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Interventions to Prevent Falls in Older Adults: An Updated Systematic Review

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Structured Abstract

Background: Falls represent an important source of preventable morbidity and mortality in older adults, the fastest growing segment of the U.S. population. We undertook a systematic review of falls interventions applicable to primary care populations to inform the U.S. Preventive Services Task Force's (USPSTF's) updated recommendation on preventing falls in older adults.

Purpose: To assess the benefits and harms of interventions for reducing falls and improving health outcomes in older adults in primary care settings, including multifactorial assessment and management, exercise/physical therapy, single clinical treatment of nutritional risks and visual deficits, hip protectors, home hazard modification, and clinical education/behavioral counseling.

Data Sources: We searched the Cochrane Database of Systematic Reviews, the Database of Abstracts of Reviews of Effects, MEDLINE, Health Technology Assessments, and the National Institute of Health and Clinical Excellence for systematic reviews in 2007. We searched MEDLINE, Cochrane Central Registry of Trials, and the Cumulative Index to Nursing and Allied Health Literature (January 2002 to February 2009), limiting to English language only. We examined reference lists of relevant systematic reviews and other articles and considered references supplied by experts.

Study Selection: Randomized clinical trials meeting inclusion/exclusion criteria, of at least fair quality according to USPSTF criteria, and reporting falls outcomes.

Data Extraction: We abstracted data into standardized evidence tables, with data abstraction checked by another investigator. Two investigators evaluated all studies against pre-specified, design-specific USPSTF criteria for trials. Differences were resolved by consensus. Excluded studies are listed in the exclusion tables, with reasons for exclusion.

Data Synthesis: We included 47 intervention trials with a total of 23,980 participants. Fourteen trials (16 intervention arms) addressed multifactorial assessment and management (n=5,570). Seven comprehensive multifactorial interventions reduced falls among primarily high-risk older adults, while nine noncomprehensive interventions did not. Seventeen trials (21 intervention arms) (n=3,985) of exercise/physical therapy interventions significantly reduced falls, with some suggestion that benefits were primarily among participants selected at higher-than-average risk for falling. Eight trials (n=5,216) of vitamin D supplementation among participants with mean ages of 71–77 years showed significantly reduced falls. Four trials (n=1,437) addressing visual acuity and cataract correction among adults with mean ages of 76–80 years found no reduction in falls. Two trials (n=4,769) with high-risk female participants with mean ages of 78–83 years found no benefit on falls or falls injuries with hip protector use. Small single trials of medication management, protein supplementation, and behavioral counseling showed no benefit. Limited data were available on intervention-associated harms or health outcomes in addition to falls.

Limitations: The body of research is of fair quality and rarely reports important health outcomes, such as falls-related injuries. Available studies do not clarify the best way to identify higher risk community-dwelling older adults for evidence-based interventions due to heterogeneity in tested approaches.

Conclusions: There is strong evidence that several types of primary care applicable falls interventions (i.e., comprehensive multifactorial assessment and management, exercise/physical therapy interventions, and vitamin D supplementation) reduce falls among those selected to be at higher risk for falling. Harms of these interventions appear to be minimal, but future research should confirm this assertion.

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Chapter 1. Introduction

Scope and Purpose

This systematic review was undertaken to support the U.S Preventive Services Task Force (USPSTF) in updating its 1996 recommendation on prevention of falls in older adults, which was part of its general review on household and recreational injuries.

The 1996 USPSTF review found sufficient evidence that certain interventions (e.g., individualized and repeated home-based multifactorial interventions, exercise) reduce the risk for falls. This review found insufficient evidence, however, that counseling could be generalized to the primary care setting or that counseling reduced fall risk factors or the incidence of falls.[1] The USPSTF also found insufficient evidence to recommend for or against the routine use of external hip protectors to prevent fall injuries. Issues requiring rectification for the USPSTF to change its recommendations include evidence showing that: primary care feasible interventions reduce the risk for falls or fall-related injuries in high-risk older adults; the general population benefits from these interventions; primary care counseling reduces the incidence of falling or fall-related injuries; primary care counseling is effective in encouraging older adults to increase their physical activity levels; and screening (balance and gait, visual acuity, ophthalmoscopic exam, dementia or altered mental status) reduces incidence of falls or fall-related injuries.

Condition Definition

A fall is "an unexpected event in which the participant comes to rest on the ground, floor, or lower level."[2] The operationalization and measurement of this definition varies considerably across studies, with some studies using no explicit definition.[3] Fall data may be collected through retrospective reporting systems using telephone interviews, face-to-face interviews, or postal questionnaires; prospective reporting systems using postcards, calendars, and diaries; or routine surveillance systems using health care records. Because no single definition for a fall was consistently used across studies, we use the definition of a fall used by each reviewed study to maximize the number of included studies in the current review.

Prevalence and Burden of Disease/Illness

People aged 65 years and older represent the fastest-growing segment of the U.S. population, in part due to the increased average U.S. life expectancy and the aging of baby boomers. The U.S. Census Bureau projects that the number of persons aged 65 years and older will more than double by 2030, and the number of persons aged 85 years and older will increase by more than a factor of five by 2050.[4]

Falls are associated with many adverse health outcomes, including injury and death.[5-14] In 2003, the Centers for Disease Control and Prevention (CDC) reported that falls were the leading cause

of injury deaths, and the ninth leading cause of death from all causes, among those 65 years of age and older.[15] Between 30 and 40% of community-dwelling persons aged 65 years and older fall at least once per year.[5,16] This is complicated by the fact that the risk for falling and fall-related injuries increases with age.[5,16] The 2006 Behavioral Risk Factor Surveillance System reported that 13% of adults aged 65–69 years, 14% of those aged 70–74 years, 16% of those aged 75–79 years, and 21% of those aged 80 years and older fell during the 3 months preceding the survey.[16] Population-based studies of community-dwelling elderly persons have estimated annual total injurious fall rates from 84–229/1,000 persons[6,17] and fall injury hospitalization rates of 14/1,000.[7] Falls and fall-related injuries increase with age.[5,16] Hip fractures are an especially grave complication of falls in older adults, resulting in more hospital admissions than any other injury; the age-adjusted hospitalization rate for hip fractures was 775.7 per 100,000 population in 2003.[18] The death rate due to falls is 10/100,000 for those aged 65–74 and 147/100,000 for persons aged 85 and older.[19] There is a 10% to 20% reduction in expected survival during the first year following a hip fracture,[20-23] and roughly half of the survivors never recover normal function.[21]

Falls also predict quality of life and disability.[11,13] Twenty to 30% of those who fall suffer injuries that result in decreased mobility that limits subsequent independence.[8] Even falls that do not result in injury can lead to negative outcomes. In particular, experiencing a fall can increase an older person's fear of falling,[24,25] an important psychological outcome correlated with future falls.[26] Fear of falling leads older adults with and without a history of falling to limit activities, which eventually increases fall risk through functional decline, deterioration in perceived health status, and increased risk for admission to institutional care.[24,25]

Falls represent a significant burden on the U.S. health care system. In 2004, the mean inpatient hospitalization cost for falls in older adults was $17,483. The mean reimbursement costs for an emergency department and outpatient clinic were $236 and $412, respectively.[27] The estimated direct medical costs for fatal and nonfatal fall-related injuries for community-dwelling people aged 65 or older was $19.2 billion in 2000,[28] with one study estimating that this cost could reach $43.8 billion by 2020.[29]

Etiology and Risk Factors

Falls are caused by complex interactions between multiple risk factors, including long-term or short-term predisposing factors.[30-32] Interactions between these factors may be modified by age, disease, and environment.[31] Risk factors are often characterized as intrinsic (i.e., patient related) or extrinsic (i.e., external to the patient). Studies of intrinsic and extrinsic factors that could lead to falls have reported the following major risk factors: increasing age, muscle weakness, gait and balance impairment, postural hypotension, medication use, low body mass index, history of recurrent falls, vision impairment, special toileting needs, urinary incontinence, comorbid illness, depression, and cognitive impairment.[30,33-40] Repeated falls can each have a different etiology.[11,30,33,41]

At a population level, increasing age is the most important risk factor for falls. As people age, they may develop more than one risk factor for falls. Functional capacity may decrease with age due to physical and mental changes that lead to impairments in balance, gait, and strength.

People may develop impairments in vision and cognition with advancing age that may contribute to the risk for falls. Numerous medical conditions that are associated with age contribute to falls risks, including Parkinson's disease, stroke, history of diabetes mellitus, and arthritis. Increased medication use is also associated with disease and aging. Use of certain psychoactive and cardiac medications, and use of four of more medications, has been associated with an increased risk for falls.[42-44]

Rationale and Current Practice

Falls among older adults are prevalent and preventable. Falls may have a significant impact on subsequent morbidity, disability, and mortality risk. Various falls-prevention interventions targeting a number of fall risk factors have been evaluated. Falls prevention approaches aim to increase older adults' strength and balance, identify and remove hazards in their environment, increase awareness of falls and associated risk factors, correct clinical conditions that may increase fall risk, or some combination of these approaches.

Since 1996, two published evidence-based clinical guidelines for prevention of falls in older adults recommended routine assessment of falls history during the past year along with brief tests of gait and balance during primary care visits to identify older adults appropriate for further assessment and management to prevent falls.[28,45] The CDC recommends that an annual check-up for chronic medical conditions include a review of medications and a vision screening.[46] The American Geriatrics Society, British Geriatrics Society, and the American Academy of Orthopaedic Surgeons jointly recommend asking all older persons about falls at least once per year and endorse several falls-prevention interventions, including gait and exercise training, home visits, and medical management.[28] The National Institute for Clinical Excellence (NICE) recommends that older people's health care providers routinely ask about recent falls; that those reporting falls be observed for balance and gait deficits and considered for interventions to improve strength and balance; and that older adults appearing to be at high risk for falls be offered an individualized, multifactorial intervention including strength and balance training, home hazard assessment and intervention, vision assessment and referral, and/or medication review and modification.[45]

Despite these professional organizations' recommendations for routine falls risk assessment and intervention in older persons, physicians may under-detect falls risk.[47] A survey conducted in several regions of the United States found that most older adults are not asked about falls by their primary care physician.[48] Complexities due to the interaction and probable synergism among multiple risk factors for falling present barriers to physicians' risk assessment.[12] Among primary care providers, barriers to intervening to prevent falls include lack of awareness and appropriate knowledge, competing risks, availability of appropriate providers for referrals, transportation and time barriers, patient compliance, and lack of Medicare reimbursement.[49-51]

Since 2000, several published systematic reviews for prevention of falls in older adults have concluded that fall prevention interventions are likely to be beneficial. All of these reviews except two[52,53] included institutionalized and hospitalized populations in addition to community-dwelling older adults. A 2003 Cochrane review concluded that fall-prevention programs

including multifactorial assessment and management, muscle strengthening and balance training, more intensive home hazard assessment and modification, withdrawal of psychotropic medication, cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity, and some types of group exercise are likely to reduce falls.[54] Interventions including certain group exercise approaches, lower-limb strength training, nutritional or vitamin D supplementation, some home hazard modification approaches, pharmacological therapy, interventions using a cognitive/behavioral approach alone, hormone replacement therapy, and correction of visual deficiency were found to be of uncertain benefit. Brisk walking among women with recent upper-limb fractures was found to be of unlikely benefit. Chang and colleagues[55] concluded that a multifactorial assessment and management intervention was the most effective for reducing falls risk and that exercise interventions also had a beneficial effect. A systematic review of randomized or controlled clinical trials comparing the use of hip protectors with a control group found no evidence of reduced hip fracture incidence from hip protectors among community-dwelling participants.[56] A systematic review of multifactorial assessment and management found limited evidence that multifactorial fall prevention programs in primary care, community, or emergency care settings are effective in reducing the number of fallers or fall-related injuries.[57] Another systematic review of exercise programs for preventing falls found that exercise prevented falls in older people and reported that greater relative effects were seen in programs that included exercises that challenge balance, used a higher dose of exercise, and did not include a walking program.[58] A 2009 Cochrane review focused specifically on community-dwelling older adults, the focus of the current report. This review concluded that Tai Chi and group- or home-based exercise with multiple components reduced the risk for falling; multifactorial assessment and management reduced the rate of falls but not the risk for falling; and vitamin D did not reduce falls, but may do so in people with lower vitamin D levels.[53] Another review of complex interventions to improve physical function and maintain independent living in general, community-dwelling older adults concluded that fall-prevention interventions in general, and multifactorial assessment and management interventions specifically, successfully reduced the risk for falling.[52]

