effect as the young. INTERPRETATION: The activation duration and function of leg muscles, especially the knee extensor muscle, are significantly affected by the speed of the selected Tai Chi Chuan movement. Practicing Tai Chi Chuan at different speed may alter the role of muscular function in movement control.

Xin, L., Y. D. Miller, et al. (2008). "A preliminary study of the effects of Tai Chi and Qigong medical exercise on indicators of metabolic syndrome and glycaemic control in adults with elevated blood glucose." Br J Sports Med.

OBJECTIVES: To evaluate the feasibility, acceptability and effects of a Tai Chi and Qigong medical exercise program that aimed to improve indicators of metabolic syndrome and glycaemic control in adults with elevated blood glucose. **Design, Setting, and PARTICIPANTS:** A single group pre-post trial of 11 participants (3 male and 8 female; aged 42-65 years) with elevated blood glucose, conducted from August to November 2005 at a university in Australia. **Intervention:** Participants attended Tai Chi and Qigong exercise training for 1 to 1.5 hours, 3 times per week for 12 weeks, and were encouraged to practice the exercises at home. **MAIN OUTCOME MEASURES:** Indicators of metabolic syndrome (body mass index, waist circumference, blood pressure, fasting blood glucose, triglycerides, HDL-cholesterol), and glucose control (HbA1c, fasting insulin and insulin resistance). **RESULTS:** There was good adherence and high acceptability for the group based program. There were significant improvements in four of the seven indicators of metabolic syndrome including body mass index [mean difference -1.05 (95% CI: -1.48, -0.63), $p < 0.001$], waist circumference [-2.80 cm (-4.97, -0.62), $p < 0.05$], and both systolic [-11.64 mm Hg (-19.46, -3.51), $p < 0.01$] and diastolic blood pressure [-9.73 mm Hg (-13.58, -5.88), $p < 0.001$]. There were also small improvements in HbA1c [-0.32 % (-0.49, -0.15), $p < 0.01$], fasting insulin [-9.93 pmol/L (-19.93, 0.07), $p = 0.051$] and insulin resistance [-0.53 (-0.97, -0.09), $p < 0.05$]. **CONCLUSIONS:** The program was shown to be feasible and acceptable and the findings suggest that it may be helpful for control of indicators of metabolic syndrome and glycaemic control. Larger controlled studies are needed to confirm these promising results.

Xu, D. Q., Y. Hong, et al. (2008). "Tai Chi exercise and muscle strength and endurance in older people." *Med Sport Sci* **52**: 20-9.

The purpose of the study was to investigate the influence of regular Tai Chi (TC) practice on muscle strength and endurance of the lower extremities in older people. Twenty-one long-term older TC practitioners were compared with 18 regular older joggers and 22 sedentary counterparts. Maximum concentric strength of knee flexors and extensors was tested at angular velocities of 30 degrees and 120 degrees/s. Ankle dorsiflexors and plantar flexors were tested at 30 degrees/s. Moreover the dynamic endurance of the knee flexors and extensors was assessed at the speed of 180 degrees/s. The strength of knee extensors and flexors in the sedentary group was significantly lower than that in the jogging group and marginally lower than that in the TC group at the higher velocity. For ankle joint, the subjects in both the TC group and the jogging group generated more torque in their ankle dorsiflexors. In addition, the muscle endurance of knee extensors was more pronounced in TC practitioners than the controls. Regular older TC practitioners and joggers showed better scores than the sedentary controls on most of the muscle strength and endurance measures. However, the magnitude of the exercise effects on muscles might depend on the characteristics of different types of exercise.

Xu, D. Q., J. X. Li, et al. (2006). "Effects of long term Tai Chi practice and jogging exercise on muscle strength and endurance in older people." *Br J Sports Med* **40**(1): 50-4; discussion 50-4.

OBJECTIVES: To investigate the influence of regular Tai Chi (TC) practice and jogging on muscle strength and endurance in the lower extremities of older people. **METHODS:** Twenty one long term older TC practitioners were compared with 18 regular older joggers and 22 sedentary counterparts. Maximum concentric strength of knee flexors and extensors was tested at angular

velocities of 30 degrees/s and 120 degrees/s. Ankle dorsiflexors and plantar flexors were tested at 30 degrees/s and the dynamic endurance of the knee flexors and extensors was assessed at a speed of 180 degrees/s. RESULTS: The differences in the muscle strength of the knee joint amongst the three experimental groups were significant at the higher velocity. The strengths of knee extensors and flexors in the control group were significantly lower than those in the jogging group and marginally lower than those in the TC group. For the ankle joint, the subjects in both the TC and jogging groups generated more torque in their ankle dorsiflexors. In addition, the muscle endurance of knee extensors was more pronounced in TC practitioners than in controls. CONCLUSION: Regular older TC practitioners and joggers showed better scores than the sedentary controls on most muscle strength and endurance measures. However, the magnitude of the exercise effects on muscles might depend on the characteristics of different types of exercise.

