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AGS (2001) + Guideline for the prevention of falls in older persons. Evidence support recommendations was grade from A to D, with A being the strongest evidence	Literature review for: -individual studies and reviews -expert opinion Reviewed by panel of experts	Setting not specified Older persons (age not specified)	Recommendations <u>Assessment</u> (no evidence cited) 1. All older persons should be asked about falls at least once per year 2. Persons reporting one fall should be evaluated with the 'get up and go test' and if they have difficultly, further assessment should be done 3. Persons requiring medical care due to fall or who report recurrent falls should have a fall evaluation <u>Interventions</u> 1. In community-dwelling older people, multifactorial interventions are recommended, though the strength of evidence varies—B for medication review, exercise, treatment of low blood pressure and use of assistive devises; C for environmental modifications and D for treatment of cardiovascular disorders 2. When used as an isolated intervention, health or behavioral education does not reduce falls	No information provided or located on effectiveness of guideline or evaluations of implementation.

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			3. Insufficient evidence exists for vision correction, modification of footwear, and use of restraints. Bone strengthening medications may have other positive effects, but do not reduce the rate of falls	
Baker (2007) * A review of the evidence available on the prescription of exercise for older adults, specifically on whether "simultaneously prescribed doses and intensities of strength, aerobic, and balance training at levels known to produce physiological adaptation in older adults are both feasible and capable of eliciting changes in physical functioning and quality of life."	Systematic review of 15 RCTs "The study exercise intervention must have been multi-modal, comprised of at least the three modalities including strength/ resistance training, aerobic/ cardiovascular training and balance/ stability training"	Only studies that involved adult cohorts with a mean age greater than or equal to 60 were included. 10 of 15 studies did not select participants based on any functional or mobility limitation 6 trials were home-based and 9 trials were group-/class-based	Strength Balance Aerobic fitness Rate of falls Function Quality of life	5 of 9 studies showed a significantly greater increase in strength in the intervention group compared to controls. Relative effect sizes (ES) ranged from –0.08 to 1.67, with a mean of 0.41 across all study strength measures. 6 of 11 studies that included a balance measure reported significant improvement. Relative effect sizes for balance measures ranged from 0.22 to 1.41. Aerobic fitness was infrequently measured or reported; 2 of 4 studies showed improvement. 5 of 6 studies assessing the incidence of falls in the intervention group compared to the control group saw significant reduction in falls. Functional and quality of life measures generally did not improve with exercise.
Campbell (2007) * A meta-analysis comparing the effectiveness of single and multifactorial interventions for fall prevention in at risk populations of older people.	14 RCTs that met additional criteria including a minimum of a twelve month follow-up period, prospective recording	All participants being over 65 was an inclusion criteria for studies Majority of subjects	Rate ratio for falls recorded during the study period	Single interventions reduced falls by 23% and were as effective in reducing falls as multifactorial interventions (22% reduction) (pooled rate ratio 0.77, 95% CI 0.67-0.89 and 0.78, 95% CI 0.68-0.89). Sensitivity analysis that included relaxing

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Single interventions are those that address one risk factor with the intervention, such as exercise to improve balance or home assessments to increase safety.	of falls and the majority of subjects living in the community	had to be community residents No mention of home care		the age requirement and the length of follow-up for study inclusion produced the same results. Additionally, there was no trend toward multifactorial interventions being more effective. Authors conclude that targeting a single intervention to a population where the risk factor addressed accounts for a large portion of fall risk (e.g. home assessments for people with sensory deficits, strength and balance interventions for people whose frailty is at a point of inferring with daily activities) is as effective as multifactorial interventions for community populations. Multifactorial interventions should be reserved for those who have fallen and have access to individualized assessment and treatment.
Chang (2004) * A systematic review and meta-analysis of interventions to prevent falls in older adults Interventions assessed included multifactorial falls risk assessment and management, exercise, environmental modifications, and education. Multifactorial assessments included combinations of orthostatic blood pressure, vision,	40 RCTs	Subjects are from general population, and community settings Studies had to be limited to subjects over 60 to be included in the review	Falling at least once during study follow-up period Monthly rate of falling	Analysis that compared all interventions to a normal care or control group found reduced falls for both measures: Falling at least once --risk ratio 0.88, 95% CI, 0.82 to 0.95, monthly rate of falling – incidence rate ratio 0.80, CI 0.72 to 0.88). Analyses of the different types of interventions found positive effects for multifactorial treatments and exercise and no significant effects for environmental modifications and education.