Previous USPSTF Recommendation

The 1996 USPSTF review focused on the effectiveness of counseling to prevent household and recreational injuries by age group, which included falls. The review focused on adults aged 65 years or older. The 1996 USPSTF recommendations related to falls are provided below.[1]

> *Counseling elderly patients on measures to reduce the risk for falling, including exercise (particularly training to improve balance), safety-related skills and behaviors, and environmental hazard reduction, along with monitoring and adjusting medications, is recommended based on evidence that these measures reduce risk for falls (B recommendation), although the effectiveness of routinely counseling older adults to prevent falls has not been adequately evaluated (C* recommendation).*
>
> *Recommendations for regular physical activity in elderly patients without contraindications can also be made based on other proven benefits. Intensive individualized home-based multifactorial intervention to reduce the risk for falls is recommended for high-risk elderly patients in settings where adequate resources are available to deliver such services. Elderly*

persons at high risk for falls include those aged 75 years and older or aged 70–74 with one or more additional risk factors including: use of certain psychoactive and cardiac medications (e.g., benzodiazepines, antihypertensives); use of 4 or more prescription medications; impaired cognition, strength, balance, or gait. (B recommendation)

There is insufficient evidence for or against the routine use of external hip protectors to prevent fall injuries. Once these devices become generally available, recommendations for their use in institutionalized elderly may be made on other grounds, including the large potential benefit and limited adverse effects. (C recommendation)*

There is insufficient evidence for or against post-fall assessment and intervention in institutionalized elderly persons in order to prevent falls. Recommendations for such interventions may be made on the basis of other benefits, including reduced hospitalizations and hospital days unrelated to falls. (C recommendation)*

Since the 1996 recommendations, the USPSTF has adopted a different methodology and rating system to evaluate evidence. The 1996 recommendations of the letter "C" are annotated as "C*" if the current USPSTF grading criteria would warrant a recommendation of "I."[59]

The 1996 recommendations included hospitalized patients and nursing home residents. The current focus of the USPSTF is preventive services provided by health care providers in an outpatient/ambulatory primary care setting.

Chapter 2. Methods

Key Questions and Analytic Framework

Using the methods of the USPSTF,[60] we developed an analytic framework (Figure 1) and four key questions (KQs) to guide our literature search and systematic review. These KQs were designed to evaluate the effectiveness and harms of primary care relevant interventions to prevent falling in older adults. Interventions relevant to primary care include those conducted in primary care, judged feasible to be delivered in primary care, or those easily referred from primary care (Appendix A). We grouped these interventions into five main categories: multifactorial assessment and management, single clinical treatment (with or without screening), clinical education/behavioral counseling, home hazard modification, and exercise/physical therapy. The KQs used for this search were:

KQ 1: Is there direct evidence that primary care interventions reduce fall-related injury, improve quality of life, reduce disability, or reduce mortality when used alone or in combination to reduce falling in community-dwelling older adults?

1a. Do these interventions reduce injury, improve quality of life, reduce disability, or reduce mortality in older adults specifically identified as high risk for falls?

KQ 2: Do primary care interventions used alone or in combination in community-dwelling older adults prevent falling?

2a. Do these interventions prevent falling in older adults specifically identified as high risk for falls?

2b. Are there positive outcomes other than reduced falling, and related morbidity and mortality, that result from primary care interventions to prevent falling?

KQ 3: What are the adverse effects associated with interventions to prevent falling?

KQ 4: How are high-risk older adults identified for primary care interventions to prevent falling?

Search Strategy and Selection Criteria

We initially searched for relevant existing systematic reviews in the Cochrane Database of Systematic Reviews, the Database of Abstracts of Reviews of Effects, and the Health Technology Assessments and MEDLINE databases, as well as the Institute of Medicine, the Agency for Healthcare Quality and Research (AHRQ), and NICE Web sites. We developed separate literature searches for each KQ based on our review of this literature. We used one good-quality 2003 Cochrane systematic review and meta-analysis, which conducted a comprehensive search and had detailed reporting, as a foundation for our literature search for KQs 1 and 2.[54]

We conducted the search for KQs 1 and 2 (Appendix B Table 1) in MEDLINE, the Cochrane Central Registry of Controlled Trials, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) from the end of the Cochrane review[54] search date of 2002 through February 2009. We limited the scope of KQ 4 to the high-risk definitions and assessments used in the primary care relevant interventions included for KQs 1 and 2. The search for KQ 3 focused on the harms of interventions included in KQs 1 and 2, which include multifactorial assessment and management, clinical education/behavioral counseling, home hazard modification, exercise/physical therapy, liquid energy and protein dietary supplementation, and hip protectors. We did not systematically search for harms of vitamin D supplementation or harms of vision screening and early treatment as these have both been reviewed in recent AHRQ-funded evidence reports. We searched in MEDLINE and CINAHL beginning in 1992 through February 2009, as 1992 was the earliest publication date of the included trials. For all KQs, we also obtained references from outside experts and through reviewing bibliographies of other relevant articles and systematic reviews.

Two investigators independently reviewed all abstracts and articles against inclusion and exclusion criteria. Discrepancies were resolved by consensus. Inclusion and exclusion criteria were developed for each KQ and are detailed in Appendix B Table 2. Briefly, for KQs 1, 2, and 4, we included only randomized controlled trials conducted among community-dwelling older adults in settings generalizable to the U.S. outpatient and ambulatory primary care populations (see Appendix A for a definition of primary care feasible or referable interventions). We excluded trials that were not designed to assess falls prevention based on assessment of falling or falls as a primary or secondary outcome. For KQ 3 (evaluating harms), we included both trials and observational studies that included primary care relevant interventions to prevent falls conducted in settings generalizable to U.S. primary care populations. Case series and case reports were excluded unless they addressed fatal harms. All trials were limited to English-language articles.

Article Review and Data Abstraction

After dual-reviewing articles for inclusion, two independent investigators critically appraised all included articles using design-specific criteria (Appendix B Table 3). Discrepancies in quality ratings were resolved by consultation with a third investigator. All studies rated as poor quality were excluded from the review. The USPSTF's Methods Workgroup has defined a three-category quality rating of "good," "fair," and "poor" based on specific criteria.[60] We reviewed a total of 1,179 abstracts and 425 articles for KQs 1, 2, and 4 and 765 abstracts and 84 articles for KQ 3 (see Appendix B Figure 1 for search results and article flow). A listing of excluded studies and reasons for exclusion can be found in Appendix C Table 6 (KQ 1), Appendix C Table 7 (KQs 2 and 4), and Appendix D Table 3 (KQ 3).

One investigator abstracted data from included studies into evidence tables and a second investigator reviewed these data for accuracy. We abstracted pre-specified study details into evidence tables, including population (age, gender, dwelling, race/ethnicity, socioeconomic status, fall history, inclusion and exclusion criteria); study design, location, and recruitment strategy; number assessed for eligibility, excluded, and randomized; definition and instrument used to identify population at risk, if any; intervention type (multifactorial assessment and

management, single clinical treatment, exercise/physical therapy, home hazard assessment, or counseling/education) and description, including key elements, intensity, and duration; length of followup; outcomes; and any recorded adverse effects. Furthermore, we categorized interventions by hours of contact, calculating overall dose in hours; high-intensity interventions had more than 75 hours of contact, moderate-intensity interventions had 26–75 hours, low-intensity interventions had 10–26 hours, and very low-intensity interventions had 0–9 hours. Relevant outcomes for abstraction were determined a priori. Outcomes for KQ 1 included fall-related fractures; quality of life as measured by the SF-12, SF-36, or EuroQol; disability as measured by activities of daily living and instrumental activities of daily living; and mortality (see Table 1 for a description of the outcome measures). For KQ 2, we included number of falls and person-years if provided, number of fallers, and number of frequent fallers. If raw numbers were not available, we also included rate ratio and odds ratio or risk ratio. For KQ 3, we included any adverse effect requiring unexpected medical attention (e.g., fall-related fractures, hospitalization, and mortality), as well as any paradoxical increase in falls or fallers. Complete evidence tables are included in Appendix C Tables 1–5 (KQs 1 and 2) and Appendix D Tables 1 and 2 (KQ 3).

This review included 39 articles representing 36 unique trials for KQ 1, 51 articles representing 47 trials for KQs 2 and 4, and 49 articles representing 48 trials and one systematic review for KQ 3.

Literature Synthesis

Evidence was synthesized by type of intervention into five main categories:

1. *Multifactorial assessment and management*. Multifactorial assessment and management interventions include a clinical assessment of two or more domains of functioning, generally supplemented by assessment of falls-related or general geriatric risk factors and/or conditions, with assessment results used as a basis for remedial management. In this review, multifactorial risk assessments may have been a comprehensive geriatric assessment or a falls-focused assessment, generally including two or more of the following screenings: vision, gait, mobility, strength, medication use, cognitive impairment, orthostatic hypotension, and environmental risks. Management approaches were categorized as comprehensive (treatments and education to comprehensively address risks, conditions, or functional limitations identified through the assessment) or noncomprehensive (less comprehensive interventions that provided only referral or provided treatment of selected risks, conditions, or functional limitations).
2. *Single clinical treatment*. Single clinical treatment protocols were defined as those with or without screening to identify persons needing treatment for a single fall-related risk factor, including vision correction, medication optimization/adjustment, assistive device prescription, pharmacological/nutritional interventions, treatment for orthostatic hypotension or urinary incontinence, and hip protectors.
3. *Clinical education or counseling*. Education or behavioral counseling included interventions delivered by primary care clinicians and related health care staff to assist

patients in adopting, changing, or maintaining behaviors related to fall risk, including exercise, fall risk reduction, and a home hazard checklist.

4. *Home hazard modification*. Home visits to identify and remove potential fall hazards, adding grab bars and handrails, or otherwise modifying the environment to improve mobility and safety.
5. *Exercise/physical therapy*. Organized programs for individuals or small groups that are part of a health care setting or widely available for referral in most communities, including physical exercise, mobility/gait training, muscle strengthening, balance training, and training for recurrent fallers. Programs may be home-based or occur in a community setting.

We conducted meta-analyses to quantitatively estimate the effect size of falls prevention interventions on fall-related and mortality outcomes. Separate analyses were conducted for each intervention category. For single clinical treatments, the analyses were further stratified by treatment type. In the case of trials with multiple intervention arms,[61-63] we calculated estimates for combined intervention arms when the interventions were variations of the same intervention type (i.e., two exercise programs).

For binary outcomes (fallers, fallers with fractures and mortality), a risk ratio and its standard error were calculated using the raw numbers reported from each study and combined using a random effects model.[64,65] We used the reported risk ratio[66] or odds ratio[67] for two studies[66,67] that did not report raw numbers. For the latter, the estimate of odds ratio was very close to 1 and provided a good approximate for risk ratio. For mortality, another analysis using the fixed effect model was also performed as a sensitivity analysis since the events were rare. In this case, a fixed effect model could provide a better estimate.[68] For the number of falls, the rate ratio and its standard error were obtained from the studies, if reported. If not, they were calculated based on a Poisson distribution if the study reported the number of falls and the corresponding person-time. Rate ratios were also combined using a random effects model.

In the two studies that used clustered randomization[69,70] and another study whose design had potential clustering effect,[71] we used the reported estimate if the study ate adjusted for clustering effect. Otherwise, we adjusted for clustering effect by multiplying the standard error of the risk or rate ratio by the square root of the design effect. Here, design effect=$1+(m-1)\rho$, where m is the average cluster size and ρ is the intracluster correlation coefficient. In the main analysis, ρ is assumed to be 0.60 for household clustered studies,[71] to be comparable with the reported values,[70] and 0.05 for a physician clustered study[69] as a conservative estimate. Sensitivity analyses were also performed by assuming a range of plausible values for ρ.

