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Interventions for addressing low balance confidence in older adults; a systematic review and meta-analysis

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Abstract

BACKGROUND—Low balance confidence is a major health problem among older adults restricting their participation in daily life.

OBJECTIVES—To determine what interventions are most effective in increasing balance confidence in older adults.

DESIGN—Systematic review with meta-analysis of randomized controlled trials including at least one continuous endpoint of balance confidence. Studies including adults 60 years or older without a neurological condition, were included in our study.

METHODS—The standardized mean difference (SMD) of continuous endpoints of balance confidence was calculated to estimate the pooled effect size with random-effect models. Methodological quality of trials was assessed using the Physical Therapy Evidence Database (PEDro) Scale.

RESULTS—30 studies were included in this review and a meta-analysis was conducted for 24 studies. Interventions were pooled into Exercise (N=9 trials, 453 subjects), Tai Chi (N=5 trials, 468 subjects), Multifactorial intervention (N=10 trials, 1233 subjects). Low significant effects were found for Exercise and Multifactoral interventions (SMD 0.22–0.31) and medium (SMD 0.48) significant effects were found for Tai Chi.

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PLEASE NOTE: The very long list of references supporting this review has meant that only the most important are listed here and are represented by bold type throughout the text. The full list of references is available on the journal website http://www.ageing.oxfordjournals.org/ as appendix 1

CONCLUSION—Tai chi interventions are the most beneficial in increasing the balance confidence of older adults.

Introduction

Low balance confidence and/or falls self-efficacy[1–3] is a major health problem which can lead to avoidance of activities[2], causing restriction of physical activities[4] and participation in daily life[5]. This restriction can result in physical frailty, falls and loss of independence[4,6]. Thus it is important to evaluate the effectiveness of strategies which address the balance confidence of older adults.

Self-efficacy refers to one's perception of capability within a certain domain[7]. Three similar self-report tools have been created to capture the notion of self-efficacy with respect to falling or losing one's balance. The 10 item Falls Efficacy (FES) Scale and the Modified FES were developed in order to determine an individual's capabilities in performing activities of daily living without falling[3, 8]. As indicated by the name of the tool, the 16 Activities-specific Balance Confidence (ABC) Scale reports on the individual's perceived ability to perform activities without losing balance[1]. The ABC was developed in order to expand on the FES's responsiveness through the inclusion of items that were considered to be more difficult. While it could be argued that there is a conceptual difference between losing one's balance and falling, these tools have been shown to be correlated[1,9], which may explain why these terms are frequently used interchangeably. In this review we aimed to focus on low balance confidence or low falls self-efficacy, which negatively affects daily living and has not been specifically researched before. Therefore, the term balance confidence (BC) will be used.

A number of randomized controlled trials (RCTs) have assessed the effectiveness of different interventions on balance confidence. Interventions to increase BC have included balance training (e.g. [10]), exercise (e.g.[11]) and Tai Chi (e.g.[12]), in addition to using assistive devises such as hip protectors (e.g.[13]). In a systematic review Zijlstra et al. (2007) [14] aimed to determine which interventions were effective to reduce fear of falling among older adults. However only 3 of the 19 studies included in the review had a primary goal of reducing fear of falling (others were aimed primarily at reducing falls), which may have an effect on the clinical applications of reducing fear of falling[15]. The increased number of new publications in this field since 2007 enabled us also to conduct a meta analyses and we aimed to focus only on the balance confidence construct.

The objective of this systematic review was to assess the published peer reviewed literature of RCTs focused on BC of older adults and to determine what type of interventions are most effective in increasing BC in older adults.

Methods

This meta-analyses report was written in accordance with the guidelines of the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement[16]. This statement revised the 1999 QUOROM statement aiming to improve the quality of reporting meta-analyses of RCTs.

Searching

During 2008–2009, computerized bibliographic databases including MEDLINE, EMBASE, CINAHL, PsycINFO, and Evidence-Based Medicine Reviews (such as the Cochrane Database of Systematic Reviews) were searched for relevant articles published in peer reviewed journals. In addition we hand searched key journals on aging and gerontology. See Supplementary data available in Age and Ageing online for an example of the search strategy.