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balance and gait, drug review, IADLS/ADLs, cognitive evaluation, and environmental hazards.				Authors conclude "Implementing a multifactorial falls risk assessment and management programme would be most feasible by targeting selected people, such as those with a history of falls. Exercise programmes, however, could feasibly be implemented to a general population of older adults."
Gates (2008) * An update to the Gillespie Cochrane review (see below). This systematic review and meta-analysis incorporates additional studies and conducts a meta-analysis including at the studies from which data were available data.	19 RCTs, some randomized individuals, other randomized clusters	Subjects were recruited in ER, primary care clinic or community Assessments occurred in homes or primary care Studies included older people; the definition varied across studies: >60, <65, <70 or <75	For meta-analysis: Number of people who fall Other outcomes included in reviewed studies: Fall related injuries Fall rate Death Admission to hospital Move to institutional care Physical activity Quality of life	The combined risk ratio for the number of people who fell (data from 18 studies) was not significant 0.91, 95% CI 0.82 to 1.02. For fall related injuries (data from 8 studies) the risk ratio was also not significant 0.90, 95% CI 0.68 to 1.20) The authors conclude that "our analysis suggests that any benefits from this type of intervention might be smaller than previously supposed." They attribute this to the fact that the new trials showed no significant reduction in the number of fallers in the intervention groups.
Gillespie (2003) * A Cochrane systematic review of interventions for preventing falls in elderly people. Interventions included (# of studies): Exercise/PT (23) Home Hazard Modification (9) Cognitive/Behavioral (7)	62 RCTs	47 studies were of people living in the community Subject had a history or risk of falling in 17 studies, were defined as frail in another 17, and in 28 volunteers were recruited in the	Number of people who fall Number of falls Severity of falls	"Interventions which target an unselected group ….are less likely to be effective then those which target known fallers. Even amongst known fallers the risk reductions are small; even where these are statistically significant, the clinical significance and cost effectiveness remain less clear than we would wish. Interventions that target multiple risk factors are marginally effective, but so

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Medication Adjustment (2) Nutrition/Vitamins (6) Hormonal-Rx Therapies (2) Correction of Vision (1) Cardiac Pacemaker (1) Exercise, Visual Correction and Home Safety (1) Multifactorial Risk Screening and Intervention (21) Systems Modifications in Hospitals (3) Multifaceted NH Intervention (1)		community generally In 17 studies the mean age was over 80		also are targeted exercise interventions, home hazard modification, and reduction psychotropic medication. Where important individual fall risk factors can be corrected, focused interventions may be more clearly effective."
Hauer (2006) * A systematic review of the effectiveness of physical training on motor performance and fall prevention in cognitively impaired older persons. Interventions include group and individual training and a wide range of activities from chair-based exercise, exercise with weights and bands, gait retraining, skill training and the use of recreational activities such as throwing balls or bowling.	11 RCTs	Home and institutional settings, though most were in facilities. Subjects had to be older and cognitively impaired No specific mention of home care	Number of falls Muscle strength Flexibility Walking speed Measures of functional reach, standing balance, get up and go Caregiver reports of physical activity PT and mobility assessments	Five studies reported significant improvement in at least one outcome, but for the majority of analyses, there was insufficient or contradictory data and/or analysis. Authors could not find strong evidence for the effectiveness of physical training in patients with cognitive impairment, but add that the available trials "do not provide sufficient evidence and partly lack methodological quality and research consensus."
Howe (2007) * A Cochrane systematic review of the evidence for exercise interventions designed to improve balance in older people living in	Randomized controlled trials and quasi-randomized trials were included.	Participants in 27 trials were described as healthy older people; participants in the remaining 7 trials had	Trials were only included that reported primary outcome measures that were direct or indirect measures of balance performance	"Statistically significant improvements in balance ability were observed for exercise interventions compared to usual activity. Interventions involving gait; balance; co-ordination and functional exercises;