We assessed the presence of statistical heterogeneity among the studies using standard chi-square tests and the magnitude of heterogeneity was estimated using the I^2 statistic.[72] A series of random effects meta-regression models were used to examine possible sources of heterogeneity and to investigate whether the size of effect measure estimates were associated with various study-level characteristics. In all cases, the outcome was the log of the risk ratio for having a fall. Separate models were run for each predictor, which included mean age, average age of 80 or older (yes vs. no), percent female, percent with a fall during the previous year, presence of several specific components, comprehensiveness or intensity of the intervention, and whether the sample was comprised of high-risk participants. See Appendix F Table 3 for detailed descriptions of how these predictors were defined and which group of trials comprised the samples for each of the

predictors. We also conducted sensitivity analyses to determine if selecting the more intense or more comprehensive intervention arm or excluding outliers changed effect size or statistical significance. Test of publication bias on whether the distribution of the effect sizes was symmetric with respect to the precision measure were performed using funnel plots and Egger's linear regression method[73] when the number of studies was about 10 or more.[74]

All analyses were performed using Stata 10.0 (StataCorp LP, College Station, Texas).

USPSTF Involvement

The authors worked with USPSTF liaisons at key points throughout the review process to develop and refine the analytic framework and KQs and resolve issues around scope and approach. AHRQ funded this research under a contract to support the work of the USPSTF. AHRQ staff provided oversight throughout the project.

Chapter 3. Results

To be included in this review, an intervention was required to measure falls as a primary or secondary outcome. Thus, the 36 unique trials (39 articles) reviewed for KQ 1 are a subset of the 47 trials (51 articles) reviewed for KQ 2. Falling was assessed in a variety of ways in these intervention studies (e.g., number of fallers, fall rate, time to first fall, and number of frequent fallers). Number of fallers is the most consistent measure of falling across all studies with the remaining measures used selectively. To enhance comparability, we primarily discuss number of fallers (risk for falling) in the results below. We also reported fall rate if data were available.

KQ 1. Is There Direct Evidence That Primary Care Interventions Reduce Fall-Related Injury, Improve Quality of Life, Reduce Disability, or Reduce Mortality When Used Alone or in Combination to Reduce Falls in Community-Dwelling Older Adults?

Thirty-six of the 47 primary care interventions to prevent falling included in this review reported data on at least one health outcome.

Three studies[67,75,76] pre-specified mortality as a health outcome and reported no reduction in mortality associated with the intervention. All-cause mortality was assessed in 26 studies as part of attrition (10 multifactorial assessment and management,[62,69,77-84] 10 single clinical treatment,[66,67,85-92] and six exercise/physical therapy[63,93-97]). We found no evidence that primary care interventions had a significant impact on all-cause mortality after 3 to 36 months (Figure 2). The pooled relative risk for all-cause mortality was 0.90 (95% CI, 0.80 to 1.02) with low statistical heterogeneity (I^2=0%). Results from the fixed effect model were similar. Data that would allow us to evaluate fall-related mortality were not available in the evaluated studies. The results do not rule out the possibility of a longer-term influence on all-cause mortality or fall-related mortality. Given that all-cause mortality was not identified as a health outcome in most studies that reported deaths, mortality is not discussed further as part of the health outcome results.

The evidence for fall-related fracture includes 16 unique trials assessing multifactorial assessment and management,[69,75,76,82] hip protectors,[66,85] correction of vision-related defects,[87,90,91] vitamin D supplementation,[67,86,89,98,99] and exercise or physical therapy interventions.[96,100] Quality of life was reported in 12 unique trials assessing multifactorial assessment and management,[79,81,84,101] correction of vision-related defects,[87,91] vitamin D supplementation,[102] clinical education/behavioral counseling,[103] and exercise or physical therapy.[96,100,104-106] Disability was reported in 13 unique trials assessing multifactorial assessment and management,[75,77-81,84] correction of vision-related defects,[87,91] and exercise or physical therapy.[94,97,105-107] Results from these trials are discussed by intervention type. Given that few studies reported each of these health outcomes, the results are not robust. Furthermore, these results may reflect selective reporting and should be interpreted with caution.

Multifactorial Assessment and Management

Summary of findings. Of 14 multifactorial assessment and management interventions, 11 fair- to good-quality trials reported health outcomes identified for inclusion in this review. These studies included measures of fall-related fractures,[69,75,76,82] quality of life,[79,81,84,101] and disability (Table 2).[75,77-81,84] All of these trials were conducted in high-risk populations; in seven trials participants were selected based solely on history of a fall[75-77,79,80,82,84] and in three trials, based on presence of at least one of several fall-related risk factors (including history of a fall).[69,78,81] While these studies provided no evidence that multifactorial assessment and management interventions improved quality of life, they provided limited evidence of reduced fall-related fractures and reduced disability.

The four fair-quality trials (n=1,282) that assessed fall-related fractures among older adults showed a nonsignificant reduced risk for fracture associated with multifactorial assessment and management.[69,75,76,82] The pooled relative risk was 0.83 (95% CI, 0.61 to 1.14) with low heterogeneity (I^2=0%). In one trial of a multifactorial intervention, Tinetti and colleagues[69] reported fractures in four people out of 147 in the intervention group, compared with seven people out of 144 in the control group, during the 12-month followup period. We calculated a relative risk of 0.49 (95% CI, 0.09 to 2.58) for this trial. Hogan and colleagues reported fractures in three out of 75 in the intervention group, compared with five out of 77 in the control group, during the 12-month followup period. We calculated a relative risk of 0.62 (95% CI, 0.15 to 2.49) for this trial. Davison and colleagues[76] reported fractures in six intervention subjects (4%) compared with 11 (7%) in controls during 12 months of followup (RR, 0.53 [95% CI, 0.20 to 1.39]). Spice and colleagues[75] reported fractures in 40 of the subjects in the more intensive intervention group (19%) compared with 35 (22%) of the controls (OR, 0.90 [95% CI, 0.61 to 1.34]). These studies were not powered to evaluate a difference in fracture rate. These studies relied on self-reports of fall-related fractures using monthly calendars with followup phone calls to fallers to assess injuries resulting from the fall.

None of the four fair- to good-quality multifactorial assessment and management trials (n=914) in older adults reported a significant change in quality of life after 12 months of followup.[79,81,84,101] Three trials assessed change in self-reported quality of life using the SF-36 instrument,[79,81,101] and the fourth used the EuroQol instrument.[84] Two of these studies reported blinding of outcome assessors.[79,84]

Seven fair-quality multifactorial assessment and management trials (n=3,237) evaluated effects on disability with mixed results.[75,77-81,84] One trial (n=1,242) including older adults with one or more fall risk factors reported that a multifactorial assessment and management program was associated with a significant difference in the percentage of participants with worsened disability in the intervention group (15%) compared with controls (20%) after 12 months ($p<0.05$).[78] Limitations in activities of daily life were assessed using the Medical Outcome Study physical function scale. Two studies reported slightly less disability, based on the Barthel Index, in the intervention group, compared with the control (mean difference in change ranged from 0.6 to 1.0 on a 100 point scale), representing a greater improvement in one study[80] and less of a decline in the others.[75,77] This difference, however, is not clinically meaningful. The remaining three studies reported no significant improvements in disability.[79,81,84]

Single Clinical Treatment

Eleven of the 16 clinical trials reported fall-related fracture, quality of life, or disability (Table 3). Interventions that included a single clinical treatment are diverse, and thus it is more relevant to describe the evidence for subgroups of similar interventions: vitamin D (with or without calcium),[67,86,89,98,99,102] vision correction,[87,90,91] and hip protectors.[66,85] Eight of the 11 trials were restricted to women[66,67,85-87,89,91,98] and all except one were conducted in high-risk populations.[86]

Summary of findings. *Hip protectors.* Hip protectors were not associated with a significant reduction in 24-month risk for fall-related fractures among high-risk women with an average age of 78–83 years (n=4,769) (Figure 3).[66,85] One third (31%) to one half (53%) of women wore their hip protectors as intended.

Vision correction. Three of four vision-correction trials (n=1,161) among adults aged 78–81 years on average reported health outcomes.[87,90,91] All studies were rated fair to good quality. The results for fall-related fractures were mixed and data were not pooled due to very high statistical heterogeneity. One of the trials of expedited cataract surgery was associated with a reduced risk for fractures,[87] while the other was associated with a nonsignificant increased risk.[91] The third trial treated vision deficiencies based on screening results and reported a nonsignificant increased risk for fall-related fractures (OR, 2.5 [95% CI, 0.5 to 12.5]).[90] Additionally, no significant differences were observed in 6-month change in disability among 545 participants[87,91] or quality of life among 239 participants.[91]

Vitamin D. Six of eight vitamin D trials[67,86,89,98,99,102] reported health outcomes 6 to 36 months after the beginning of treatment. Trials included healthy ambulatory women and men aged 65 years or older;[86,99] individuals with vitamin D deficiency and a history of falling,[89] vitamin D deficiency without a history of falling,[98] or a history of falling without vitamin D deficiency;[102] and women at risk for hip fracture.[67] No trials evaluated disability. All studies were rated as fair quality.

Five studies (n=4,252) tabulated the number of people who experienced a fall-related fracture[67,86,89,98,99] and one study assessed quality of life.[102] Risk for fall-related fractures was not reduced over 12 months among women aged 71–77 years on average (pooled RR, 0.85 [95% CI, 0.64 to 1.12]) (I^2=0%) (Figure 4). The trial that evaluated improvements in quality of life found no significant improvement.[102]

Study details. *Hip protectors.* Two fair-quality trials[66,85] (n=4,769) assessed the influence of hip protectors on overall risk for fracture among high-risk noninstitutionalized women over 24 months of followup, during which 415 women fell in one study [85] and there was a total of 1,437 falls in the other study (mean, 2.2 to 2.7 per person).[66] Both interventions provided participants with semi-rigid shields sewn into modified underwear. One trial (n=600) provided intervention-group participants with a nurse to assist with fitting the protectors and encourage adherence. The nurse made three home visits followed by two telephone calls to intervention participants.[66] The other intervention (n=4,169) mailed the hip protectors with an educational pamphlet.[85] While adherence was higher in the trial including the nurse contact (53%)[66] compared with the trial without contact (38%)[85] at 6 months, neither was associated with a significant reduced risk for any fracture or hip fractures in intention-to-treat analyses. The pooled relative risk for experiencing a fall-related fracture during 24 months after initiation of the intervention was 0.89 (95% CI, 0.75 to 1.06) (I^2=0%) (Figure 3).

