Exercise

Evidence-based exercise prescription for balance and falls prevention: a current review of the literature.
Though physical therapists commonly treat balance and strength, standardized falls screening has not been fully incorporated into physical therapy practice and there is much variation in the frequency, intensity and duration of therapy prescribed to achieve optimal results. For community-dwelling older adults, a progressive exercise program that focuses on moderate to high-intensity balance exercises appears to be one of the most effective interventions to prevent falls. For more frail older adults in institutional settings, exercise programs in addition to multifactorial interventions appear to show promise as effective falls prevention interventions. The minimum dose of exercise to protect an older adult against falls is 50 hours. This article describes the current best practices for physical therapists to effectively improve balance and manage falls risk in patients. The unique challenges and opportunities for physical therapists to incorporate evidence-based fall-prevention strategies are discussed. Innovative practice models incorporating evidence-based fall-prevention programs and partnerships with public health and aging service providers to create a continuum of care and achieve the optimal dose of balance training are presented.

Impact of Tai Chi exercise on multiple fracture-related risk factors in post-menopausal osteopenic women: a pilot pragmatic, randomized trial.
In a pragmatic randomized trial, 86 post-menopausal osteopenic women, aged 45-70, were recruited from community clinics. Women were assigned to either nine months of Tai Chi training plus usual care verses usual care alone. Results showed clinically relevant trends of the Tai Chi group attenuating bone loss and improving quality of life. These trends were statistically significant in “per protocol” secondary analyses. A change in bone mineral density (BMD) of 1-2% is clinically significant as the risk for fracture doubles for each standard deviation lower BMD and a gain of 2-4% in BMD from pharmacologic therapy results in close to a 50% reduction in fracture risk. There were also statistically significant improvements in fall-predictive measures of postural control. Tai Chi training offered through existing community-based programs is a safe, feasible and promising intervention for reducing multiple fracture risks.

External validity of physical activity interventions for community-dwelling older adults with fall risk: a quantitative systematic literature review.
Studies that examined the effects of physical activity interventions designed to reduce falls among community-dwelling older adults were included in this review (n = 46). Studies were assessed using the Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework to foster an understanding of intervention’s essential ingredients for success. The majority of studies in this review described indicators representing internal validity. Details about indicators representing
external validity were reported infrequently, limiting the generalizability of fall-preventive physical activity interventions in diverse cultures and social contexts over time. Authors conclude that in order to foster translational research into real world settings, additional programmatic intervention research is needed that:

- targets diverse populations;
- incorporates theories of behavioural change;
- describes and operationalizes critical content that enables replication and translation;
- tests innovative measures of fall risk and physical activity;
- evaluates feasibility and acceptability.

**Effectiveness of tai chi as a community-based falls prevention intervention: a randomized controlled trial.**
Community-residing older adults (mean age 74.5; 73% female) participated in tai chi once a week (TC1) (n = 233); tai chi twice a week (TC2) (n = 220), or a low-level exercise program control group (LLE) (n = 231) for 20 wks. The number of falls was tracked with monthly falls calendars. Mobility (Timed-Up-and-Go Test), balance (step test), and lower limb strength (chair stand test) were also assessed. Authors observed a clinically relevant trend of TC training attenuating bone loss. There was no difference in falls rates between the groups, with falls reducing similarly (mean falls rate reduction of 58%) over the 17-month follow-up period. Strength and balance improved similarly in all groups over time.

**Gardening as a potential activity to reduce falls in older adults.**
This study examines whether participation in gardening predicts reduced fall risk and performance on balance and gait-speed measures in older adults. Data on adults age 65 and older (N = 3,237) from the Health and Retirement Study and Consumption and Activities Mail Survey were analyzed. Participants who spent 1 hr or more gardening in the past week were defined as gardeners, resulting in a total of 1,585 gardeners and 1,652 nongardeners. Independent t tests, chi square, and regression analyses were conducted to examine the relationship between gardening and health outcomes. Findings indicate that gardeners reported significantly better balance and gait speed and had fewer chronic conditions and functional limitations than nongardeners. Significantly fewer gardeners than nongardeners reported a fall in the past 2 yr. The findings suggest that gardening may be a potential activity to incorporate into future fall-prevention programs.