Study selection

Randomized controlled trials published by December 2009, including at least one (primary or secondary) continuous endpoint of BC (FES, MFES or ABC) were included. The target age range was a mean of 60 years or older. Trials were excluded if the samples included individuals with a neurological condition (e.g. stroke, Parkinson's disease). Since fractures are a common consequence of falling, older adults with orthopaedic conditions (e.g. hip fractures) were included in the study. Trials which used a single question (e.g. "Are you afraid of falling?") were also excluded since these questions are not sensitive and measure the construct of fear of falling (a phobia) rather than BC[17].

Validity assessment

Methodological quality of trials was assessed using the Physical Therapy Evidence Database (PEDro) Scale[18]. The scale rates the trial's methodological quality and ranges from 0 to10 points. One point is awarded to each of the 11 criterions if it is fully satisfied. The point for the first item (eligibility criteria) is not included in the total score. Good quality RCTs were defined as scores ranging from 6–8 points, fair quality RCTs had PEDro scores ranging from 4–5 points and poor quality RCTs had 3 points or less on the PEDro score[19]. Adhering to the Delphi Principle, a third rater was brought in when any disagreement occurred at all stages of the rating process. The raters were not blinded to authors' names or institution.

Data abstraction and study characteristics

Two individuals independently rated the titles and abstracts. After establishing the final article list, information regarding participants, interventions, comparisons, outcomes, and study design (PICOS) was reviewed and extracted. Since not all of the studies had retention assessments, baseline scores were compared to the first assessment after the end of the intervention. The interventions provided to the experimental groups were pooled according to type of intervention and were compared to the control group, which varied in type of intervention (for example, conventional exercise, usual care and education). When a third arm of intervention was provided, the experimental group was compared to the control group and not another treatment. For trials that provided exercise as the intervention, the type of exercise was determined by assessing its components; strengthening, functional balance training (including exercises such as sit to stand) or task specific exercises (such as stepping, standing). The intervention was required to include at least two of the three components before qualifying to be termed as exercise. If the intervention included only one

component, such as balance training, the name of the intervention remained the same as in the trial. Tai Chi was given a separate category because of the amount of trials using it as an intervention. Multifactorial interventions were defined if the intervention involved a home and individual assessment and treatment planning including; reduction of environmental hazards, review of medication, education and exercise/training.

Quantitative data synthesis

The end point outcome measures in the RCTs were all continuous scales of BC or falls efficacy; the ABC, FES, MFES (modified Falls Efficacy Scale). These scales measure a similar construct and significant correlations have been reported[9].

Data management and statistical analysis

The mean difference and standard deviation (SD) between pre and post intervention for both groups were extracted. When only the median and inter-quartile range were reported, we used a conversion formula[20] to convert to the mean and SD. The standard mean difference (SMD) with 95% confidence intervals (CI) was used to calculate the treatment effect size. The effect size of multiple studies was calculated with RevMan 5.0 (http://www.cc-ims.net/revman/download) using the weighted effect size. The strength of the SMD effect size was defined according to Cohen's *d*; 0.2–0.3 as a small effect size, around 0.5 is a medium effect size and above 0.8 is considered a large effect size[21]. To illustrate the cumulative effect of the different interventions on balance confidence, forest plots were constructed. Data were pooled in different subgroups according to the intervention provided. In most of the cases the grouping was done by the intervention provided to the experimental group but in some cases the intervention provided to the control group was used for the meta analysis; this is stated explicitly in Table 1. The degree of heterogeneity (I^2) for each outcome was evaluated with non significance ($p<0.05$) indicating similarity between the different studies. Heterogeneity was expected since the populations included in the studies varied. Sensitivity analysis was used to determine the robustness of our findings. Random effect models were used for evaluating the pooled intervention effect in order to reduce effects of heterogeneity between studies[22]. In addition we examined the effect of deleting low quality studies (scores below 5/10 on the PEDro Scale) from the analysis. Funnel plots were used to detect possible publication bias.

Results

Figure 1 presents the trial flow diagram illustrating that the initial search strategy identified 965 citations and of these 43 studies met our inclusion criteria. Thirty studies were finally included in our systematic review and 24 studies were included in our meta-analysis.