Vision correction. Two trials evaluated expedited cataract surgery.[87,91] A third trial evaluated single clinical treatment of vision problems identified through screening.[90] All of the participants (n=1,161), women aged 78–81 years on average, were identified as high-risk populations by virtue of selection for frailty or for an age of 70 years or older and cataracts. Fall-related fractures were self-reported in all three trials and were assessed by monthly postcards, a telephone followup (if the postcard was not returned),[90] or during a telephone interview or clinic visit every 3 months.[87,91]

The trials of expedited cataract surgery among women with unoperated cataracts[87,91] (n=545) found mixed results. Harwood and colleagues[87] reported a significant risk reduction for fall-related fracture (four persons in the intervention group compared with 12 in the control group [p=0.04]). Foss and colleagues,[91] on the other hand, reported a nonsignificant *increased* risk in the intervention group compared with the control group. Expedited cataract surgery trials also reported no significant reduction in disability, as measured by the Barthel Index,[87,91] or quality of life, as measured by the EuroQol.[91] An intervention including an eye exam and treatment was associated with a significantly increased risk for sustaining a fall-related fracture in the intervention group, compared with the usual care control.[90]

Vitamin D. In a fair-quality study (n=148) restricted to women who were vitamin D deficient (25-hydroxycholecalciferol level<50 nmol/liter), a regimen of vitamin D and calcium supplement (400 IU vitamin D and 600 mg calcium daily) for 8 weeks was associated with a 4% risk for sustaining a fall-related fracture over 1 year, compared with 9% in the control group that received only the calcium supplement.[98] This difference was not statistically significant, although the study may have been underpowered. A study (n=242) in healthy older adults that was also not powered to detect a significant reduction in the number of fractures reported 12 fractures in the calcium plus vitamin D group (800 IU of cholecalciferol per day) compared with 19 fractures in the control group that received calcium only (p=0.12).[99] Another study (n=246) in healthy women reported a nonsignificant reduction in risk for nonvertebral fractures (RR, 0.60 [95% CI, 0.28 to 1.27]) for 0.25 μg of calcitriol twice per day compared with placebo.[86] Another fair-quality study[89] (n=302) restricted to women who were vitamin D deficient (25-hydroxycholecalciferol level<24.0 nmol/liter) and had fallen at least once during the previous year evaluated a higher-dose vitamin D and calcium supplement (1000 IU vitamin D2 and 250 IU calcium citrate tablets twice daily) compared with calcium supplementation alone for 1 year. One woman in each group experienced a fall-related fracture during the year of followup.[89] A large study (n=3,314) among women with at least one risk factor for hip fracture evaluated a vitamin D plus calcium supplement (two tablets of 1000 mg of calcium and 800 IU of vitamin D3 daily) for 6 months.[67] Women in the intervention group also received a brief education/counseling visit with a nurse that focused on reducing fracture risk and a pamphlet describing how to consume adequate calcium and vitamin D from dietary sources. The control group only received the pamphlet in the mail. After a median followup of 25 months, the risk for fall-related fractures was 4.8% in the intervention group and 5.0% in the control group.

Change in quality of life was assessed in an intervention comparing an intramuscular injection of 600,000 IU of ergocalciferol with a placebo injection among men and women (n=139) who had fallen during the previous 8 weeks.[102] Dhesi and colleagues found no significant change in the intervention group between baseline and 6-month followup in any of the eight subscales of the SF-36 measure of health-related quality of life. Control participants, on the other hand, reported

small but statistically significant improvements in two of the subscales (social functioning and role-emotional). The difference in changes between the two groups was not assessed.

The followup period for all of these trials was 6 to 36 months. As such, the absence of any influence on distal outcomes may reflect inadequate time to see an improvement or rare events, in the case of fractures.

Clinical Education/Behavioral Counseling

Summary of findings. One good-quality study (n=310) of a low-intensity behavioral counseling intervention (<26 contact hours) in community-dwelling older adults reported no significant difference in change in quality of life after 14 months[103] (Table 4). The 7-week intervention included 2 hours per week of group sessions taught by an occupational therapist. The sessions were designed to assist older adults in developing strategies to reduce fall risk. The control group received two social visits with an occupational therapy student. Quality of life was assessed using the physical function and mental function composite scores of the SF-36. All women included in the trial had a history of at least one fall during the previous year or had a fear of falling.

Home Hazard Modification

No trials reported health outcomes related to home hazard modification interventions other than mortality (Table 5).

Exercise and Physical Therapy

Summary of findings. Of 17 exercise or physical therapy intervention trials, seven fair-quality trials (n=1,072) of physical activity in community-dwelling older adults assessed multiple health outcomes, including measures of fall-related fractures,[96,100,107] quality of life,[96,100,104-106] and disability[94,97,105-107] (Table 7). Six of these trials were conducted in a high-risk population: three were identified based on gait and balance impairments,[100,104,105] two were restricted based on chronic disease status (Parkinson's disease)[96] or recent stroke,[94] and one was restricted to women aged 80 years or older.[97] The remaining trial included an unselected population.[107]

In two trials (n=201), exercise interventions addressing muscle strengthening and balance did not significantly reduce risk for fall-related fractures in community-dwelling high-risk older adults 3 to 6 months after initiation of the intervention.[96,100] The third trial included a Tai Chi intervention and did not report any fracture-risk data.[107]

Only one of the four studies evaluating change in quality of life found significant improvement after 3 to 6 months of followup.[95,96,104-106] Ashburn and colleagues[96] reported a significant difference of 5.7 units (95% CI, 0.47 to 11.0) in change in quality of life, as measured by the EuroQol instrument, after adjusting for baseline EuroQol, balance, functional reach, and disability. The remaining three trials assessed quality of life with the SF-36 instrument.[95,104-106] Rubenstein and colleagues[100] reported a nonsignificant improvement of 7 points in quality of life (physical function subscale) in the intervention group compared with the control group (p=0.08).

No significant reduction in disability was observed among older adults followed for 4 to 6 months (n=708).[94,97,105-107] The followup period for all of these trials was short. As such, the

absence of any influence on distal outcomes may reflect inadequate time to see an improvement or rare events, in the case of fractures. Additional details about the interventions are provided below in KQ 2.

KQ 2. Do Primary Care Interventions Used Alone or in Combination in Community-Dwelling Older Adults Reduce Risk for or Rate of Falls/Fallers?

Multifactorial Assessment and Management Interventions

Summary of findings. In seven arms (n=3,195) of comprehensive multifactorial assessment and management interventions among older adults,[69,75,76,78,80,82,108] the interventions were associated with reduced risk for falling compared with usual care 12 months after entry. The pooled estimate of relative risk was 0.75 (95% CI, 0.58 to 0.99), with high heterogeneity (I^2=86.4%) (Figure 5). Among the nine noncomprehensive multifactorial clinical assessment intervention arms,[71,75,77,79,81,83,84,108] the risk for falling was not reduced (RR, 1.04 [95% CI, 0.98 to 1.10]) (Figure 6). The statistical heterogeneity of these trials was low (I^2=0%).

Study details. Fourteen trials of multifactorial assessment and management interventions[62,69,71,75-84,101] measured fall outcomes. These trials (n=5,570) randomized community-dwelling adults aged 65 years or older (Table 6). The average age of participants was 75 years or older, except for one study in which the average age was 72.5 years.[78] The majority of participants were women (percentage ranged from 40% to 77%) and none of the studies reported a substantial proportion of nonwhite or Hispanic participants. Only four of the trials were conducted in the United States,[69,78,83,101] while the majority were conducted in other countries, including the United Kingdom,[75-77,80] the Netherlands,[71,84] Australia,[62,81] and Canada.[82] Most trials identified participants through primary care practices or insurance rolls, while four identified community-dwelling participants presenting to the emergency department for a fall-related event.[76,77,80,84] One study recruited directly from the community.[83] Seven trials recruited participants who had a history of falling,[75-77,79,80,82,84] and four trials recruited a high-risk population by screening for multiple possible risk factors.[62,69,71,78,101] The remaining two trials were conducted in unselected populations.[81,83] In the eleven studies that reported a history of falls during the 12-month period preceding the trial initiation, the percentage of individuals experiencing a fall ranged from 33% to 100%.[69,71,75-80,82,84,101] Most studies excluded older adults with evidence of cognitive impairment or physical disability.

Components of multifactorial assessment and management interventions are described in Table 8. The primary fall risk factors identifiable during a clinical evaluation were generally evaluated as part of the multifactorial assessments;[109] the majority of assessments included visual acuity, gait and balance, medication use, and home environment. We evaluated a total of 16 different active treatment arms in 14 trials that ranged from comprehensive (multifactorial assessment and provision of medical and social care) [69,75,76,78,80,82,108] to noncomprehensive (multifactorial assessment and referral or limited management).[62,71,75,79,81,83,84,101] Control groups primarily received usual care, although two trials (described in three studies) provided social visits

designed to mirror time and attention provided to the intervention group.[69,82,110] These may at least partially explain the reduced effect size reported in one of these trials.[82]

We conducted meta-analyses of all 14 trials reporting risk for falling. The reduced risk for falling was not statistically significant (RR, 0.90 [95% CI, 0.80 to 1.02]), but the statistical heterogeneity was substantial (I^2=79.6%). After removing one study that appeared to be an outlier,[80] the heterogeneity was reduced to 44.9% and the relative risk estimate was attenuated to 0.96 (95% CI, 0.90 to 1.04). Publication bias was assessed using the funnel plot and Egger's regression test; no important publication bias was detected. Of the study-level factors evaluated in a meta-regression, only comprehensiveness (comprehensive vs. noncomprehensive) explained a significant amount of the heterogeneity in the effect estimate (-0.30 [SE, 0.11]) (p=0.009).

Given the significant results in the meta-regression for comprehensiveness, we conducted meta-analyses stratified by the comprehensiveness of the intervention (Figures 5 and 6). The pooled relative risk was 0.75 among the seven comprehensive trial arms (95% CI, 0.58 to 0.99). The statistical heterogeneity, however, was substantial (I^2=86.4%). This analysis was restricted to the most comprehensive arm of the trials with two intervention arms.[62,75] After removing an outlier,[80] the heterogeneity was substantially reduced to 44.4% and the relative risk remained significant (RR, 0.90 [95% CI, 0.82 to 0.99]). The remaining heterogeneity was not explained in meta-regressions using study-level variables. Among the seven noncomprehensive trial arms, the risk for falling was not reduced (RR, 1.04 [95% CI, 0.98 to 1.10]). The statistical heterogeneity was low (I^2=0%).

Among the comprehensive interventions, one study also reported a significant reduction in fall rate. Tinetti and colleagues reported 31% reduction in fall rate in the intervention group compared with the control group (incidence rate ratio, 0.69 [95% CI, 0.52 to 0.90]).[69] Only one noncomprehensive trial measured fall rate and reported no reduction in the rate of falling.[79]

Study design and quality. We rated two[79,83] trials as good quality and the remaining trials as fair quality (see Appendix B Table 3 for quality criteria). Most trials did not report whether treatment allocation was blinded or whether those conducting followup assessments were blind to the treatment condition. The majority had retention rates between 70% and 90%. While recent trials used prospective methods to assess falls, older studies [78,101] assessed falls retrospectively after 12 months. Most trials reported the percentage of fallers based on the number available for analysis rather than the number randomized.

Overall, the results of these trials may not be generalizable to nonwhite or Hispanic older adults, or older adults with cognitive limitation or physical disability. Two studies relied on self-referral from community-based or health-care based advertising,[82,83] and thus may have enrolled participants who were more motivated to participate in interventions. The 12-month risk for falling in the control group ranged from 37%[78] to 79%[82] following study initiation.[82] Overall, the risk for falling in the included participants was higher than that of the average community-dwelling adult aged 65 years and older, of whom approximately one third fall every year.[16] Thus, these findings may be most relevant to a high-risk population. Additionally, the majority of these studies were conducted outside of the United States and may vary from "usual care" in the United States.

Single Clinical Treatment

Sixteen trials evaluating single clinical treatment strategies to reduce falling are described by subgroups: vitamin D (with or without calcium),[67,86,89,92,98,99,102,111] vision correction,[61,87,90,91] hip protectors,[66,85] medication withdrawal,[112] and nutritional supplementation[88] (Table 9).

Summary of findings. *Vitamin D.* Among seven fair-quality trials (n=5,216) in adults aged 71–77 years on average, vitamin D with or without calcium was associated with a reduced risk for falling during 6 to 36 months of followup (pooled RR, 0.83 [95% CI, 0.75 to 0.91]) (I^2=14.6%).[67,86,89,92,98,99,102,111] Only one of the individual trials,[99] however, reported a statistically significant reduction in fall risk (Figure 7).

Vision correction. Among four fair- to good-quality trials (n=1,437) in adults aged 76–81 years on average, risk for falling during 12 to 18 months of followup was not reduced as a result of vision correction (improving acuity or correcting cataracts with surgery).[61,87,90,91]

Hip protectors. In two trials (n=4,769), the effect of hip protectors on falling risk was mixed among high-risk women aged 78–83 years on average, with a significant protective effect in one trial[85] and no effect in the second.[66] Adherence to the hip protectors was low in both studies.