**Rhythmic stepping exercise under cognitive conditions improves fall risk factors in community-dwelling older adults: Preliminary results of a cluster-randomized controlled trial.**
This pilot compared screened participants’ (n=52) physical function and fear of falling measurements after completing a rhythmic stepping exercise (RSE) or a non-rhythmic
stepping exercise (NRSE). Each exercise group received 60-minute sessions once a week for 24 weeks. The RSE group included a cognitive function (reaction, short-term memory, etc.) and a motor function unlike the NRSE which just included a motor function. Participants in the RSE group had significantly greater improvements in physical function and fear of falling outcome measures.

**Effects of new, individually adjusted, progressive balance group training for elderly people with fear of falling and tend to fall: a randomized controlled trial.**
This study evaluated the effects of a new, individually adjusted, progressive and specific balance group training program on fear of falling, step execution, and gait in healthy elderly people having a fear of falling and experiencing a fall (intervention group n=34; control group n=21). The adherence rate to the training sessions (3 times per week for 3 months) was 71–100%, mean 87%. Three months after the intervention, the intervention group showed a significant decrease in fear of falling and in time for step execution during dual-task performance and an increase in velocity during fast walking. A significant decrease was also found for the likelihood of depression after participating in the training program.

**Motivators and barriers for physical activity in the oldest old: A systematic review.**
This review included 44 studies involving a total of 28,583 subjects having a partial representation of people aged 80 years and over. Sixty one motivators and 59 barriers for physical activity in the elderly were identified, including those relevant for persons aged 80 years and over. Results indicate that when promoting physical activity in the oldest old, caregivers should discuss the health benefits of physical activity, the subject’s fears and individual preferences. Particularly for single and widowed older persons, programs should include social interaction. Factors such as weather, accessibility and costs should also be considered. Authors conclude that future research is necessary to differentiate the barriers or motivators that are specific for the oldest old from those of younger elderly.
Exercise to prevent falls in older adults: An updated meta-analysis and best practice recommendations
This systematic review update includes 54 randomized controlled trials and confirms that exercise as a single intervention can prevent falls. Authors conclude that falls prevention exercises should provide a moderate or high challenge to balance for at least 2 hours per week on an ongoing basis. Additionally, targets should include both the general community and those at high risk for falls in a group or home-based setting. Strength and walking training may be included in addition to balance training; however, high risk individuals should not be prescribed brisk walking programs, and other health-related risk factors should also be addressed.

Tai chi as an intervention to improve balance and reduce falls in older adults: A systematic and meta-analytical review.
This systematic review included 13 randomized controlled trials that examined the effects of tai chi on balance improvement and fall reduction in older adults. The results indicated that tai chi was effective in improving balance in older adults but may not necessarily be superior to other interventions. Results also showed that in the absence of other interventions, tai chi reduced falls in the non-frail elderly.

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Effects of new, individually adjusted, progressive balance group training for elderly people with fear of falling and tend to fall: a randomized controlled trial.
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during dual-task performance and an increase in velocity during fast walking. A significant decrease was also found for the likelihood of depression after participating in the training program.

The effects of multidimensional exercise on functional decline, urinary incontinence, and fear of falling in community-dwelling elderly women with multiple symptoms of geriatric syndrome: A randomized controlled and 6-month follow-up trial.
This study assessed the effects of multidimensional exercises on functional decline, urinary incontinence, and fear of falling in community-dwelling Japanese elderly women (n = 61). Participants were randomly assigned either to a 3-month intervention program consisting of twice-weekly, multidimensional exercise classes focused on increasing muscle strength, walking ability, and pelvic floor muscle strength or to a control group which consisted of a 3-month once-monthly health education classes. There were no significant differences between the groups in any of the baseline characteristics. The intervention group improved the usual walking speed, maximum walking speed, abductor muscle strength, tandem walking and functional reach. Furthermore, the increment of the physical fitness components appeared to contribute greatly to the improvement of the functional decline, urinary incontinence, and multiple symptoms of geriatric syndrome.

Jumping combined exercise programs reduce fall risk and improve balance and life quality of elderly people who live in a long-term care facility.
Residents living in a long term care facility were screened and then randomly grouped in a combined exercise program that included stretching, strength and aerobic exercise or in combined exercise program that included jumping. The two groups ran three times a week for six weeks with warm-up, effective training and cooling down periods. The total exercising time was no longer than 45 minutes in each group. 66/78 participants completed the programs and it was found that balance improvement and fall risk reduction were observed (Berg Balance test and Biodex Balance System) in both groups at the end of the trial; however, the improvements were statistically better in combined exercise programs that included jumping.