Study characteristics

The study characteristics of the 30 studies are presented in Table 1. Eleven studies included older adults living in the community or nursing homes, eight studies included older adults that had fallen in the past year, seven studies included older adults with a risk of falling, and

four studies included only older women or women with Osteoporosis or low mass bone. The frequency of the end points used in the 30 trials appears in Table 1.

PEDro scores ranged from 3 to 8 points with a median score of 6 points; 22 studies (71.0%) were defined as having good quality, 8 studies (25.8%) were defined as having fair quality and one study was of poor quality. The PEDro scores for each of the 11 items of the PEDro scale, for each trial, appear in the Supplementary data available in Age and Ageing online. Funnel plots were produced for the Exercise and Multifactoral interventions [including 9 or more studies each which assured the plots were valid[22]. Both plots showed a publication bias, i.e. an under-representation of negative findings in our meta-analysis.

Quantitative data synthesis

Meta-analysis was performed for pooled interventions with a minimum of three studies (24 of the 30 trials). The 24 studies were divided into subgroups based on the intervention provided; Exercise (N=9 trials), Tai Chi (N=5 trials) and multifactorial intervention (N=10 trials). Information regarding the individual studies appears in Table 1; the results for change in BC are summarized as “+” (positive for the experimental group, $p \leq 0.05$) or “0” (no difference, $p \geq 0.05$). The intervention for the control group was usual care (N=20), but some studies provided the individuals in the control group with educational and cognitive programs, exercise, social visits and attention. Since the remaining 6/30 studies[10,13, 23–26] used diverse interventions, they could not be grouped together and meta-analysis could not be performed. See Supplementary online data available in Age and Ageing for a description of the individual studies and the effect sizes. The results of the meta analysis according to the sub-groups appear below.

Exercise

Nine trials provided exercise training aiming to increase the low BC of older adults and included a strengthening component in addition to functional balance exercises or a task specific component. Once the 9 trials[11, 27–34] recruiting a total of 453 subjects were combined using a random effect model, a low significant effect was seen with a standard mean difference (SMD) of 0.22, 95% CI 0.07 to 0.36, p=0.003 (Figure 2). The heterogeneity was I^2=0%, which was not significant (p=0.93), indicating similarity between the 9 studies. When the two studies which had a low PEDro score (≤4 points)[29, 35] were removed, the SMD remained unchanged and the model remained significant ($p<0.05$).

Tai Chi

The data from five trials[12,35–38] (N=468 subjects) examining Tai Chi were combined using a random effects model. The effect size was large but not statistically significant (P=0.06). The study by Sattin et al.[37] provided training for 48 weeks and had a very large effect size (4.38) compared to the other 4 studies which provided treatment for 8–26 weeks and had small effect sizes ranging from 0.2 to 0.77. The variability of the trials was large, possibly leading to non-significance. When that study was removed from the meta-analysis, the effect size was medium (SMD 0.48, 95% CI 0.11 to 0.84) and statistically significant

(p=0.01), however the heterogeneity was high and significant (I^2=71%, p=0.02) indicating heterogeneity between the trials (See supplementary online data available in Age and Ageing).

Multifactorial treatment

Ten studies provided multifactorial interventions aimed to increase low BC. This intervention varied slightly between trials but included home visits by a nurse, occupational therapist or physical therapist who assessed the individual's needs and provided counselling on home modifications for a safe environment, medication prescription, and education regarding the risks of falls. In some trials exercise training was provided as well (e.g.[39]). Upon combining the 10 trials[39–48] (N=1233 subjects) of multifactorial treatment using a random model we found a small statistically and significant effect size [SMD 0.31, 95% CI (0.15–0.48), p=0.0002]. The heterogeneity was I^2=74%, which was statistically significant (p<0.00001), indicating heterogeneity between trials (Figure 4). When the one low scoring study (Pedro ≤4)[41] was removed the model remained unchanged.