Yang, Y., J. Verkuilen, et al. (2008). "Effects of a traditional Taiji/Qigong curriculum on older adults' immune response to influenza vaccine." Med Sport Sci 52: 64-76.

Previous studies have suggested that Taiji (T'ai Chi) practice may improve immune function. The current study examined whether 5 months of moderate traditional Taiji and Qigong (TQ) practice could improve the immune response to influenza vaccine in older adults. Fifty older adults participated in this study. Baseline pre-vaccine blood samples were collected. Subjects received the 2003-2004 influenza vaccine during the 1st week of the intervention. Post-vaccine blood samples were collected 3, 6 and 20 weeks after intervention for analysis of anti-influenza hemagglutination inhibition titers. Findings indicated a significant increase in the magnitude and duration of the antibody response to influenza vaccine in TQ participants when compared to controls. There was a significant between-group difference at 3 and 20 weeks after vaccine, and at 20 weeks the TQ group had significantly higher titers compared to the pre-vaccine time point, whereas the controls did not. A higher percentage of TQ subjects also responded to the influenza A strains with a protective antibody response, but differences between groups were not statistically significant. Traditional TQ practice improves the antibody response to influenza vaccine in older adults, but further study is needed to determine whether the enhanced response is sufficient to provide definitive protection from influenza infection.

Yao, L., B. Giordani, et al. (2008). "Developing a positive emotion-motivated Tai Chi (PEM-TC) exercise program for older adults with dementia." Res Theory Nurs Pract 22(4): 241-55.

Exercise, particularly Tai Chi, has many known benefits, especially in reducing fall risk. However, exercise studies have tended to exclude older adults with dementia (OAD), who may be at high fall risk but have difficulty participating in formal exercise programs. This paper describes development and feasibility testing of a Tai Chi fall risk reduction exercise protocol, the positive emotion-motivated Tai Chi (PEM-TC) program for OAD, and explores strategies that facilitate their participation in and adherence to exercise programs. Preliminary data indicates that difficulties in delivering exercise to OAD may be eased by using the Sticky Hands Tai Chi teaching technique. Family members may have the optimum advantage in using Sticky Hands because of established emotional connections with their OAD.

Yau, M. K. (2008). "Tai Chi exercise and the improvement of health and well-being in older adults." Med Sport Sci 52: 155-65.

Activity participation has a positive impact on both quantity and quality of life (QOL). Regular participations in physical, social, and cultural activities are associated with successful aging. There is considerable evidence that Tai Chi has positive health benefits; physical, psychosocial and therapeutic. Furthermore, Tai Chi does not only consist of a physical component, but also sociocultural, meditative components that are believed to contribute to overall well-being. This chapter describes the benefits of Tai Chi exercise for the older adults, particularly in terms of the psychosocial aspect. The perceived meanings, associated values and well-being, as well as the impact on QOL, of Tai Chi practice among the older adults in Hong Kong are also discussed. Tai Chi exercise is chosen by the elderly participants for its gentle and soft movements. Besides the physical aspect, the benefits they describe include lifestyle issues, as well as psychological and social benefits. Evidence points out that the improvements in physical and mental health through the practice of Tai Chi among the older adults are related to their perceived level of QOL. Findings from numerous studies support the belief that the practice of Tai Chi has multiple benefits to practitioners that are not only physical in nature. It is recommended as a strategy to promote successful aging.

Yeh, G. Y. (2008). "Commentary on the Cochrane review of Tai Chi for rheumatoid arthritis." Explore (NY) 4(4): 275-7.

Yeh, G. Y., J. E. Mietus, et al. (2008). "Enhancement of sleep stability with Tai Chi exercise in chronic heart failure: preliminary findings using an ECG-based spectrogram method." Sleep Med 9(5): 527-36.