Which Types of Activities Are Associated With Risk of Recurrent Falling in Older Persons?
Authors explored the associations between various types of activities, their underlying physical components, and multiple falls in community-dwelling older persons aged 65+ (n = 1,329), using data from the Longitudinal Aging Study Amsterdam Physical Activity Questionnaire (LAPAQ). The results suggest that the relationship between physical activity and recurrent falling differs as per type of activity and is modified by physical performance. Doing household activities was associated with a decreased risk of recurrent falling in women. In physically fit older persons, doing sports or activities with
high intensity or mechanical strain demands was associated with an increased risk of recurrent falling.

http://biomedgerontology.oxfordjournals.org/content/early/2010/02/16/gerona.glq013.abstract

Community living, adults (N=14) average age 78.4 years with a fear of falling (FoF) completed a bi-weekly 12-week yoga intervention that included both sitting and standing postures and breathing exercises. Before and after the intervention, FoF was measured with the Illinois FoF Measure along with balance with the Berg Balance Scale and upper- and lower-body flexibility with the back scratch test and chair sit and reach test, respectively. FoF decreased by 6%, static balance increased by 4%, and lower-body flexibility increased by 34%. Authors conclude that rehabilitation therapists may wish to explore yoga as a modality for balance and falls programming; however, future research is needed to confirm the use of yoga in such programming.

A 12-month randomized controlled trial of balance training in elderly women with osteoporosis: Improvement of quality of life.
Sixty women with senile osteoporosis were randomized into a Balance Training Group (BT) and a no intervention control group (CG). The BT program was facilitated by a physiotherapist and included techniques to improve balance over a period of 12 months (1 hour exercise session/week and home-based exercises). The quality of life was evaluated before and at the end of the trial using the Osteoporosis Assessment Questionnaire and functional balance was evaluated by Berg Balance Scale. The results revealed a significant improvement in quality of life in all parameters for BT compared to CG (well-being, physical function, psychological status, symptoms and social interaction). There was also an improvement of Berg Balance Scale scores and a reduction of falls in BT group compared to the CG.

Modelling the population-level impact of Tai-Chi on falls and fall-related injury among community-dwelling older people.
Results from a Cochrane Review on tai-chi and seniors falls were applied to an epidemiological and economic model developed by the authors that estimates the population-level impact of a falls prevention intervention. The model included tai-chi for 1 hour twice weekly for 26 weeks and assumed that there would not be a sustained effect beyond the intervention period. The population included in the model was community living seniors aged 70 or more without debilitating conditions or profound visual defects. Authors found that in order to get a significant reduction in fall-related hospitalization rates, a substantial investment in and high population uptake of tai-chi would be required.

http://injuryprevention.bmj.com/content/early/2010/07/19/ip.2009.025452.abstract
The effect of aquatic exercise and education on lowering fall risk in older adults with hip osteoarthritis.
Seventy-nine adults, 65 years of age or older with hip osteoarthritis (OA) and at least 1 fall risk factor, were randomly assigned to 1 of 3 groups: aquatics and education (AE; aquatic exercise twice a wk with once-a-wk group education), aquatics only (A; 2 wk aquatic exercise) and control (C; usual activity). Balance (Berg Balance Scale), falls efficacy (Activities and Balance Confidence), dual-task function (TUG and cognitive subtraction), functional performance (chair stands), and walking performance were measured pre- and post-intervention or control period. Results showed that AE significantly improved falls efficacy compared with C and when just completers were measured. This resulted in a greater improvement in falls efficacy than in A as well.

Impact of participation in a wellness program on functional status and falls among aging adults in an assisted living setting.
In this quasi-experimental study 36 aging adults (72-96 years of age) participating in a wellness program were evaluated at enrollment and after 12 months of participation. The wellness program consisted of small group and individual exercise sessions, with emphasis on balance/ postural control, endurance, flexibility, and strengthening. Evaluation tools used included Mini-Mental State Examination, Berg Balance Scale, and 6-Minute Walk Test. Falls over 12 months were determined by tracking annual reported incidence of falls. Subjects were classified as "regular" or "non-regular" exercisers on the basis of participation frequency and adherence. There were no differences between exercisers at the time of enrollment. Based on results, authors conclude that regular participation in an individualized wellness program as little as twice weekly for 9 of 12 months provides protection against functional decline and risk of falls in older adults in assisted living settings.