Discussion

The majority of the studies addressing reduced balance confidence in older adults used interventions designed to improve balance (e.g. lower extremity strengthening or balance exercise) or prevent falls (e.g. multifactoral treatment). Since the ability to maintain balance has been found as a strong determinant of balance confidence [49–51], the focus on balance seems logical. Exercise including strengthening exercises in addition to functional balance training or task specific exercises (e.g. sit to stand, marching or walking through an obstacle course) was provided in 9 of the reviewed trials. The exercise programs ranged from 2 sessions per week for duration of 5 weeks to a maximum of 4–5 sessions a week for 16 weeks. A small significant effect size was found when these studies were pooled.

Tai Chi (N = 5 studies) was found to have a medium effect size. Tai Chi training duration also varied considerably ranging from 8 to 48 weeks. Tai Chi, a self-paced system of gentle physical exercise and stretching, [52] is known to develop flexibility and coordination. Many of the postures challenge balance requiring individuals to move through positions using a reduced base of support (e.g. standing on one leg). Tai Chi addresses the sensory-motor aspects of balance which may also result in increased balance confidence. It also addresses the cognitive and emotional areas by promoting relaxation, awareness and focus[52] which again may improve balance confidence. The combination of physical exercise and cognitive-emotional stimuli may explain the increased effect size observed when Tai Chi was used.

A multifactoral/multifaceted approach generally addressed fall related issues while reducing barriers in the person's environment. Pooling the results (N=10 studies) resulted in a small effect size which was similar to for exercise only. It seems plausible that not enough emphasis was placed on the exercise component. For instance in some cases there was no exercise training at all (e.g.[43]), or subjects were referred to an exercise program (e.g.[39]) where the adherence was poor[39], or the exercise component was minimal, consisting of 15 repetitions of strength and postural exercises 3–4 times a week[41]. Finally, in some studies

subjects were encouraged to train on their own after therapists provided them with balance and strengthening techniques (e.g.[45,46]). Since most therapists have not been trained in progressive balance training for fall prevention the training is often not beneficial[53]. Interestingly, the effectiveness of Multifactoral interventions for preventing falls and related injuries in older people has not been supported[53]. Since our meta-analysis did find a small and significant effect size, using multifactoral interventions may still be beneficial for increasing balance confidence despite having little effect on fall prevention[53].

According to Bandura's self-efficacy theory[7] performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal are the four major sources of efficacy information. Addressing all of these sources should improve domain specific self-efficacy. Two studies[28,33] included some of these sources of information however a meta-analysis could not conducted because there weren't enough studies to pool the data. In both trials the intervention and control groups received exercise training while only the intervention group received efficacy training as well however the additional efficacy information did not result in an improvement in balance confidence.

Components of efficacy training, usually mastery experiences, were often included in multifactoral interventions as well. These interventions included practicing challenging Instrumental Activities of Daily Living (IADL) activities leading to successful performances which seemed to increase balance confidence. For example participants in a multicomponent home intervention had less difficulty at 6 months with IADL and ADLs compared to controls[47]. Balance confidence may be mediator between aging and ADL. Studies have shown having low confidence is related to greater declines in ability to perform ADLs [6,36] however it may only be among individuals with declining physical performance (gait, balance, and arm and leg movement)[54]. Incorporating ADL/IADL practice, particularly those the subjects identify as difficult, along with exercise may result in larger effect size in future RCTs.

The previous systematic review[14] revealed that Tai Chi, home-based exercise and fall-related interventions were shown to reduce fear of falling in older people living in the community. Our meta-analysis, which included sensitivity analysis, emphasizes Tai Chi to be the best intervention to treat BC. The small effect sizes observed for exercise & Multifactoral interventions may have resulted from the fact that BC was not the principal endpoint in one third of the reviewed studies. The subjects in these 10 trials were individuals who had fallen or had a risk of falling and therefore the primary aim was to prevent falls. Since BC was a secondary end point, individuals with high BC may not have been excluded.

Limitations

Due to the publication bias detected for Exercise and Multifactoral interventions, the study findings should be carefully considered. The interventions were very different in terms of type, duration and intensity. Grouping of the interventions was based on the short description published in the articles and therefore might not be accurate. Because follow-up assessments were not performed in all of the trials, we used the first assessment done after the intervention, therefore the long term effects of the interventions cannot be determined.