Medication withdrawal. One fair-quality study (n=48) among adults with an average age of 75 years reported no reduction in fall rate associated with medication withdrawal (with or without exercise).[112] An additional three multifactorial assessment and management interventions also included medication assessment and management and were effective in preventing fallers.[78,80,82]

Protein supplementation. In one fair-quality study (n=50) among frail adults with an average age of 78 years, nutritional supplements and home visits over 12 weeks were significantly associated with a reduced risk for falling (zero falls in the intervention group vs. five falls in the control group at 3 months) ($p<0.05$).[88]

Study details. *Vitamin D.* We evaluated eight trials (n=5,216) of vitamin D supplementation conducted in community-dwelling older adults aged 71–77 years on average (Table 9). These studies included more women than men. Four of the trials' participants were 100% female and the remaining four's participants ranged from 51% to 80% female. Six studies did not report race or ethnicity; the two that did consisted primarily of nonHispanic white participants (77% to 97%).[102,111] Four trials were conducted in populations defined as high risk by virtue of recent falls and/or vitamin D deficiency, and the remaining four studies used populations that were unselected except for age (≥65 years).

The overall vitamin D intervention dosages ranged from 22,400 IU over 8 weeks[98] to 766,500 IU over 36 months.[111] Delivery was variable across studies, including intramuscular injection, daily oral dose, and mega oral dose every 4 months. Two of the studies evaluated ergocalciferol (vitamin D2)[89,102] and the remaining studies evaluated cholecalciferol (vitamin D3). Five trials included calcium supplements with the vitamin D. The control groups ranged from no intervention to placebo to calcium supplements only.

Among adults aged 71–77 years on average (n=5,216), vitamin D with or without calcium was associated with a reduced risk for falling during 6 to 36 months of followup (pooled RR, 0.83 [95% CI, 0.75 to 0.91]) (I^2=14.6%). However, only one of the individual trials reported

statistically significant reductions (Table 9, Figure 7).[99] Only one study evaluated differences in fall rate and reported a significantly lower rate of falls in the group receiving calcitriol compared with the group receiving placebo (0.27 falls/year in intervention group vs. 0.43 falls/year in placebo group [p=0.0015]). The majority of these trials were not sufficiently powered to observe a significant reduction in risk for falling. Excluding one large study,[67] these individual studies randomized between 139 to 445 participants. Two of the trials conducted analyses of the cumulative development of the number of subjects with no falls.[99,111] These analyses suggest that the minimum required time to observe an effect on falls outcomes appears to be 12 months and that between group differences may be maintained but probably do not increase after 12 months.

All studies were rated as fair quality. Only three trials assessed falls prospectively using a diary or questionnaire;[86,99,102] the remaining trials assessed falls retrospectively with periods of recall ranging from 6 weeks[89] to 12 months.[98]

Vision correction. Four trials (n=1,437) in adults aged 76–81 years on average evaluated the effect of vision correction (after screening for visual impairment) on risk for falling. Three trials were conducted in populations deemed high-risk because of frailty or having uncorrected cataracts (with or without a history of falling). The fourth study had a population that was unselected except for age (>70 years). Two studies included only women and evaluated expedited cataract surgery compared with routine wait controls.[87,91] One of the trials of expedited cataract surgery evaluated first cataract surgery,[87] while the other evaluated second cataract surgery.[91] The other two studies primarily included women (60%–68%) and evaluated vision screening and referral/treatment.[61,90]

None of the trials significantly reduced the risk for falling.[61,87,90,91] The trial evaluating first cataract surgery, however, reported a significantly reduced fall rate among the intervention group participants compared with the controls. Rate of falling was reduced by 34% in the operated group (incidence rate ratio, 0.66 [95% CI, 0.45 to 0.96]).[87] One of the trials that evaluated the effect of visual treatment impairment based on screening results reported a statistically significant 30% increased risk for falling in the intervention group compared with the control group (95% CI, 14 to 50).[90] This result is described further in KQ 3 (harms). Studies were rated as fair- to good-quality.

Hip protectors. In one large, fair-quality study (n=4,169), hip protectors were associated with a significant reduction in 12-month risk for sustaining a fall among high-risk women with an average age of 78 years (28% in the intervention group vs. 38% in the control group [p<0.001]).[85] These results may be conservative, as the 6-month adherence rate among the intervention group was 38%. A second smaller, fair-quality study reported no significant effect of hip protectors on the total number of falls or on being a frequent faller.[66] This study employed a study nurse to make routine home visits to encourage use of the hip protectors among intervention group participants. While the adherence was higher in this study than in others, it was still low (57% after 12 months) (Table 9). Additional study details were provided in KQ 1.

Medication withdrawal. One fair-quality study (n=48) evaluated the influence of medication withdrawal (with and without exercise) on fall outcomes among adults with an average age of 75 years and taking psychotropic medications, but did not report fall risk.[112] The number of falls per group was lower in the intervention group (17 falls out of 48 people) compared with the control group (29 falls out of 22 people). The fall rate, however, was not significantly lower among the intervention group compared with the groups that did not receive

medication withdrawal (difference of 0.64 falls/person-year [95% CI, -0.07 to 1.35]) (Table 9). These results compare the rate of falling among the trial arms that received medication withdrawal (medication withdrawal alone and medication withdrawal plus exercise) to the rate of falling in the trial arms that did not receive medication withdrawal (exercise plus regular medications with no alteration and a control group that received only regular medications). An additional four multifactorial assessment and management interventions also included medication assessment and withdrawal.[75,78,80,82] All four trials were associated with a significantly reduced risk for falling. The pooled estimate for all five studies together was noninformative because of high statistical heterogeneity (I^2=91.9%). These studies have been described previously, thus they are not discussed further in this section.

Protein supplementation. One small study (n=50) evaluated the effect of protein supplementation among frail adults with an average age of 79 years.[88] The majority of participants were female and had less than high school education. All were frail and at nutritional risk, defined as involuntary weight loss of greater than 5% body weight in previous month, greater than 7.5% in 3 months, or greater than 10% in 6 months, and a body mass index of less than 24.

The intervention group received 235 mL of liquid supplement twice a day and home visits once per week. The control group received weekly home visits providing encouragement and dietary suggestions. The intervention was associated with a reduced risk for falling (zero falls in the intervention group vs. five falls in the control group at 3 months [p<0.05]).

This study was rated fair quality. Outcome assessors were blinded to intervention status and there was no attrition from assessment during the 3-month followup. However, participants in the control group were slightly more likely to report having a good appetite at baseline (suggesting potentially better health) and falls were assessed retrospectively at 6 and 12 weeks.

Exercise and Physical Therapy

Summary of findings. Of the 17 fair- to good-quality trials (n=3,716) of exercise/physical therapy in community-dwelling older adults, 13 were consistent with a reduced risk for falling. The majority of differences, however, were not statistically significant. Pooled data suggest that those participating in an exercise/physical therapy intervention were less likely to fall during followup (RR, 0.86 [95% CI, 0.80 to 0.92) (I^2=5.4%) (Figure 8). There was an indication that exercise had a greater effect on fall risk in the trials that were conducted in higher-risk populations (Figures 9 and 10).

Study details. These trials (n=3,985) randomized community-dwelling older adults to exercise/physical therapy interventions (Table 10). The majority of participants were aged 75 years or older on average. In five trials, the average age was 80 or older.[63,93,95,113] Women were more common than men in the majority of trials; most trials consisted of between 60% and 100% female participants. One study was restricted to men,[100] and three trials were evenly split or had more men.[94,96,105] The majority of trials did not report race or ethnicity. The trials reporting race or ethnicity data were primarily nonHispanic white (≥90%). Ten of the physical activity trials were conducted in high-risk populations. Of these 10 trials, three were identified based on gait and balance impairments,[100,104,105] one based on falls during the past year or one or more risk factors for falling,[93,114] one based on use of psychotropic medication,[112] and one based on visual impairment; two were restricted based on chronic disease status (Parkinson's disease plus at least

one fall in the previous year)[96] or recent stroke,[94] and one included only people with a recent hospitalization or period of bed rest.[107] The remaining studies were conducted in unselected populations.[61,95,97,107,108,115,116] The percentage of participants who reported falling during the 12 months preceding the intervention (excluding trials that selected participants based on history of a fall at baseline) ranged from 10% to 64%.

Trial characteristics are listed in Table 11. Exercise/physical therapy trials included a variety of components that can be summarized into three major categories: gait, balance, or functional training; strength or resistance exercise; and general exercise (including walking, cycling, aerobic activity, and endurance exercise). All but one trial included gait, balance, and/or functional training. The majority of trials included at least two exercise components, about half of which were primarily group-based exercises conducted in the community. The remaining trials were individual-based and generally conducted at home. Five studies were conducted in the United States. The remaining trials were conducted in the United Kingdom, Finland, Australia, and New Zealand.

We evaluated a total of 20 treatment arms in 17 unique trials. Three trials evaluated 12-month interventions.[63,95,104] The duration of the remaining trials ranged from 6 to 26 weeks (median, 12.5 weeks). Treatment intensity (estimated in hours of contact) ranged from 2 to 80 hours. Control groups varied from no treatment/usual care to social visits or educational information unrelated to falls. One Tai Chi intervention matched the number of contact hours in the intervention group with stretching and relaxation classes.[116]

The majority of trials were consistent with a beneficial effect on falling or fall rate compared with controls. Most of these differences, however, were not statistically significant. Across all trials, the 12-month risk for falls in the intervention group compared with the control group ranged from 39% lower[116] to 34% higher.[94] Meta-analysis of all 15 trials reporting fall risk was conducted (Figure 8). Among physical activity interventions, the pooled relative risk estimate for reduction in percentage of fallers comparing the intervention to the control group was 0.86 (95% CI, 0.80 to 0.92), with minimal heterogeneity (I^2=5.4%). We detected no evidence of publication bias based on Egger's test and a visual inspection of Begg's funnel plot. Two intervention arms of a trial intended to improve balance (Tai Chi or platform training) were combined in our meta-analysis.[107] Results were unchanged when the more intense of the two arms was included. A parallel analysis was conducted on the subset of trials that reported fall rate, which resulted in a very similar pattern of results (RR, 0.76 [95% CI, 0.67 to 0.89]) (I^2=55.4%).

Three of the trials had intervention arms that included exercise plus another intervention type.[61,63,112] One trial included an intervention arm that evaluated exercise plus home hazard modification in addition to an exercise-only arm.[63] One trial included an intervention arm that evaluated exercise plus treatment of visual impairment and an intervention arm that evaluated exercise plus home hazard modification in addition to an exercise-only arm.[61] A third trial evaluated exercise (exercise alone and exercise plus medication withdrawal), comparing these groups to a group that did not receive exercise (a medication withdrawal group plus the control group). We conducted an additional meta-analysis including these combination intervention arms and the results were similar, although the statistical heterogeneity was slightly greater (I^2=12.4%).

Meta-regression identified no study-level variables that explained significant within-study variability. Visual analyses examining pattern of results by intervention intensity, number of

intervention components, type of intervention (group vs. not), and risk status of participants (selected vs. unselected and percentage fallers in previous year) confirmed that there was no pattern in intervention effectiveness by these variables. Differences in results, however, were observed when the observed fall risk among the control group after randomization (>35% vs. <35%) was used as a measure of risk status. This stratification roughly represents the groups above and below the average fall risk for people aged 65 years or older. Meta-analyses stratified by fall risk in the control group support the qualitative observation. The pooled risk from 10 trials with more than 35% of the control group falling during the intervention was similar to the overall results (RR, 0.84 [95% CI, 0.78 to 0.91]) (I^2=1.1%) (Figure 10). However, the pooled relative risk among the five trials with 35% or less of the control group falling was not significant (0.98 [95% CI, 0.82 to 1.62]) (I^2=0%) (Figure 9).