Balance perturbation system to improve balance compensatory responses during walking in old persons.
This paper describes the Balance Measure & Perturbation System which is a system that provides small, controlled and unpredictable perturbations during treadmill walking. It is hypothesized that providing perturbation will improve compensatory postural responses in older adults.
http://www.jneuroengrehab.com/articles/browse.asp

Individual, social environmental and physical environmental barriers to achieving 10 000 steps per day among older women.
Daily step counts over 7 days were measured using accelerometry in 128 older, community-dwelling women. Self-reported environmental characteristics, self-efficacy, social support and functional limitations were also assessed. The presence of areas for activity within 1 km of each participant's residence was assessed using Geographic
Information Systems. Results showed that participants who did not attain 10 000 steps per day reported lower self-efficacy, greater functional limitations, had significantly fewer walking paths within 1 km of their home and reported significantly less street connectivity and safety from traffic than those who achieved 10 000 steps per day. [http://her.oxfordjournals.org/content/25/3/478.abstract](http://her.oxfordjournals.org/content/25/3/478.abstract)

**Tai chi as a balance improvement exercise for older adults: a systematic review.**
Studies meeting the selection criteria included 15 randomized control studies and 3 pretest/posttest studies. Results showed that older vigorous and likely transitional frail individuals seemed to benefit more from tai chi (TC) than did older frail individuals. The most commonly used TC parameters were Yang’s style, with 12 or fewer forms, durations of 12 weeks or longer, frequencies of twice a week or more, and session lengths of at least 45 minutes. This review indicates that TC may be an economic and effective exercise program for improving balance and balance confidence in older adults.

**Does the 'Otago exercise programme' reduce mortality and falls in older adults?: a systematic review and meta-analysis.**
The Otago exercise programme (OEP) is a tailored, home based strength and balance retraining program designed for community living older adults. This review includes 7 trials, involving 1,503 participants with an average age of 81.6 years. The OEP significantly reduced the risk of death and fall rates over 12 months. There was no significant difference in the risk of a serious or moderate injury occurring as the result of a fall. Of the 747 participants who remained in the studies at 12 months, 36.7% were still exercising at the recommended levels of three or more times per week and 56% were exercising a minimum of two times per week.

**Effects of Feldenkrais Exercises on Balance, Mobility, Balance Confidence, and Gait Performance in Community-Dwelling Adults Age 65 and Older.**
Independent, relatively healthy older adults (n = 47, mean age 75.6) were randomly assigned to a Feldenkrais group (FG, n = 25) or to a control group (CG, n = 22). The FG group attended a 5-week Feldenkrais program for 60 minutes three times per week. The program focused on improving balance and mobility using Feldenkrais themes like differentiation of pelvic movements, relationship between eye organization and body movement, coordination of muscles, breathing, and exploring habits. After completion of the program, balance (p = 0.030) and mobility (p = 0.042) increased while fear of falling (p = 0.042) decreased significantly for the FG group. No other significant changes were observed. However, participants of the FG group showed improvements in balance confidence (p = 0.054) and mobility while performing concurrently a cognitive task (p = 0.067). Authors conclude that Feldenkrais exercises are an effective way to improve balance and mobility. [http://www.liebertonline.com/toc/acm/16/1](http://www.liebertonline.com/toc/acm/16/1)
Influences of Built Environment on Walking and Cycling by Latent Segments of Aging Population.
Authors examined the effect of environmental characteristics, various types of land use, and degree of urbanization on participation on senior populations walking and bicycling, for both leisure and transportation. Detailed individual travel data were correlated with objectively defined environmental attributes. The results showed that people make more walking trips in more highly urbanized areas, whereas they use their bikes more often in less-urbanized areas. Furthermore, results showed that highly urbanized neighborhoods populated with lower socioeconomic seniors with a low percentage of recreation and green areas were related to overall physical inactivity.