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the community or in institutional care. 11 trials of exercise programs involving gait, balance, co-ordination and functional task activities 6 trials of strengthening programs, including resistance or power training 4 trials of 3D exercise programs, including tai chi, qi gong, dance, and yoga 2 trials of general physical activity 4 trials of walking 1 trial of static cycling 12 trials of multiple exercise types	The review consisted of 39 papers which described 34 studies	general frailty and/or functional limitations Participants were residing in institutions in 5 trials; in the community in 27 trials; and types of residence were mixed in 2 trials Programs took place mainly in gym, clinic or community settings in supervised groups; programs delivered predominately by healthcare professionals or fitness instructors	Direct Measures: --Force platform and sway indicators Indirect Quantifiable Measures: --Functional reach --Timed up-and-go --Gait speed --Single legged stance --Parallel stance --Tandem stance --Tandem walk --Tilt boards --Balance beams Indirect Observational Measures: --Berg Balance Scale	muscle strengthening; and multiple exercise types appear to have the greatest impact on indirect measures of balance. There was trend towards an improvement in balance with cycling on a static cycle." "where differences were observed immediately post intervention there was limited evidence to suggest that these effects were maintained over longer periods of time." "The lack of standardization of measures and their relative validity limit the interpretation of these results." Overall, quality of the evidence is mixed. Of the 34 included trials, only 9 trials had more than 100 participants at entry, and 10 trials had less than 40 participants. The main weaknesses were inadequate information on randomization procedures and limited follow-up data.
Jette (1999) **Etkin (2006)** Strong for Life, an in-home resistance training program for functionally impaired elders. The program is designed as a cost effective means of providing	The initial study was an RCT of 215 older persons Subjects were asked to perform the program 3 times a week for 6 months	All program components were conducted in the participant's home Participants were a minimum of 60 years of age and reported limitations in at least 1	Muscle strength Balance Functional mobility Mood state Disability status	Overall, subjects in the intervention arm adhered to 89% of the recommended exercise sessions over the 6-month period. The intervention group showed a statistically significant improvement in strength, with lower extremity strength improvements ranging from 6% to 12% relative to controls. Statistically significant group differences were also

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functionally impaired elders with a home-based exercise program, thus eliminating the need for older adults to travel to a gym or community center and avoiding the high cost of in-home personal trainers. Strong for Life consisted of a 35-minute videotaped program of 11 exercise routines. Subjects used color-coded elastic bands of varying thickness to individualize resistance. The program also had a cognitive and behavioral component, led by a physical therapist who made two visits to each participant over the course of the trial, and included a motivational videotape.	Assessments were conducted at baseline and at 3- and 6-month follow-ups	of 9 functional areas listed in the Short-Form Health Survey physical function scale		observed in disability status, as reflected by a net 15% to 18% reduction in the study group's physical disability at 3 and 6 months and an 18% reduction in overall disability at the 6-month follow-up. Borderline statistically significant group differences were observed in gait. No statistically significant group differences were detected in psychological mood states.
Keysor (2003) A "best-evidence framework" was used to examine the questions: (1) Do the benefits of late-life physical activity or exercise extend beyond disease and impairment-level factors? (2) Does late-life physical activity minimize or prevent functional limitations and disability?	Meta-analyses and systematic reviews were the focus Review articles were included if relevant; RCTs were included if they contributed critical information; relevant longitudinal observational studies were also included	Adults aged greater than 60 The review aimed to examine the effects of physical activity and exercise among a "general population of older adults"; studies examining the effects among persons with arthritis were also	Function, particularly walking; other functional outcomes include chair-rise transfers and stair-climbing Disability (often ADL disability)	Randomized controlled trials and several critical reviews show strength training and walking programs improve function, particularly walking. Effects on chair-rise transfers are measured less frequently and results have been inconsistent. The evidence on the beneficial effect of exercise to minimize or prevent disability is mixed. Few controlled trials examine this outcome, and only a small percentage of those trials have been successful.