Study design and quality. One trial was rated good quality,[115] while the remaining trails were rated fair quality (see Appendix B Table 3 for quality criteria). It is not possible to blind participants to their group assignment in physical activity trials, and most of the trials did not report whether those collecting followup assessments of falls were blinded to intervention status. The majority of the interventions did not provide an attention control to address a possible Hawthorne effect.[117] Many studies reported retention of 80% or more, although retention in five trials was below 80%.[93,108,112,113,116] Three studies appeared to have differential attrition,[97,100,105] but these differences were not tested statistically. All of the studies relied on self-reported falls. Participants in most trials were provided with a calendar or diary to record falls and queried at least monthly by study staff to report falls over the past month throughout the study period; five trials assessed falls retrospectively with periods of recall ranging from 2 weeks[100] to 3 months.[94] Trials conducted in unselected older adults tended to limit the population to healthier older adults, resulting in a large percentage of screened older adults not randomized for the intervention.[95,107,116] Similarly, the high-risk populations are also very unique (e.g., stroke patients[94] or extremely frail[105] or recently hospitalized).[113] As such, results may not generalize to other selected populations, such as those selected based on history of falls.

Home Hazard Modification

Summary of findings. Three fair-quality trials (n=2,348) in community-dwelling adults aged 76–84 years on average assessed the influence of home hazard assessment and modification on risk for falling. All three trials were consistent with a reduced risk, ranging from 7% to 41%, when comparing the intervention group with the control group. This risk reduction, however, was only statistically significant in one study (n=196) conducted among high-risk older adults.[63] In a meta-analysis, the pooled relative risk was 0.81 (95% CI, 0.63 to 1.04), with significant heterogeneity (I^2=70.4%) (Figure 11). An additional five multifactorial assessment and management trials included home hazard assessment and modification as a component of the overall intervention.[71,75-77,84] Adding these trials to the meta-analysis attenuated the risk reduction and did not change the significance (RR, 0.90 [95% CI, 0.77 to 1.06]) (I^2=54.5%). As these three trials have been discussed previously, they will not be discussed further in this category.

Study details. Three studies (n=2,718) randomized community-dwelling older adults to home hazard modification interventions (Table 12). All participants were aged 70 years or older. Trials primarily included women, with the proportion of women ranging from 52% to 70%. No trials reported race/ethnicity or socioeconomic status of the included participants. One study was restricted to a high-risk population, defined as people with visual impairment.[63]

Trial characteristics are listed in Table 12. All three trials evaluated an assessment of the home and modification of any identified hazards (e.g., adding nonslip tape to rugs and steps) and/or provision of free safety devices (e.g., grab bars). Two interventions also provided intervention participants with behavioral counseling.[63,70] Occupational therapists conducted the assessment and oversaw modifications in only one trial,[63] and the remaining two trials used trained assessors/research nurses. We evaluated a total of six treatment arms. In addition to evaluating home hazard modification separately, two of the trials evaluated home hazard assessment in combination with physical activity[61,63] or vision assessment and correction.[61] Two trials provided the control participants with social visits,[63,70] while the third provided nothing to the control group.[61]

Only one home-hazard modification trial (n=196) conducted in New Zealand reported a significant beneficial effect on risk for falling compared with controls.[63] Modification of home hazards and behavioral counseling among vision-impaired adults with an average age of 84 years was associated with a significant reduction in the percentage that fell at least once during the 12-month intervention (36% vs. 61% [$p<0.05$]).[63] Notably, the process of assessment and modification was guided by the Canadian Model of Occupational Performance and conducted by occupational therapists, whereas the assessment was conducted by research nurses in the remaining two trials and modification was conducted by participants themselves and the same nurses[70] or by a city maintenance worker.[61] The other two home-hazard modification trials that did not demonstrate significant results were conducted in Australia among unselected adults with an average age of 76 years.

Two of these trials also evaluated intervention arms that combined home hazard modification with exercise[61,63] or vision correction.[61] The results from the combination arms were generally similar to the results in the home hazard modification only arm. When these combination intervention arms were added to the home hazard modification only arms, the results of the meta-analysis were unchanged.

Study quality. The three studies were rated as fair quality. Falls were recorded prospectively in all three studies. Only one study reported blinded assessment of outcomes.[61] All three studies reported attrition less than 10%, although attrition was differential in one study.[70] Compliance with the intervention ranged from 83%[70] to 90%.[63] One study also reported crossover, such that 16% of the control group also made home safety modifications.[70] Two of these studies were conducted before 2005,[61,70] and all were conducted outside of the United States. One of the studies conducted in an unselected population was restricted to healthier older adults.[61]

Clinical Education and Behavioral Counseling

Summary of findings. Only one good-quality trial (n=310) evaluated the influence of an intervention that was primarily educational.[103] This study reported no evidence of a reduced risk for falling associated with behavioral counseling. We conducted a meta-analysis including all twelve trials providing minimal education or counseling in conjunction with other interventions.[62,69-71,75,77,78,80,83,101,103,112] One of these trials included two intervention arms (exercise and medication assessment/withdrawal) and shared a single control group.[112] To address the lack of independence, two meta-analyses were conducted: the first with the physical activity arm and the second with the medication assessment/withdrawal arm. The pooled estimates from these meta-analyses were consistent with reduced risk for falling, but were not

informative because of high statistical heterogeneity (I^2=84.0% and 80.1%, respectively). These additional nine studies have been described previously and thus are not discussed further in this section.

Study details. A multifaceted community-based learning program was conducted among adults selected to be higher risk for falling (Table 13). The majority of participants were female (74%) and 65% had fallen at least once during the previous year. Those who had not fallen during the past year but were afraid of falling were also included. The average age of participants was 78 years; race/ethnicity and socioeconomic status were not reported. The intervention group received seven weekly group sessions of 2 hours duration and a single booster session held 3 months after the final group session. All sessions were conducted by an occupational therapist. The control group received two social visits conducted by an occupational therapist. Among the intervention group, 52% fell during the 14-month followup, compared with 58% among the control group. This difference was not statistically significant.

Attrition was low (<10%). Falls were reported monthly using diaries; 90% of intervention participants attended at least five educational sessions. Homebound individuals and those with cognitive problems were excluded.

KQ 1a. Do These Interventions Reduce Injury, Improve Quality of Life, Reduce Disability, or Reduce Mortality in Older Adults Specifically Identified as High Risk for Falls?

KQ 2a. Do These Interventions Reduce Falls in Older Adults Specifically Identified as High Risk for Falls?

A variety of methods were used to select higher-risk populations in the interventions included in this review (Table 14). The evidence for improved health outcomes other than falling among high-risk populations was insufficient to evaluate, and thus is not further discussed. Meta-regression analyses were conducted to evaluate the association between study characteristics related to risk status and estimates of the effect of the intervention on risk for falling. Risk status characteristics included in meta-regressions included history of a fall at baseline (percent), average age (≥80 years vs. <80 years), percent female subjects, high-risk selection (history of falls, gait and balance limitations, other, none), and fall risk in the control group during followup. When possible, we conducted the meta-regression by type of intervention.

In meta-regression analyses with all included studies, none of the risk status characteristics explained a significant amount of the intervention effect. Evidence related to risk for falling within each intervention category is described below.

Multifactorial Assessment and Management

There was sufficient variability to evaluate the influence of age, history of falls, and high-risk selection on the effect of multifactorial assessment and management programs on fall risk via

meta-regression. None of these risk characteristics could explain the significant between-study variability in effect sizes.

Twelve of the 14 trials were conducted in populations selected for falls risk. One trial, conducted entirely among women, reported no significant reduction of fall risk overall. Post-hoc analyses were restricted to those participants with more than two falls during the 3 months prior to the study, and this subgroup analysis supported a significant difference between the intervention and control groups (p=0.046).[82] Another study that conducted a similar post-hoc analysis reported no differences in fall risk between the intervention and control groups by history of one or more falls during the past 3 months at baseline.[83] A third study also found no significant difference in post-hoc analyses on fall outcomes among participants at higher fall risk: people with history of two or more falls during the previous year, people with mobility impairments, and people with limitations in activities of daily living.[84]

Single Clinical Treatment

Two of the Vitamin D trials in unselected populations conducted post-hoc analyses to evaluate fall outcomes separately for high-risk populations: people with low dietary calcium intake or low serum 25-hydroxyvitamin D levels[92,111]and women.[111] The effect of vitamin D alone on risk for falling was larger among participants with less than 512 mg/d calcium intake.[92] The study's authors, however, do not provide the statistical significance of the interaction term. In the second study, fall reduction was not enhanced among individuals with low serum 25-hydroxyvitamin D levels (p=0.71) or in women (p=0.25).[111]

One of the four vision-correction trials conducted a subgroup analysis of those with a history of falls during the past year at baseline and found no significant differences in effect.[90]

Exercise and Physical Therapy

Ten of the 17 trials were conducted in populations selected to be high risk; none identified a high-risk population based solely on history of falls. There was sufficient variability to evaluate the influence of age, history of falls, and high-risk selection (selected vs. unselected) on the effect of exercise and physical therapy programs on fall risk through meta-regression. None of these risk characteristics explained a significant amount of between-study variability in effect sizes.

Differences in results, however, were found when the observed fall risk among the control group after randomization (>35% vs. <35%) was used as a measure of risk status. This stratification roughly represents the groups above and below the average fall risk among older adults. Meta-analyses stratified by fall risk in the control group support the qualitative observation. The pooled risk from 10 studies conducted among high-risk populations was 0.84 (95% CI, 0.78 to 0.91) (I^2=1.1%), while the pooled relative risk was no longer significant (RR, 0.98 [95% CI, 0.82 to 1.17]) (I^2=0%) among the five studies conducted in a low-risk population (Figure 9).

None of the physical-activity trials conducted post-hoc subgroup analyses to evaluate the influence of high-risk characteristics.

Home Hazard Modification

The only home-hazard modification trial conducted among a selected population—older adults aged 75 years or older with reduced distance visual acuity—reported a significant reduction in fall risk. None of the trials with unselected populations conducted subgroup analyses to evaluate specific risk factors.

Clinical Education/Behavioral Counseling

The single trial solely evaluating a clinical education/behavioral counseling intervention was conducted in a high-risk population and did not evaluate subgroups.

KQ 2b. Are There Positive Outcomes Other Than Reduced Falls and Related Morbidity and Mortality That Result From Primary Care Falls Interventions?

The main outcomes assessed by included trials were fear of falling or falls efficacy[67,69,71,76,80,85,87,91,103,114,116,118] and balance, gait, and mobility measures.[75,83,94,96,114,116,118] Additional positive outcomes assessed in trials, but not reported as part of this report, are described in Appendix H Table 2.

Multifactorial Assessment and Management

Five trials evaluated other positive outcomes, including falls efficacy[69,71,76] and neuromuscular performance measures.[75,83] Three multifactorial assessment and management trials (n=930) reported a significant difference in 12-month change in fear of falling using the falls efficacy scale favoring the intervention group.[69,71] The differences in the mean change score ranged from 1.4 to 7.5 and were consistent with a decline in falls efficacy in the control group, compared with no change in the intervention group. One moderate-intensity trial (n=453) reported significantly different 12-month improvements in the timed Get Up and Go test and the Berg balance scale in intervention participants compared with controls.[83] This trial provided all intervention group participants with a referral to a physical activity intervention. Another trial reported a significantly greater percentage of intervention participants who completed the timed Get Up and Go test in less than 30 seconds (82%) compared with the control group (72%).[75]

Single Clinical Treatment

One vitamin D trial reported a significant decrease in time to complete the timed Get Up and Go test in the intervention group compared with the control group ($p<0.001$).[99]

Two vision correction trials (n=545) reported a significant difference in 6-month change in falls efficacy favoring the intervention group.[87,91] The differences in the mean change score were consistent with reduced falls efficacy in the control group, accompanied by stable or slightly increased falls efficacy in the intervention group (differences ranged from 3.6 to 5.4).

One of the two trials of hip protectors evaluated differences in fear of falling between the intervention and control groups at 12 months and reported significantly less fear of falling in the intervention group (p=0.003).[85]

Exercise and Physical Therapy

Four trials (n=1,000) evaluated other positive outcomes, including the timed Get Up and Go test,[96] functional reach,[96,116] Berg balance scale,[96,104,114,116] timed walk,[94,104] and falls efficacy.[114,116] One study reported significantly better falls efficacy, functional reach, and balance in the intervention group compared with the control groups at 12 months ($p<0.05$). All the measures were balanced at baseline.[116] Only one other trial reported significantly different mean change in functional reach after 6 months (adjusted difference in change, 5.7 [95% CI, 0.47 to 11.0]), although no differences were found in the timed Get Up and Go test or the Berg balance score.[96] The remaining studies reported no significantly different changes in these positive outcomes.