Results from the Healthy Moves for Aging Well program: changes of the health outcomes.
Authors examined the Healthy Moves for Aging Well program (a home-based, low-intensity strength exercise program) in an ethnically diverse sample of community-residing adults aged 65 and older (n = 338) having impairments in two or more activities of daily living (ADL) or having at least one ADL deficiency and cognitive impairment. Pretests and 3-month post-tests were compared and results showed that participants who improved their exercise performance had statistically significant declines in the number of falls and level of pain. This pilot suggests that a modest intervention that couples behavior change with home-based exercise can have a positive outcome on older adults who have high levels of functional impairment and lack a regular exercise regime.

The effect of modified jazz dance on balance, cognition, and mood in older adults.
This pilot study evaluated the impact of a 15-week (once per week) jazz dance class on balance, cognition, and depression in 13 healthy, community-dwelling, English-speaking older women with a mean age of 68. The findings showed that jazz dance did not significantly change cognition or mood - participants remained in normal range. However, Sensory Organization Test scores showed improvement in balance throughout the entire program especially in younger participants.

Three-year follow-up of the fall risk and physical function characteristics of the elderly participating in a community exercise class.
Japanese elderly people aged 60 years or over (n = 197) participating in a 3-year community exercise class once a week were assessed for falls risk at the first and third year. Results showed that in the high falls-risk group, an improvement in the fall risk and fall incidence was found but none was found within the low risk group. Authors suggest that exercise classes may more effectively prevent falls within community-dwelling elderly by incorporating more diverse activities adapted to individual functional levels.
Martial arts fall training to prevent hip fractures in the elderly.
Six male and nineteen female healthy seniors (60 to 81 years of age) completed a five-session martial arts fall training where they learned to change a sideways fall starting from a kneeling position into a rolling movement. After fall training, fall performance from a kneeling position was improved by a mean increase of 1.6 on a ten-point scale (P < 0.001). Hip impact force was reduced by a mean of 8% (0.20 N/N, P = 0.016). Fear of falling was reduced by 0.88 on a VAS scale (P = 0.005). Authors note that additional research is needed to determine whether older individuals will be able to apply martial arts fall techniques during unexpected falls from a standing position in daily life and whether this will result in less hip fractures.

Scheduled Medications and Falls in Dementia Patients Utilizing a Wander Garden.
Participating residents (n = 28) of a dementia unit were divided into high and low wander garden user groups and assessed for the number and severity of falls and psychiatric medication use 12 months before and 12 months after the wander garden was opened. Results showed that the high wander garden user group required fewer scheduled medications and experienced reduced falls and lower fall morbidity than the lower user group.

A lower-limb training program to improve balance in healthy elderly women using the T-bow© device.
Independent, healthy women older than 65 years (n = 28) were randomly assigned to an experimental group (n = 18) or a control group (n = 10) to measure the effects of a training program to develop balance using a new device called the T-Bow©. A program for lower limbs was applied for 30 minutes twice per week for an 8 week period using 5 exercises on the T-Bow©: squat, lateral and frontal swings, lunges, and plantarflexions. Results for the experimental group showed an increase of 35.2% in static balance, 12.7% in dynamic balance, and 5.9% in overall balance. The control group showed a decline of 5.79% in static balance but no change in the other balance variables. Authors conclude that the T-Bow© could be used to gain moderate improvement of balance in healthy, older women.

Effectiveness of a video-based exercise programme to reduce falls and improve health-related quality of life among older adults discharged from hospital: a pilot randomized controlled trial.

A DVD and workbook describing a progressive exercise programme combining lower limb strength and balance exercises was evaluated in a randomized controlled trial with 53 older adults (>65 years) using a mobility aid discharged from hospital. Multiple home visits from a project physiotherapist were included followed by weekly follow-up telephone calls. The intervention group participants (n = 19) complied with the exercise programme well during the first two weeks but then reduced their compliance levels thereafter. Control group patients (n= 34) received usual care. The intervention group did not differ significantly from the control group in terms of falls, health-related quality of life, participation in activities of daily living, physical capacity and fear of falling; however, a non-significant reduction in the rate of falls was observed. Authors concluded that the intervention may be beneficial for reducing the rate of falls in this patient population though further research with a larger sample size is indicated.

Knee strength capabilities and slip severity.