The study samples varied which may confound the results. The limited number of trials per population within each intervention did not enable us to account for this factor. Therefore the effectiveness of exercise for homogeneous samples (such as fallers, non-fallers) needs to be further investigated by conducting high quality randomized controlled trials.

Low BC in older adults can be addressed most effectively by Tai Chi, while exercise was also found to be beneficial but the effect size was smaller. Future studies that provide intervention that incorporates sources of efficacy information and includes practicing challenging ADL and IADL tasks, are warranted since these may enhance effect sizes and outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Keypoints

- Low balance confidence is a major health problem in older adults
- Determining the most effective interventions to increase balance confidence in older adults is important
- Tai chi/exercise interventions are beneficial in increasing the balance confidence of older adults

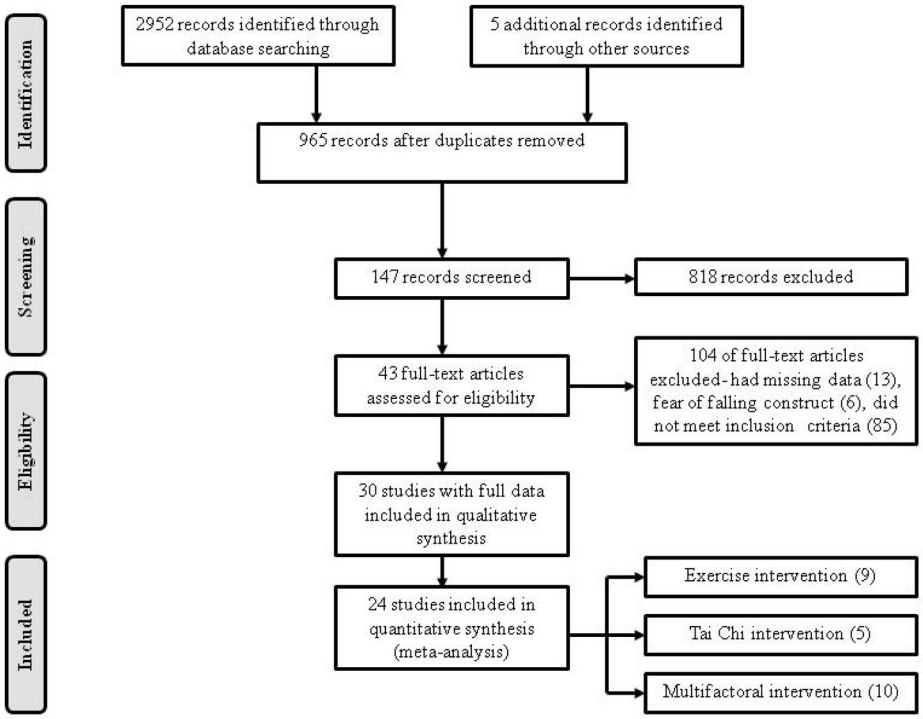

Figure 1.
Trial flow diagram illustrating the search and selection of the studies.

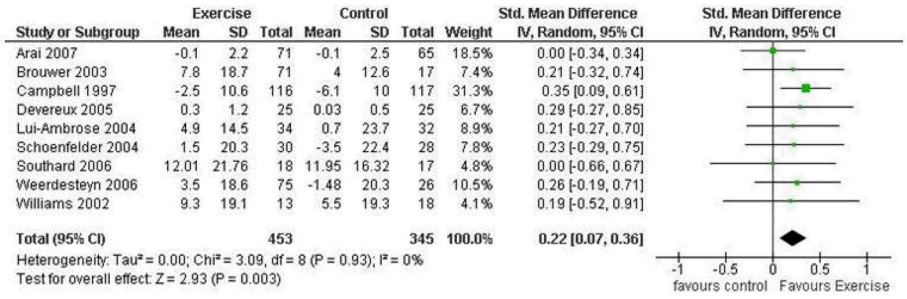

Figure 2.