Home Hazard Modification

None of the studies evaluated other positive outcomes.

Clinical Education/Behavioral Counseling

The community-based group behavioral counseling intervention was not associated with a significantly greater improvement in falls efficacy when comparing the intervention group with the control group over the 14-month followup (mean difference, 1.74 [95% CI, -6.1 to 2.7]).

KQ 3. What Are the Adverse Effects Associated With Interventions to Reduce Falls?

In addition to reviewing the trials included in KQs 1 and 2, we conducted additional searches for evidence addressing significant clinical harms (i.e., intervention-related events requiring medical services) for each intervention type. Due to both practical limitations and the availability of recent AHRQ-funded evidence reports, we did not systematically review the evidence of harms of vitamin D supplementation, vision screening, or early vision correction in older adults. These topics are briefly addressed in the Discussion section. For KQ 3, we included harms reported in 44 trials from KQs 1 and 2 (Appendix C Tables 1–5), two additional trials on exercise interventions,[119] and one systematic review on protein and energy supplementation in older adults[120](Appendix D Tables 1 and 2). We found no observational studies examining clinically significant harms of fall prevention interventions.

Summary of findings. Based on the meta-analyses conducted for KQ 2, there was limited evidence of paradoxical effects of the falls prevention interventions resulting in an increased number of fallers, fall-related fractures, or increased rate of falls. A few physical activity interventions[94,100,114] and multifactorial assessment and management interventions[62,71,75,79] reported increased falls in the intervention group, but only one of these was statistically

significant.[79] In addition, there does not appear to be an increase in all-cause mortality or disability or decrease in self-reported quality of life with falls prevention interventions (Figure 2). We found no evidence to suggest serious harms of hip protectors, medication withdrawal, liquid protein-energy supplementation, vitamin D supplementation, clinical education and counseling, home hazard modification, or exercise and physical therapy interventions. In one trial (n=312) conducted in New Zealand, a group randomized to receive a nurse-conducted multifactorial clinical assessment plus referral intervention had more fallers than the control group.[79] Based on one fair-quality trial (n=616) in Australia, vision assessment and correction in frail older adults may have increased fallers.[90] Overall, trials were primarily designed to evaluate the intervention's efficacy or effectiveness, and therefore did not report adverse outcomes other than falls outcomes.

Minor adverse outcomes associated with specific interventions include: increased fall-related outpatient visits after comprehensive falls assessment, self-reported musculoskeletal complaints (but not outpatient visits or hospitalizations) with exercise interventions, increased outpatient visits for abnormal heart rhythm with exercise intervention, minor local skin irritation or infection with use of hip protectors, gastrointestinal side effects with liquid protein-energy supplementation, and transient or asymptomatic hypercalcemia and hypercalciuria with vitamin D supplementation.

Study details. We found 12 fair- to good-quality trials (n=5,099) that evaluated the effectiveness of multifactorial assessment interventions.[62,69,71,75,77-84] Overall, there was no evidence for clinically significant harms. One good-quality trial (n=312) in New Zealand evaluating a nurse-conducted multifactorial clinical assessment with referral had a slightly higher proportion of fallers and frequent fallers at 12 months (i.e., 2 or more falls) in the intervention group compared with the control group (68.4% vs. 62.4% [p=0.040] and 44.5% vs. 34.4% [p=0.067], respectively).[79] Only three of the 12 trials explicitly reported on additional adverse effects.[69,77,84] In one fair-quality trial (n=348) evaluating a nurse-conducted multifactorial assessment and referral in the United Kingdom, persons in the intervention group had more fall-related outpatient visits to their general practitioner than persons receiving usual care.[77] In another fair-quality trial (n=301) evaluating a comprehensive multifactorial assessment with management, persons in the intervention group self-reported more musculoskeletal symptoms, which were probably related to the exercise program according to the study investigators. However, there was no increase in falls, hospitalizations, or deaths.[69]

There were 15 fair- to good-quality trials (n=12,133) evaluating different single clinical treatments. Two fair-quality trials (n=4,769) evaluated hip protectors in older community-dwelling adults.[66,85] In these two trials, there was no statistically significant increase in falls or frequent fallers. In one trial, the investigators reported that 5% of persons in the intervention group had minor local complications, including skin irritation or infection due to wearing hip protectors.[66] In one fair-quality trial (n=93) of persons receiving medication management and medication withdrawal to prevent falls, no adverse effects were reported.[112]

Four fair- and good-quality trials (n=1,437) included interventions to correct vision to prevent falls.[61,87,90,91] In one fair-quality trial (n=616) in Australia, frail older adults received a comprehensive eye exam with subsequent treatment of vision problems. Approximately 44% of participants received some sort of vision-related intervention. Persons in the intervention group, compared with those in the control group, had a higher proportion of fallers (65.0% vs. 49.8% [p=0.0001]) and frequent fallers (37.9% vs. 30.6% [p=0.003]).[90] There was also a nonsignificant

trend in fall-related fractures. The trial investigators hypothesized that corrected vision may have increased the level of activity of these frail older adults, thereby increasing their risk for falls. In the two trials (n=545) evaluating expedited cataract surgery, complication rates from the cataract surgery were reported for the intervention group (cataract surgery at approximately 4 weeks) but not for the control group (surgery at approximately 12 months). Complications included iris damage, anterior vitrectomy performed, and posterior capsular opacification noted 6 months afterward. Harms for vision assessment and early treatment are addressed in the discussion.

Only one fair-quality trial (n=50) evaluated liquid protein and energy supplementation in frail older adults.[88] This trial did not report any adverse effects. One good-quality systematic review designed to evaluate the effectiveness of oral protein and energy supplementation for older adults found 18 trials that reported adverse effects.[120] Ten of the 18 trials found some problems with tolerance and gastrointestinal side effects (e.g., nausea, vomiting, and diarrhea). Most of these trials, however, were conducted in hospitals or nursing homes. Only two trials were conducted among community-dwelling adults: one trial in persons with diabetic foot ulcers and one trial in undernourished persons recently discharged from the hospital. Most of these trials did not report methods for assessing harms or for conducting comparisons with the control group.

Based on eight fair-quality trials (n=5,216) evaluating vitamin D supplementation for the prevention of falls in older adults, there is no evidence of an increase in falls or fallers or other significant clinical harms. Most of the trials, however, did not report adverse effects.[67,89,92,98,99,102,111] Three trials (n=926) reported transient and asymptomatic hypercalciuria or hypercalcemia in the intervention group but no differences in side effects or significant harms, such as incident kidney stones, cancer, ischemic heart disease, or stroke.[86,89,92] Harms of vitamin D supplementation are addressed in the Discussion section.

In one good-quality trial (n=310) evaluating primarily clinical education and behavioral counseling to prevent falls, there was no increase in falls or fallers. However, no additional adverse effects were reported.[103]

Based on the three fair-quality trials (n=2,348) that included home hazard modification interventions, there was no evidence of increased falls or fallers.[61,63,70] None of these trials reported additional adverse events.

There is no evidence of an increase in falls or fallers due to exercising, based on 17 fair- to good-quality trials (n=3,985) examining exercise and physical therapy interventions to prevent falls[61,63,93-97,100,104,105,107,108,112-116] plus two additional fair-quality trials (n=496) identified in our search for harms.[119,121] Few of these trials report additional adverse effects. Two trials (n=312) reported one fall while exercising as instructed, although there was no increased number of fallers in the intervention group overall.[95,119] One fair-quality trial (n=424) that explicitly evaluated adverse effects found that persons in the exercise group had more physician visits for abnormal heart rhythm compared with those in the control group (20.2% vs. 11.4% [p=0.016]), but not for other problems, including syncope, shortness of breath, or musculoskeletal complaints.[121] There were also no statistically significant differences between the two groups for serious harms, including clinically significant abnormal laboratory or other diagnostic testing, hospitalization, or life-threatening event.

KQ 4. How Are Community-Dwelling Older Adults Identified for Primary Care Interventions to Prevent Falls?

Summary of findings. The intervention studies that focused on higher-risk community-dwelling older adults considered different, noncomparable sets of self-reported or measured risk factors to identify those at risk for falling. These risk factor assessment approaches included from one to six different risk factors (some with multiple measures for a single risk factor, such as balance). Few studies used the same set of risk factors or used a formal battery (risk assessment tool). To complicate matters further, the measured risk factors (e.g., balance, gait speed, mobility) used several different measures across studies and many studies used measures that would not be feasible for use in routine primary care. Other reviewers have noted similar challenges in addressing the falls epidemiology and intervention literature.[122]

Study details. Most of the fall prevention interventions selected participants considered high risk for reasons in addition to age. Nine of the trials, however, defined high risk only as an age of 70 years or older,[61,67,70,92,99] 75 years or older,[63,81,95] or 80 years or older[97] (Table 14). Five trials[78,83,108,111,115] were unselected for falls risk. Of the 32 interventions that selected participants based on risk factors for falls, seven trials [66,85,87,89,91,97,98] included only women, although female gender was not the only selection criteria.

Twelve of the 32 interventions that selected participants based on other risk factors for falls defined high risk according to fall history. A history of at least one fall in the last 2 to 12 months was required for participation in seven studies[75,79,82,89,100,102,103] and a history of more serious falls (e.g., falls leading to hospitalization or urgent/emergency/specialty health care services, multiple falls) was required in another seven studies.[66,71,76,77,80,84,93]

Even within these studies, few used the same method to assess fall history. Several studies used fall history as one of several risk factors assessed to qualify participants for interventions.[66,71,79,89,93,100,102,103,114] In two of these studies, people who had fallen during the past year represented less than half of the selected participants.[71,93]

Eight studies included participants at high risk as defined by measures of gait or balance impairment or mobility limitation.[62,69,71,93,100,104,105,114] While some of these studies used similar measures to define gait, balance, or mobility impairment, none were precisely the same, and most would not be feasible in the primary care setting.

Chapter 4. Discussion

Summary of Review Findings

We evaluated 47 randomized controlled trials (n=23,980) testing primary care interventions to prevent falling among community-dwelling older adults against minimal or no-treatment control groups. This represents a substantial body of research on interventions to prevent or reduce falls published since the 1996 USPSTF recommendation. Furthermore, this remains a very active area of international research. We did not include comparative effectiveness trials in our review since they do not provide data on the absolute effectiveness of interventions to prevent falling compared with not intervening. To allow synthesized consideration of the evidence for potential types of interventions, we have organized the Discussion by intervention type rather than by key question. A summary of the overall evidence is provided in Table 15.

Multifactorial Assessment and Management

We evaluated 14 multifactorial assessment and management trials (n=5,570) with 16 intervention arms conducted in community-dwelling older adults aged 73 to 81 years on average. We found evidence that the most comprehensive interventions that provided medical and social care based on assessment results were more consistently associated with a significant benefit (random effects RR, 0.75 [95% CI, 0.58 to 0.99]) (I^2=86.4%). After excluding one outlier, the statistical heterogeneity was moderate (I^2=44.4%) and the relative risk was attenuated by 11% but remained marginally significant. Limited evidence suggests that fall-related fractures and disability were reduced. The trials would need more subjects to detect a statistically significant difference in rare outcomes, such as fracture risk, if one existed. These trials also provided limited evidence of other positive outcomes, such as maintenance of falls efficacy and improvements in functional limitations. Firm conclusions are difficult to draw since these outcomes were not consistently reported in this literature. The evidence is adequate that there are not serious harms associated with multifactorial assessment with comprehensive management of identified risks. Minor harms, including paradoxical increased falls and musculoskeletal symptoms, were identified for multifactorial assessment and management programs.