Understanding the relationships between specific joint muscle strength characteristics and propensity to slip is important to identify biomechanical factors responsible for slip-initiated falls and to improve slip/fall prevention programs. Knee corrective moments generated during slipping assist in balance recovery. Isometric knee flexion/extension peak torque and rate of torque development (RTD) of the slipping leg were measured in 29 young and 28 older healthy subjects. Motion data were collected for an unexpected slip during self-paced walking. Peak slip velocity (PSV) of the slipping heel served as a slip severity measure. Within-sex and age group regressions relating gait speed-controlled PSV to strength of the slipping leg revealed significant inverse PSV-knee extension peak torque and PSV-knee flexion/extension RTD relationships in young males only. Differences in PSV-strength relationships between sex and age groups may be caused by greater ranges of strength capabilities in young males. In summary, this study suggests that knee strength, particularly extension strength (peak and explosive measures), is important in slip recovery efforts. Authors recommend that fall prevention programs include strength training focused not only on improving maximum strength, but also on muscle force generation abilities in short time intervals.


Eight electronic databases were searched for randomized controlled trials assessing Tai Chi interventions with participants aged 60+ using falls occurrences as an outcome measure. Six randomized controlled trials were included in this systematic review with a total of 1857 participants (majority being female) with intervention periods ranging from 15 weeks to 2 years. The level of evidence ranged from 1-to 1++. Authors conclude that
Tai Chi practiced by older adults may be beneficial in reducing fall occurrences; however, the trials examined suggest that Tai Chi may not be effective in frail participants. They suggest that more research is needed with male participants.

Is there a U-shaped association between physical activity and falling in older persons?
This study looked at community-dwelling persons aged 65 and older (n = 1,337) from the Longitudinal Aging Study Amsterdam (LASA). Participants were prospectively followed on falls for 3 years after a baseline assessment which included the LASA Physical Activity Questionnaire. Results showed that an increase of 100 units led to a 4% lower risk of recurrent falling (100 units equaled 30 min per day of walking, 20 in of swimming, or 40 min of billiards). The hypothesized U-shaped relationship between physical activity and falling could not be confirmed. At higher levels of physical activity, the risk of recurrent falling decreased, while no association was found with fall risk. Authors note that the number of participants having extremely high activity patterns was very small and suggests that more research in this specific group is necessary before final conclusions can be drawn.
http://www.springerlink.com/content/663476712038552u/fulltext.pdf

Balance control in patients with distal versus proximal muscle weakness.
In order to develop more effective fall prevention strategies, authors examined specific patterns of instability in patients with either proximal (n = 8) or distal muscle weakness (n = 5) using a multi-directional rotating support surface with multimodal outcome measures (EMG electromagnetic), kinetics and kinematics. Authors conclude that distal muscle weakness causes instability primarily for pitch directed perturbations and that proximal muscle weakness causes a lesser instability, but that further studies are needed to determine the effect of weakness severity on balance control. They found that compensating balance correcting strategies consisted of trunk and arm movements in both groups of patients and that ankle and knee bending was particularly abnormal in distal weakness patients leading to instability. Authors question if training the use of knee movements to aid balance responses will reduce instability and prevent falls.

Visuomotor adaptation of voluntary step initiation in older adults.
The stepping movements of young adults (n = 18; average age 26) were compared to those of healthy older adults (n = 18; average age 72) during baseline where the stepping target remained stationary and during adaptation where a visual perturbation was introduced by shifting the target laterally during mid-step. Older adults adapted stepping accuracy similarly to young adults, but showed significant slowness during movement. Thus older adults were able to achieve accuracy levels nearly equivalent to younger adults, but only at the expense of movement speed, at least during the early adaptation period. With practice, however, they were able to reduce movement times and gain
speed and accuracy to levels similar to young adults. These findings suggest older adults may retain the ability for stepping adaptations to environmental changes or novel demands, given sufficient practice.

**Effect of the Exercise Dance for Seniors (EXDASE) Program on Lower-Body Functioning Among Institutionalized Older Adults.**
Authors conducted a multi-centre, randomized controlled trial to measure the effects of the EXDASE program on lower-body functioning in sedentary, frail older adults living in residential care facilities. At baseline, there were no statistically significant differences between the intervention (n = 27) and control groups (n = 25) where both showed a substantial level of impairment. The 3-month EXDASE program consisting of once-a-week exercise had a positive effect on mobility-related outcomes. While the control group tended to experience some decline over the course of the study, the intervention group showed improvement on several outcomes. Authors conclude that a relatively simple dance-based exercise can support lower-body functioning in previously sedentary, frail older adults.