OBJECTIVE: To assess the effects of a 12-week Tai Chi exercise program on sleep using the sleep spectrogram, a method based on a single channel electrocardiogram (ECG)-derived estimation of cardiopulmonary coupling, previously shown to identify stable and unstable sleep states. **METHODS:** We retrospectively analyzed 24-h continuous ECG data obtained in a clinical trial of Tai Chi exercise in patients with heart failure. Eighteen patients with chronic stable heart failure, left ventricular ejection fraction $\leq 40\%$ (mean $[\pm\text{standard deviation}]$ age, 59 ± 14 years, mean baseline ejection fraction $24\pm 8\%$, mean) were randomly assigned to receive usual care (N=10), which included pharmacological therapy and dietary and exercise counseling, or 12 weeks of Tai Chi training (N=8) in addition to usual care. Using the ECG-based sleep spectrogram, we compared intervention and control groups by evaluating baseline and 12-week high (stable) and low (unstable) frequency coupling (HFC & LFC, respectively) as a percentage of estimated total sleep time (ETST). **RESULTS:** At 12 weeks, those who participated in Tai Chi showed a significant increase in HFC ($+0.05\pm 0.10$ vs. -0.06 ± 0.09 % ETST, $p=0.04$) and significant reduction in LFC (-0.09 ± 0.09 vs. $+0.13\pm 0.13$ % ETST, $p<0.01$), compared to patients in the control group. Correlations were seen between improved sleep stability and better disease-specific quality of life. **CONCLUSIONS:** Tai Chi exercise may enhance sleep stability in patients with chronic heart failure. This sleep effect may have a beneficial impact on blood pressure, arrhythmogenesis and quality of life.

Yeh, G. Y., C. Wang, et al. (2009). "Tai Chi Exercise for Patients With Cardiovascular Conditions and Risk Factors: A SYSTEMATIC REVIEW." J Cardiopulm Rehabil Prev 29(3): 152-160.

PURPOSE: To conduct a systematic review of the literature evaluating tai chi exercise as an intervention for patients with cardiovascular disease (CVD) or with CVD risk factors (CVDRF). **METHODS:** We searched (1) MEDLINE, CAB Alt HealthWatch, BIOSIS previews, Science Citation Index, EMBASE, and Social Science Citation Index from inception through October 2007; (2) Chinese Medical Database, China Hospital Knowledge, China National Knowledge Infrastructure, and China Traditional Chinese Medicine Database from inception through June 2005; and (3) the medical libraries of Beijing and Nanjing Universities. Clinical studies published in English and Chinese including participants with established CVD or CVDRF were included. Data were extracted in a standardized manner; 2 independent investigators assessed methodological quality, including the Jadad score for randomized controlled trials (RCTs). **RESULTS:** Twenty-nine studies met inclusion criteria: 9 RCTs, 14 nonrandomized studies, and 6 observational trials. Three studies examined subjects with coronary heart disease, 5 in subjects with heart failure, and 10 in heterogeneous populations that included those with CVD. Eleven studies examined subjects with CVDRF (hypertension, dyslipidemia, impaired glucose metabolism). Study duration ranged from 8 weeks to 3 years. Most studies included fewer than 100 subjects (range, 5-207). Six of 9 RCTs were of adequate quality (Jadad \geq 3). Most studies reported improvements with tai chi, including blood pressure reductions and increases in exercise capacity. No adverse effects were reported. **CONCLUSION:** Preliminary evidence suggests that tai chi exercise may be a beneficial adjunctive therapy for some patients with CVD and CVDRF. Further research is needed.

Yeh, G. Y., C. Wang, et al. (2008). "The effect of tai chi exercise on blood pressure: a systematic review." *Prev Cardiol* **11**(2): 82-9.

A systematic review of the literature on the effect of tai chi exercise on blood pressure (BP) was performed. The authors searched Medline, CAB, Alt HealthWatch, BIOSIS previews, Science Citation Index, and EMBASE systems (inception through January 2007); researched Chinese Medical, China Hospital Knowledge, China National Knowledge Infrastructure, and China Traditional Chinese Medicine databases (inception to June 2005); and performed hand searches at the medical libraries of Beijing and Nanjing Universities. Clinical studies of tai chi examining BP as an outcome published in English or Chinese were included. Studies reporting only acute exercise effects were excluded. Data were extracted in a standardized manner and 2 independent investigators assessed methodologic quality. Twenty-six studies examining patients with and without cardiovascular conditions met inclusion criteria: 9 randomized controlled trials, 13 nonrandomized studies, and 4 observational studies. Study heterogeneity precluded formal meta-analyses. Twenty-two studies (85%) reported reductions in BP with tai chi (3-32 mm Hg systolic and 2-18 mm Hg diastolic BP reductions). Five randomized controlled trials were of adequate quality (Jadad score \geq 3). No adverse effects were reported. Tai chi exercise may reduce BP and serve as a practical, nonpharmacologic adjunct to conventional hypertension management.

Yeh, G. Y., P. M. Wayne, et al. (2008). "T'ai Chi exercise in patients with chronic heart failure." *Med Sport Sci* **52**: 195-208.