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	Author does not indicate total number of included sources	included		However, some recent well-conducted prospective studies show that physical activity has a protective effect and does prevent disability. The Longitudinal Study on Aging (LSOA) reported that 5151 persons at baseline who were physically active (walked > 1 mile a week) were less likely to report severe or moderate disability at a 2-year or 4-year follow up (RR 2-year=0.74, 95% CI, 0.62-0.89; RR 4-year=0.64, 95% 0.54-0.77) but not at the 6-year follow-up. In a community-based study of 1321 elderly people in Taiwan who did not report ADL disability at baseline, survival analysis was used to predict the onset of ADL disability over a 3-year period. People who were physically active (engaged in folk dancing, hiking, jogging, or walking at least twice a week) were less likely to develop ADL disability than persons who were sedentary (RR=-0.52; 95% CI, 0.39-0.68), after adjusting for age, gender, education, marital status, number of chronic medical conditions, self-perceived health status, smoking, or heavy/moderate alcohol consumption. In a recently published study from the Established Populations of Epidemiological Studies of the Elderly

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				(EPESE), one of the largest population-based studies of older persons, persons who reported high levels of physical activity at baseline (frequency of walking, gardening, and vigorous exercise) were more likely to die without disability compared to sedentary elders (odds ratio=1.86; 95% CI, 1.24-2.79).
Latham (2003) * A Cochrane systematic review and meta-analysis of progressive resistance training (PRT) for physical disability in older people. Most training programs took place in gym or clinic settings with all sessions fully supervised. 7 studies were entirely home-based, while 7 additional studies carried out some of the training at home and some in gym/clinic settings. The resistance training programs in 47 of 66 trials involved high intensity training. Most of these trials used specialized exercise machines for training. 12 trials used low- to moderate-intensity training, with most using elastic tubing or bands.	66 randomized or quasi-randomized trials	Only trials with mean participant age > 60 were included Participants in 38 trials were healthy older people. In the remaining 28 studies, the participants had a health problem, functional limitation and/or were residing in a hospital or residential care In 32 studies the mean or median age of participants was 60-69, in 23 studies the mean/median age was 70-79 and in 10 studies it was 80 years or greater	<u>Primary outcome measure</u>: Physical disability, including measures of daily activities and measures of physical domains of health-related quality of life <u>Secondary outcomes</u>: -- Functional limitations (i.e. gait speed, time up and go test, chair rise) -- Impairment -- Pain and vitality -- Falls -- Adverse events -- Hospitalization, health service use and death	"Sixty-six trials with 3783 participants were included. Most studies were small and of poor quality. PRT had a large positive effect on strength (41 trials, 1955 participants), but there was statistical heterogeneity that was not explained by differences in study quality, participant characteristics or the exercise program. Some functional limitation measures showed modest improvements (i.e. gait speed, 14 trials, 798 participants,). However, there was no evidence that PRT had an effect on physical disability when activity measures or health related quality of life measures were assessed (10 trials, 798 participants,). Adverse events were poorly recorded, but musculoskeletal injuries were detected in most of the studies that prospectively defined and monitored these events."