http://jah.sagepub.com/content/vol22/issue1/

**Short-form Tai Chi Improves Standing Balance of People With Chronic Stroke.**
Au-Yeung SSY, Hui-Chan CWY, Tang JCS. Neurorehabilitation and Neural Repair; 2009 Jan 7.
One hundred thirty-six subjects with similar baseline balance and mobility measures >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 (1 hour of training per week with 3 hours self-practice) to see if Tai Chi could improve standing balance more so than general exercises. It was found that the Tai Chi group showed greater centre of gravity (COG) excursion amplitude in leaning forward, backward, and toward the affected and nonaffected sides as well as faster reaction time in moving the COG toward the nonaffected side in the end-program and in follow-up assessments (6 weeks post training). The Tai Chi group also demonstrated better reliance on vestibular integration for balance control at end-program. Neither group improved significantly in Timed-up-and-go scores.

**Exercise for falls prevention in older people: Assessing the knowledge of exercise science students.**
Exercise science students (n=566) from Australian universities completed a survey to assess knowledge about falls and exercise prescription for falls prevention. It was found that the knowledge level did not meet a desired competency level of 70% and therefore insufficient to ensure an adequately equipped future workforce in this area. Authors conclude that there is a clear need for the development and widespread delivery of an evidence-based "exercise for falls prevention" curriculum module for exercise professionals.
Preventing falls among older adults: No "one size suits all" intervention strategy.  
Research conducted over the past two decades indicates that exercise effectively reduces fall risk and/or fall incidence rates; however, no “one size suits all” exercise intervention strategy exists. While there are many exercise options for older adults identified at low risk for falls, the options become fewer for those older adults identified at higher levels of fall risk. Current evidence suggests that exercise alone may not be sufficient to appreciably lower the level of fall risk in older adults identified at high risk for falls. Instead, an individually tailored exercise program that is embedded within a larger multifactorial intervention that first identifies and then prioritizes the treatment of the major risk factors contributing to the older adult’s heightened fall risk is likely to be the more effective method of addressing falls in the older adult population.

The association between physical activity and osteoporotic fractures: a review of the evidence and implications for future research. 
Physical activity has been identified as a factor that may decrease or increase the risk of falls and fractures among older adults. A meta-analysis shows that physical activity reduces the risk of hip fracture (based on strong evidence from observational studies). However, this author’s review shows that it is unclear whether physical activity is associated with risk for fractures at sites other than the hip as few studies have examined this issue and findings have been ambiguous. Furthermore, the limited medical literature shows small decreases in risk for falls with physical activity in addition to small increases in bone mineral density (BMD). Additionally, the increments in BMD are questionable in terms of reducing fractures. The author concludes that the complexity of relationships between risk factors and fractures confirm the need for randomized trials to be done with fractures as the primary end point.

Effective exercise for the prevention of falls: A systematic review and meta-analysis. 
This systematic review with meta-analysis included randomized controlled trials (n = 44) that compared fall rates in older people who undertook exercise programs with fall rates in those who did not exercise. The majority of trials were conducted in older people living in the general community; six trials were conducted in residents of nursing homes. Twenty-nine trials included only participants who could be defined as being at greater risk of falls. Most of the exercise programs (n = 23) evaluated in the trials were conducted under supervision, with fewer than 10 participants per instructor. In most of the programs, the intensity or type of exercise was tailored to the individual (n = 28). This review showed that exercise can prevent falls in older people. Greater relative effects were seen in programs that included exercises that challenged balance, used a higher dose of exercise, and did not include a walking program.
Gaze behavior of older adults during rapid balance-recovery reactions.
Rapid stepping reactions are a prevalent response to sudden loss of balance and play a crucial role in preventing falls. This study showed that both the 12 older adults (61-73 years) and the 12 young adults (22-29 years) were able to guide these stepping reactions amid challenging environmental constraints using "stored" visuospatial information. Although the study indicated that healthy older adults were usually successful in using stored visuospatial information to guide the stepping movements, their capacity to do so could be challenged if the environment was more complex and less predictable. From a fall-prevention perspective, further research is needed to determine whether the ability of older adults to execute effective compensatory steps in “cluttered” environments could be enhanced with training to rapidly fixate on potential step landing sites in reaction to postural perturbation and/or to monitor one’s surroundings more attentively.