OBJECTIVE: To review the physiological and psychosocial effects of a 12-week T'ai Chi program (TC) in patients with heart failure (HF) as previously reported in a clinical trial. **METHODS:** We randomized 30 patients with chronic HF (left ventricular ejection fraction $<$ or

=40%) to receive TC plus usual care (n = 15), or usual care alone (wait-list control, n = 15). Outcome measures included quality of life, exercise capacity, B-type natriuretic peptide, catecholamine levels, heart rate variability, and sleep stability. **RESULTS:** The mean age (+/- SD) of patients was 64 +/- 13 years, mean baseline ejection fraction (+/-SD) was 23 +/- 7%, and median New York Heart Association Class was 2 (range 1-4). At 12 weeks, patients who participated in TC showed improved quality of life (mean change -17 +/- 11 vs. 8 +/- 15, Minnesota Living with HF Questionnaire, p = 0.001), increased exercise capacity (mean change 85 +/- 46 vs. -51 +/- 58 m, 6-min walk, p = 0.001), and decreased B-type natriuretic peptide (mean change -48 +/- 104 vs. 90 +/- 333 pg/ml, p = 0.03) compared to the control group. Those who participated in TC also showed improvement in sleep stability (increase in high-frequency coupling +0.05 +/- 0.10 vs. -0.06 +/- 0.09 proportion of estimated total sleep time, p = 0.04; reduction in low-frequency coupling -0.09 +/- 0.09 vs. +0.13 +/- 0.13 proportion of estimated total sleep time, p < 0.01), compared to the control group. **CONCLUSION:** TC may enhance quality of life, exercise capacity, and sleep stability in patients with chronic HF.

Yeh, S. H., H. Chuang, et al. (2006). "Regular tai chi chuan exercise enhances functional mobility and CD4CD25 regulatory T cells." *Br J Sports Med* **40**(3): 239-43.

BACKGROUND: The duration and vigour of physical exercise are widely considered to be critical elements that may positively or negatively affect physical health and immune response. **OBJECTIVES:** To investigate the effect of a 12 week programme of regular tai chi chuan exercise (TCC) on functional mobility, beliefs about benefits of exercise on physical and psychological health, and immune regulation in middle aged volunteers. **METHODS:** This quasi-experimental research design involving one group with testing before and after the programme was conducted to measure the effect of 12 weeks of TCC exercise in 14 men and 23 women from the normal community. **RESULTS:** Regular TCC exercise had a highly significant positive effect on functional mobility (p = 0.001) and beliefs about the health benefits of exercise (p = 0.013) in the 37 participants. Total white blood cell and red blood cell count did not change significantly, but a highly significant (p<0.001) decrease in monocyte count occurred. A significant (p = 0.05) increase in the ratio of T helper to suppressor cells (CD4:CD8) was found, along with a significant (p = 0.015) increase in CD4CD25 regulatory T cells. Production of the regulatory T cell mediators transforming growth factor beta and interleukin 10 under specific antigen stimulation (varicella zoster virus) was also significantly increased after this exercise programme. **CONCLUSIONS:** A 12 week programme of regular TCC exercise enhances functional mobility, personal health expectations, and regulatory T cell function.

Yeh, S. H., H. Chuang, et al. (2008). "Regular Tai Chi Chuan exercise improves T cell helper function of type 2 DM patients with an increase in T-bet transcription factor and IL-12 production." *Br J Sports Med*.

BACKGROUND-- Exercise has been shown to be beneficial in treatment of type 2 diabetes mellitus (DM); its benefit to immune function, however, remains to be determined. **OBJECTIVE--** This study investigated the effect of a 12-week course of Tai Chi Chuan (TCC) exercise on T cell helper (Th) reaction in type 2 DM patients. **DESIGN AND METHODS --** This study was a case-control design. Thirty pairs of type 2 DM patients and normal age-matched adults completed this study. Fasting blood glucose, HbA1c, mediators (IL-12, IL-4 and TGF β)

and transcription factors (T-bet, GATA-3 and FoxP3) of Th1/Th2/T regulatory (Treg) reaction were measured before and after a 12-week TCC exercise program. RESULTS -- Fasting glucose and HbA1c levels in the participating type 2 DM patients were significantly higher than age-matched controls before exercise. After the TCC exercise, HbA1c levels in type 2 DM patients significantly decreased (7.59 inverted exclamation markÓ 0.32 vs. 7.16 inverted exclamation markÓ 0.22 %; P= 0.047), along with a significant increase of blood IL-12 levels (5.96 inverted exclamation markÓ 1.10 vs. 12.96 inverted exclamation markÓ 3.07; P = 0.035). To probe molecular Th1/Th2/Treg reaction, we found that type 2 DM patients had lower T-bet, but not GATA-3 or FoxP3 expression than normal controls before TCC exercise. After the 12-week TCC exercise, T-bet expression significantly increased in type 2 DM patients. CONCLUSIONS -- A 12-week TCC exercise program decreases HbA1c levels, along with increase of the Th1 reaction. A combination of TCC with medication may provide even better in both metabolism and immunity of type 2 DM patients.