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The frequency of training was consistent across studies, with the exercise program carried out 2 to 3 times a week in almost all trials.				
Lopopolo (2006) * A meta-analysis examining the effect of therapeutic exercise on gait speed in community-dwelling older adults.	42 groups of which: 22 had a "true control" 13 had a "quasi-control"; and 7 had no control	Study participants were 60 years of age or older, community-dwelling or living independently in a retirement community, and free of specific impairments limiting ability to walk	Habitual gait speed, defined as comfortable walking speed (e.g., self-selected speed, preferred speed, normal pace) Fast gait speed was measured either by asking participants to walk as fast as possible (in 14 of 18 studies) or faster than normal (in 4 of 18 studies)	"24 studies met the inclusion criteria for habitual gait speed (n=1,302) and 18 studies (n=752) met the inclusion criteria for fast gait speed. Therapeutic exercise—or, more specifically, strength training and combination training (aerobic plus other exercise)—had significant effects (r=.145, P=.017; r=.176, P=.002, respectively) on habitual gait speed. High-intensity (effort expended by subjects) exercise and high-dosage (frequency and duration of exercise sessions) intervention also had a significant effect (r=.184, P=.001; r=.190, P=.001, respectively) on gait speed, whereas there was no effect for moderate- and low-intensity exercise or for low dosage exercise. No exercise intervention affected fast gait speed."
Lyons (2006) * A Cochrane review of the effect on injuries of the modification of the home environment. Interventions focused on the reduction of physical hazards. These included lighting	19 RCTs, 5 about children, 14 about older people. Older people was not defined but used to categorize the studies	All participants were residing in their homes or returning to their homes from a nursing home or geriatric ward	Injury Proxy for injury Falls Safety knowledge Use of safety equipment	Of the 14 trials involving older people that reported on falls, 5 multi-factorial interventions found no significant effect of home modifications, in 3 additional studies home modifications were impossible to separate from other interventions and in the remaining studies the results were mixed. Of the seven

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modifications, installation of grab rails, and/or housing change that might reduce hazards.				studies that reported on the effect of injuries in older people, 6 found no significant reduction. The 6 studies that reported on knowledge and use of hazard reduction all found significant effects. The authors conclude, "it is not possible to conclude that the amelioration of hazards will definitely reduce the number of injuries. Nor is it possible to determine which aspects of multifactorial interventions are most cost effective…this review has not shown that such interventions do not work. The quality and size of the studies were not sufficiently good or large to reach definitive conclusions in most cases."
Mian (2007) A review of the effect of physical training on locomotor function in older people.	Included: Articles that compared a physical training intervention with a non-exercise control group or those that compared two or more physical training interventions Excluded: Studies without a comparison group Group assignment was random in 48 of 55 studies (87%)	Older persons of any health or residential status; studies with participants aged <60 years were excluded Most interventions were gym based or gym and home based	Outcomes measured included: --Walking speed --Stair negotiation speed --Time taken to negotiate an obstacle course --Walking endurance --Gait stability	"In 36 of 45 studies (80%) that incorporated a non-training control group, physical training had a beneficial impact relative to the control condition on at least one aspect of locomotor function in older adults. Most improvements were in the range of 1-30%." Authors note that improvement is apparent in community dwelling, generally healthy, independent adults in their 60s and 70s. Further, they note that, "a number of studies have also demonstrated that physical training can be used as a means to improve locomotor function in those who are very old (i.e.