Exercise and risk of injurious fall in home-dwelling elderly.
A prospective study of 512 Finish home-dwelling subjects aged 85 years or older was conducted to examine the relationship between different types of physical exercise and the risk of subsequent fall-related injury. This study showed that habitual exercise other than walking (home exercise, group exercise, gardening, cross-country skiing, dancing, swimming, bicycling) conducted as part of everyday life is associated with a reduced risk of fall-related injuries, while female gender, fall-related injuries in the recent past and problems with near-vision acuity seem to increase the risk. The effect of novel types of exercise on the fall-related injury risk among the elderly remains to be shown.

Tai chi and falls prevention in older people.
Authors examined 9 randomized controlled trials utilizing Tai Chi (n = 6) or Tai Chi-like exercise (n = 3). They varied considerably on study settings, participant characteristics, sample size, type of Tai Chi intervention, length of intervention and quality of the study design. Three out of the six studies that used Tai Chi forms showed significant improvement in fall-related outcomes and one of the studies using Tai Chi-like exercise also had a significant fall-related outcome. Authors conclude that 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.

Balance, falls, and bone health: Role of exercise in reducing fracture risk after stroke.
This article provides an overview of exercise interventions aimed at reducing fracture risk after a stroke. Although randomized controlled trials support the use of exercise to reduce fracture risk factors after a stroke, the body of literature is small and further studies are required. Further, the optimal dose of exercise and the additive effects of
pharmacology on fracture risk need to be determined. Given the many health benefits associated with exercise, it should be considered an important modality for the management of falls and maintenance of bone health following stroke.

**Efficacy of progressive resistance training on balance performance in older adults: a systematic review of randomized controlled trials.**


A systematic review of the literature was conducted to assess the merit of progressive resistance training (PRT) as a single intervention on balance performance in older adults. Twenty-nine studies meeting defined criteria were reviewed. Participants (n = 2174) included healthy, community-dwelling, mobility-limited, frail cohorts and those with chronic comorbidities. Following PRT, twenty-two per cent of all balance tests reported showed significantly greater improvement in balance performance. The inconsistent effect of PRT on balance may be explained by differences in participants and balance tests, variability in methodology of the balance test and sample size, inadequate dose of PRT and/or compliance to training, or lack of statistical power. Standardization of balance testing methodology and better reporting of procedures may ensure greater comparability of results in future studies. It is also possible that PRT alone is not a robust intervention for balance control.

**A randomized controlled trial of fall prevention by a high-intensity functional exercise program for older people living in residential care facilities.**


A randomized controlled trial was conducted to evaluate the effectiveness of a high-intensity functional exercise program in reducing falls in residential care facilities. During the 6-month follow-up period, when all participants were compared, no statistically significant differences between groups were found for fall or incidence rates. A subgroup interaction analysis revealed that among participants who improved their balance during the intervention period, the exercise group had a lower fall rate than the control group. Authors conclude that high-intensity functional exercise program may prevent falls among older people living in residential care facilities who have improved their balance.

**Implementing a community-based falls-prevention program: from drawing board to reality.**


“Stand Up!” is a 12 week program consisting of group exercise classes (2 1-hour classes/week), a home exercise module (30 minuets of practice/week), and information/discussion classes (1 hour /week) for independent community-dwelling seniors. The program was successfully implemented in 10 different community-based organizations meeting recruitment, retention, and participation goals in all locations. Analysis of program outcomes also showed that static balance and mobility improved for participants at intervention sites compared to participants at control sites. There was also
a positive impact on balance confidence and fear of falling and continued exercise 9 months post intervention.

**Preventing falls in physically active community-dwelling older people: A comparison of two intervention techniques.**
Women and men between 70 and 90 years participated in a psychomotor program, fitness program, or no intervention. It was observed that participants in the fitness program experienced 23% less falls than the control group.

**How Tai Chi improves balance: biomechanics of recovery of a walking slip in impaired seniors.**
Gatts SK, Woollacott MH. Gait Posutre 2007; 25(2): 205-14
There was a reduction in tripping and an improvement in gait cycle kinematics for older, balance deficient persons participating in Tai Chi training verses the control group where persons participated in other physical training.

**A randomized controlled trial of Tai Chi and resistance exercise on bone health, muscle strength and balance in community-living elderly people.**
A randomized control trial was conducted with men and women aged 65-74 and researchers found that at 12 months post-intervention there were no significant differences between the intervention groups and the control group.