Meta-Analysis of Exercise aimed at increasing balance confidence (N=453)

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Table 1

The 30 Trials Included in the Systematic Review and Meta-Analysis Divided into the types of interventions

Study First Author, year	Participants Total N Mean (SD)/range Age Subjects	End point Outcome Measure (1/2)*	PEDro Score (_/10)	Intervention Duration (Sessions per week) Focus of intervention	Intervention received by the control group	Results +/0†
EXERCISE						
Campbell, 1997 [26]	211 mean age 84 years Women	FES2	8	8 weeks (4 × week) PT visit + Therapist prescribed exercises and walking plan to maintain 3 times a week. Strengthening, balance, walking, bending, stair climbing. Were telephoned for motivation	Usual Care	0
Williams, 2002 [27]	31 mean 82.8 (6.54) years Elderly	ABC1	4	16 weeks (4–5 × week) Control group - home exercise program with home follow-up visits every 2 weeks and a phone call in alternate weeks. Balance and mobility tasks (such as tandem and backward walking, stooping and crouching to pick up objects from the floor) were included.	Exercise with efficacy intervention	0
Brouwer, 2003 [28]	30 77.5 (5.3)years Elderly with concerns about falling	ABC1	7	8 weeks (2 × week for 40 minutes) warm up, low resistance exercises, reaching, marching.	Education	+
Lui-Ambrose, 2004 [29]	98 mean 79 (3) years. Women	ABC1	5	13 weeks (2 × 50 minutes) Agility Training group–aimed at challenging hand-eye coordination, foot-eye coordination, balance and psychomotor performance. Included ball games, relay races, dance movements, and obstacle Courses.	Unsupervised Exercise	+
Schoenfelder, 2004 [30]	67 84 years (range 64–100) Elderly	FES1	6	10 weeks (3 × week for 15–20 minutes) ankle strengthening Plus a supervised walking program.	Usual Care	+
Devereux, 2005 [31]	47 mean age 73.3 (4) Women	mFES1	8	10 weeks (2 × week for 1 hour) of water-based exercise and self-management program. (Including Warm-up, stretches, aerobic, Tai Chi, strength, posture, gait, vestibular, proprioception, and balance activities)	Usual Care	0
Southard, 2006 [32]	35 mean age 87 years Elderly	ABC1	5	4 weeks (3 × week for 20 minutes) Control group; obstacle course, side stepping, marching, squats	Exercise with efficacy intervention	0
Weerdesteyn, 2006 [33]	72 Mean age 74 Fallers	ABC2	4	5 weeks (2 × week for 90 minutes) balance, gait, coordination, walking exercises, and fall techniques	Usual Care	+
Arai, 2007[10]	137 74 (5.5) Elderly	FES1	5	12 weeks (2 week) increasing muscular strength of the lower extremities, balance functions, flexibility, and daily functions such as climbing stairs	Education	0
TAI CHI						
McCormack, 2004 [34]	27 mean age 79.1 (5.9) Elderly	mFES1	6	10 weeks (2 × week) Range of motion dance method (similar to Tai Chi)	Conventional Exercise	0