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				>80 years), those who are described as exhibiting frailty or functional limitations, or those who reside in nursing communities."
National Institute for Clinical Excellence (2004) + A clinical guideline for the assessment and prevention of falls in older people.	Evidence review by an expert panel who then developed the recommendations. Evidence was classified according to categories (I –IV with I being meta analyses and RCTs and IV expert opinion). The recommendations were then graded A to D according to the strength of the evidence on which they were based	Older people in the community or extended care settings. It is not intended for hospitalized patients	Guideline includes 17 recommendations. These include: Assessment (asking everyone about falls, balance/gait observation, multifactorial risk assessment for people with multiple falls or require medical attention due to a fall) multifactorial interventions (combination of strength and balance training, home hazard reduction, vision correction, medication review) specific interventions (strength and balance training, home hazard, review of psychotropic medications, cardiac pacing) encourage participation of older people in falls prevention programmes Guidelines also stated that some interventions are not effective (brisk walking) and others cannot be	Of the 17 recommendations, 7 were graded A, 2 B, 4 C and 4 D. All the assessment recommendations were graded C and all the education recommendations were graded D.

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			recommended due to insufficient evidence (group exercise, cognitive/behavioral interventions, referral for vision correction, Vitamin D, hip protectors)	
Orr (2008) * A systematic review of the efficacy of progressive resistance training (PRT) on balance in older adults.	29 RCTs 14 trials were conducted in a gym / community setting 6 trials combined gym and home-based location 3 were solely home based 6 trials did not report a training venue, but a gym /community setting was implied	Included studies with a mean age >60 and individual age >50 Most participants were healthy and community dwelling. 6 trials included functionally impaired or mobility-impaired participants	Balance measures (NB: in all of the included studies, balance was only one of a number of functional performance outcome measured)	14 studies showed some improvement in balance, and only 15 of 68 tests (22%) showed significant improvement in balance (some studies included more than one test). Author conclude that PRT as an isolated intervention has not been consistently shown to improve balance in older adults.
Rixt Zijlstra (2007) * A systematic review of interventions to reduce fear of falling in older people Interventions included: 8 multifactorial 3 tai chi programs 4 exercise 6 balance 1 hip protector 1 fall risk factors	19 RCTs	Community-living older people The average age of subject had to be 65 or older to be included in the review.	Fear of falling was measured using the Falls Efficacy Scale or a single question about fear of falling	12 studies found statistically significant reduction in fear of falling in the intervention group and 11 of these were the studies as being of higher methodological quality. The studies with positive results included 5 with multifactorial interventions, 3 tai chi programs, 2 exercise programs and 1 hip protector study. The review also examined process characteristics of the intervention that were and were not reported in the

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2 of the multifactorial and 1 tai chi class explicitly tried to reduce fear of falling				identified papers. 12 papers provided information on the intervention facilitator, compliance, and dropout rates. Fewer studies (3) reported fidelity to the intervention protocol, feasibility or recommendations for improving the intervention.
Rubenstein (2001) A structured literature review and expert consensus process used to develop ACOVE quality indicators for the management and prevention of falls and mobility problems in vulnerable elders. Indicators include assessment, evaluation and treatment consisting of assistive devices and exercise.	Cited studies include 12 RCTs, several observational studies as well as indirect and clinical evidence	Setting is not specified Population is vulnerable elders for the ACOVE initiative The population is not defined in this article	Quality indicators based on literature and judged as valid by an expert panel	Six indicators/practices were endorsed. <u>Assessment</u> 1. All vulnerable elders should be asked about occurrence of falls at least annually (indirect evidence) 2. All vulnerable elders should be asked about or examined for gait and balance disturbances at least once (Indirect evidence). <u>Evaluation</u> 3. If person reports 2 more falls or 1 fall with injury in the past year, fall evaluation should be conducted and result in diagnosis and therapeutic recommendations (3 RCTs and several observational studies) 4. If there are new or worsening difficulties with ambulation, balance or mobility, then gait, mobility and balance should be evaluated and result in diagnosis and therapeutic recommendations (indirect evidence) <u>Treatment</u> 5. If a vulnerable elder demonstrates decreased balance or proprioception or

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				increased postural sway, an appropriate exercise program should be offered and an evaluation for an assistive device performed (16 RCTs and 1 meta-analysis) 6. If vulnerable elder has problems with gait, strength, or endurance, then an exercise program should be offered (7 RCTs)