Study First Author, year	Participants Total N Mean (SD)/range Age Subjects	End point Outcome Measure (1/2)*	PEDro Score (_/10)	Intervention Duration (Sessions per week) Focus of intervention	Intervention received by the control group	Results +/0†
Li 2005 [35]	188 mean 72 (5.5) years Risk of falling	ABC1	7	26 weeks (3 × week for 1 hour)	Unsupervised Exercise	+
Sattin, 2005 [36]	242 mean age 81 Elderly	ABC1	6	48 weeks (2 × week)	Education	+
Zhang, 2006 [11]	47 70 (4) Elderly	FES1	6	8 weeks (7 × week for 1 hour)	Usual Care	+
Logghe, 2009 [37]	141 mean age 77 (4.7) years Risk of falling	FES2	8	13 weeks (2 × week for 1 hour)	Usual Care	0
Multifactoral treatment						
Tinetti, 1994 [39]	287 mean age 78 years Risk of falling	FES2	6	24 weeks (1–2 week for 1 hour) home-based leg strengthening, balance and walking + multifactorial intervention involving adjustment in medications, behavioral instructions, and exercise programs aimed at modifying risk factors.	Visits by a social worker	+
van Haastregt, 2000 [40]	235 mean age 77 years Fallers	FES2	4	8 weeks (3–4 × week for 15 repetitions) strength and postural stability exercises + 5 visits from a community nurse over a year	Usual Care	+
Clemson, 2004 [41]	283 mean 78 (5.5) years Fallers	mFES2	7	7 weeks (2 × week for 1 hour) Follow-up visit 6 wks after program from OT. 1.5 hrs of booster session 3 months after program. Program incorporates lower limb balance and strength exercises, coping with visual loss, medication management, environmental and behavioural home safety, and community safety.	Social visits	0
Huang, 2004 [42]	113 mean 72 years (5.5) older persons dwelling in the community	FES1	5	Multifactor standardized individualized intervention - improving the knowledge of medication safety, decreasing home hazards	Usual Care	+
Davison, 2005 [43]	182 mean 77 (7) years Risk of falling	ABC2	8	multifactorial intervention (medical, physiotherapy, occupational therapy). Medication, vision, and cardiovascular assessment and treatment recommendations. Gait/balance assessment and interventions. Assessment of home environmental hazards.	Usual Care	+
Gitlin, 2006 [44]	285 mean 79 (6) years Risk of falling	FES1	8	occupational and physical therapy sessions involving home modifications and training in their use. Instructions and strategies of problem solving, energy conservation, safe performance, and fall recovery techniques. Balance and muscle strength training	Usual Care	+
Elley, 2008 [38]	312 mean age 80 (5.0) Fallers	mFES2	8	Home visit and assessment by a nurse. She referred them to exercise program, to an OT for home adjustments.	Social visits	0
Ziden, 2008 [45]	102 Mean age 82 (6.8) After hip fracture	FES1	7	A geriatric, multi-professional home rehabilitation program focused on supported discharge, independence in daily activities, and enhancing	Usual Care	+

Study First Author, year	Participants Total N Mean (SD)/range Age Subjects	End point Outcome Measure (1/2)*	PEDro Score (_/10)	Intervention Duration (Sessions per week) Focus of intervention	Intervention received by the control group	Results +/0†
				physical activity and confidence in performing daily activities		
Vind, 2009 [46]	492 Mean age 74 years Fallers discharged from hospital	ABC2	8	median of 13 weeks of intervention, median of 6 visits to the outpatient clinic. Participants were examined by a team to diagnose the reason of the fall. Participants were medically treated or referred to specialists, patients with decreased visual acuity were asked to see an eye specialist. Physiotherapists provided progressive, individualized exercise or/and home exercises.	Usual Care	+
Ziden, 2010 [47]	102 Mean 81 (6) years Hip fracture	FES1	8	Home rehabilitation program was specially designed for each participant. Pre discharge goal setting and post discharge of 3 weeks (4.5 home visits) by an OT or PT to encourage self efficiency and physical activity.	Usual Care	+
Other interventions						
Cameron, 2000 [12]	131 >74 years of age community dwelling women at risk for hip fracture	FES/mFES1	8	hip protectors	Usual Care	+
Hinman, 2002 [22]	58 Mean age 72 Elderly	mFES1	4	4 weeks (3 × week for 20 minutes) computerized balance training program - exercise using the Biodex Balance System home program of balance exercises	Unsupervised Exercise	0
Hamel & Lajoie 2005 [25]	20 82 years (range 65–90) elderly persons living in housing cooperatives	ABC 2	3	6 weeks (7 × week) of training in mental imagery.	Usual Care	0
Foss, 2006 [24]	218 79 years (range 70–92) elderly women with one previous successful cataract operation	FES2	7	expedited surgery (within a month) versus routine surgery (a ‘waiting list’ within 13 months)	Usual Care	+
Lee, 2007 [23]	86 Mean age 79 Fallers discharged from the emergency department to home	mFES1	7	Use of a PERS (Personal Emergency Response System) for 2 months	Usual Care	+
Schilling, 2009 [9]	19 60–68 years Older adults	ABC 1	6	5 weeks (3 × week for 15–30 minutes) balance exercises on a VersaDisc and CorDisc devices (air filled rubber discs) while secured in a harness	No therapy	+

*1-Primary endpoint, 2- secondary endpoint

†+statistically significant (p≤0.05) positive results, 0 no significant difference in balance confidence.