The challenges to providing these comprehensive programs as part of primary care are substantial, and include barriers for both clinicians and payers.[50,51] Barriers for clinicians include patient compliance, care fragmentation and lack of coordination, and lack of knowledge and skills.[50] Additional barriers to fee-for-service Medicare coverage include cost of services, concern about fraud, legislative limitations, and complex financing structure.[51]

Single Clinical Treatment

Vitamin D. We evaluated eight trials (n=5,216) of vitamin D supplementation conducted in community-dwelling older adults aged 71 to 77 years on average. While our report found no evidence that vitamin D supplementation (with or without calcium) affects fall-related fractures, we found evidence that vitamin D can effectively reduce the risk for falling (RR, 0.83 [95% CI, 0.75 to 0.91]). One study also reported a statistically lower rate of falls per year associated with vitamin D supplementation.[86] The substantial range across trials in types and delivery of vitamin D results limits our ability to compare dosages and determine any threshold dose effect. Since almost all studies showed some effect consistent with benefit, we conclude that we cannot specify a threshold more informative than those coming from dietary reference intakes. There do not appear to be significant clinical harms associated with vitamin D supplementation.

Vision correction. We evaluated four trials (n=1,437) of vision correction conducted in community-dwelling older adults aged 78 to 83 years on average. Our report found no evidence that vision correction can effectively reduce fall-related fractures or risk for falling in populations selected for risk for falling. A single trial reported a significant reduction in fall rate associated with expedited first surgery to correct eye cataracts.[87] Falls efficacy was improved (i.e., fear of falling was reduced) as a result of these interventions. Harms associated with vision correction interventions may include a paradoxical increased fall risk.

Medication withdrawal. We evaluated one trial (n=48) of medication withdrawal conducted in community-dwelling older adults with an average age of 75 years who are taking psychotropic medications. In addition, we examined three additional multifactorial assessment and management trials that assessed medication use and provided appropriate intervention. The evidence that medication withdrawal alone reduced the rate of falling was inconclusive. We found no evidence to suggest serious harms of medication withdrawal.

Protein supplementation. We evaluated one trial (n=50) of protein supplementation among frail community-dwelling older adults with an average age of 79 years. Our report found inconclusive evidence that protein supplementation reduced risk for falling. There was no evidence to suggest serious harms of protein supplementation.

Clinical Education/Behavioral Counseling

We evaluated one trial (n=310) of high-intensity behavioral counseling conducted in high-risk community-dwelling older adults. An additional nine trials incorporated low- to high-intensity educational components into a multifactorial assessment and management, single clinical treatment, or home hazard modification intervention.[62,69-71,77,78,80,83,112] Our report found no evidence that fall prevention interventions that only included educational and counseling strategies resulted in a reduced risk for falling. There was no evidence to suggest serious harms of clinical education and counseling.

Physical Activity

We evaluated 17 trials (n=3,985) of exercise or physical therapy interventions conducted in community-dwelling older adults. While our report found limited evidence of other health benefits associated with exercise or physical therapy interventions, we found evidence that these interventions reduced risk for falling. The pooled relative risk for exercise or physical therapy interventions was 0.86 (95% CI, 0.80 to 0.92), with little statistical heterogeneity (I^2=5.4%). When we stratified the control groups by rate of falling (>35% vs. <35%, the general community rate of falling), we found that interventions appeared to be primarily effective in those at increased risk for falls. No other differences in benefit were observed based on fall-risk status. Limited evidence suggests that functional limitations improved as a result of these interventions. Firm conclusions are difficult to draw since these outcomes were not consistently reported in this literature, with no more than three trials reporting any other positive outcome. No serious harms were identified for exercise or physical therapy programs.

Home Hazard Modification

We evaluated three home hazard modification trials (n=2,348) including community-dwelling older adults. An additional five trials[69,75-77,79] (n=1,643) included home-hazard assessment and modification as part of a multifactorial assessment and management intervention. We found limited evidence that home-hazard modification reduced the risk for falling among community-dwelling populations selected based on fall risk factors. There was no evidence to suggest serious harms associated with home hazard modification. One home-hazard modification trial was excluded because it compared the effectiveness of home-hazard modification plus behavioral counseling with home hazard modification alone.[123] This large study (n=3,182) recruited community-dwelling adults aged 65 years or older, unselected for fall risk, from a managed care organization in the northwest. Participants randomized to the intervention group were provided with assistance to modify the home hazards identified in the home assessment and also attended a moderate-intensity falls-prevention education program (90-minute classes for 4 weeks). The control group participants received the home hazard assessment with minimal followup. The intervention participants had a significantly reduced risk for falling during the 23 months of followup (39%) compared with the control group (44%). The control treatment in this comparative effective trial was similar to the interventions provided in the two included home hazard modification trials that reported no significant reductions in fall risk.[61,70] Additionally, similar to the nonsignificant home hazard modification trials,[61,70] the population included in the comparative effectiveness trial was unselected, in contrast to the higher-risk population selected for the successful home hazard modification.[63] Further research on these more-intensive home hazard modifications is needed.

Comparison With Other Reviews of Interventions to Prevent Falls

While our results are similar to previous systematic evidence reviews and meta-analyses,[53-55] they do differ in some details. Other relevant recent systematic evidence reviews evaluating specific types of interventions (e.g., hip protectors,[56] multifactorial assessment,[57] and exercise[58]) also included institutionalized populations. Unlike our review, prior reviews (except one[53]) included institutional and hospitalized populations. The specific purpose of the current review was to evaluate primary care-based clinical approaches to fall prevention, a narrower focus than any of these earlier reviews.

Given the difference in scope, we will focus on the comparison of the current review with the Cochrane review of interventions for preventing falls in older people living in the community.[53] Unlike the current review, Cochrane included comparative effectiveness trials. We included 41 of the 111 trials reviewed in the Cochrane review. The most common reasons for exclusion of studies reported in the prior reviews were quality, study design (generally comparative effectiveness trials), or population (not comparable with primary care). These reasons are detailed in Appendix B Table 2. We included five trials not included in the 2009 Cochrane review—two studies of hip protectors,[66,85] two studies of vitamin D,[89,99] and one study of Tai Chi exercise[114]—most of which were published after the Cochrane review's search period ended.

Similar to the 2009 Cochrane review and meta-analyses, we found no overall reduction in fall risk when all of the 14 multifactorial assessment and management trials were pooled. Unlike the 2009 Cochrane review, however, the comprehensiveness of these interventions was a significant predictor of success. We found a significantly reduced risk for falling when the analysis was limited to the most comprehensive multifactorial assessment and management interventions. One recent systematic review and meta-analysis of multifactorial clinical assessment programs also reported an absence of an overall benefit,[57] while another reported a significant reduction in fall risk associated with these interventions.[52] The absence of an overall benefit may result from combining multifactorial assessment and management strategies that provide direct intervention with those studies that primarily provide referral.[124,125] However, the characteristics of a comprehensive multifactorial assessment and management intervention have not been clearly defined, and different approaches to classification may also lead to different results. For example, while we agreed with the 2009 Cochrane review in the majority of studies that we classified as comprehensive, one of the studies that we classified as comprehensive was classified as noncomprehensive in the 2009 Cochrane review.[82] Clarifying the components of a comprehensive multifactorial assessment and management intervention is an important topic of future research.

Similar to the 2009 Cochrane review and meta-analyses, we conclude that exercise programs are effective overall, as did Chang and colleagues[55] and Sherrington.[58] We found that exercise/physical therapy interventions for community-dwelling older adults may be particularly effective in participants at higher risk for falls based on fall risk among the control group during followup. As in the current review, the 2009 Cochrane review evaluated fall risk at baseline based on history of falling or one or more risk factor for falls at enrollment and found no difference in pooled estimates; it did not evaluate fall risk based on the control group during followup. Sherrington and colleagues reported the opposite finding (more effective among

participants at lower risk for falls), but this is likely explained by the inclusion of more frail institutionalized populations in their review.[58] We did not sort exercise interventions by components and location, as was done in the 2009 Cochrane review. This review concluded that community-based group exercise interventions, individualized home-based exercise programs with multiple components, and Tai Chi were effective.[53]

Unlike the 2009 Cochrane review and meta-analyses, we found that vitamin D supplementation was consistent with a significantly reduced risk for falling. We include data from an additional two trials that were not included in the Cochrane review and are generally protective. Also, we did not find a benefit of medication withdrawal outside of comprehensive multifactorial assessment and management. We agree with the Cochrane review that home-hazard assessment and modification interventions did not reduce fall risk.

Harms

Overall, there do not appear to be significant clinical harms associated with effective interventions to prevent falls in older adults—multifactorial assessment and management including direct provision of medical and social care, vitamin D supplementation, and exercise and physical therapy. For interventions without evidence for effectiveness, it appears that harms are small for vision correction in frail older adults.

We did not systematically review the evidence on the harms of vitamin D, vision screening, or early vision correction in older adults because of the availability of recent AHRQ-funded evidence reports. The effectiveness and safety of vitamin D have been recently reviewed by the University of Ottawa Evidence-based Practice Center.[126] This review of 19 vitamin D trials in adults found that there was limited evidence that vitamin D intake above current dietary reference intakes is harmful. However, most trials of higher doses of vitamin D were not adequately designed to assess long-term adverse effects. Daily doses ranged from 400 to 4000 IU of vitamin D3 or 5000 to 10,000 IU of vitamin D2. In most trials, reports of hypercalcemia and hypercalciuria were not associated with clinically relevant events. The Women's Health Initiative reported a 17% increased risk for kidney stones in women aged 50 to 79 years whose daily vitamin D3 intake was 400 IU combined with 1000 mg calcium. Details are available in the full evidence report[126] or the original research report.[127] In addition, there are currently two ongoing calcium and vitamin D reviews evaluating the harms of vitamin D supplementation. One review is funded by AHRQ and is projected to be completed in June 2009.[128] The other review is funded by the Institute of Medicine and seeks to redefine dietary reference intakes; it is projected to be completed in May 2010.[129] Finally, the harms of vision screening and early vision correction in older adults have been recently addressed by a separate USPSTF report.[130] This report found very sparse evidence for harms of vision screening or early treatment of visual impairment in older adults. In this review, none of the screening studies in primary care settings evaluated potential harms. Harms associated with eyeglasses were limited to a single small observational study showing an association between multifocal lens use and an increased risk for falls (adjusted OR, 2.09 [95% CI, 1.06 to 4.92]). Harms associated with other treatments for uncorrected refractive error were also limited, but included a low incidence of clinically significant harms, such as infectious keratitis, corneal ectasia, and a long-term complication of cataract surgery, posterior capsule opacification. Details are available in the full evidence

report.[130] Of note, the cataract surgery intervention trials included in this review provide limited evidence for harms since they compared expedited surgery to usual care, in which both groups received cataract surgery.[87,91]

Contextual Issues

Identification of Persons for Evidence-Based Interventions to Prevent Falls

A practical question facing primary care clinicians is how to feasibly and effectively identify the community-dwelling older adults who are appropriate for falls interventions. Epidemiologic studies demonstrate that fall risk increases dramatically as the number of risk factors increase.[122,131] However, it is challenging to translate these findings into a strategy for primary care clinicians to reliably identify persons at risk for falling. The literature we reviewed does not provide clear direction as to how to proceed.

Among the 41 intervention trials we reviewed, few (12%) enrolled unselected older persons. While some (20%) selected persons only on the basis of age (70–80 years or older), the majority of studies (68%) enrolled participants pre-selected for increased risk factors for falls, including history of falls, gait and balance impairment, clinical history (such as stroke, Parkinson's disease, recent hospitalization, or medication usage), clinical exam findings (e.g., visual defects), or were selected to be in need of the tested intervention (e.g., vitamin D deficiency in supplementation trials, hip fracture risk in hip protector trials). These intervention studies generally used noncomparable sets of self-reported or measured risk factors across a broad range, including more than 15 different domains to identify those at risk for falling (Table 14).

Among the included trials, falls history was the most common risk factor assessed other than age. The definition of falls history varied, with a history of at least one fall during the previous 2 to 12 months required for participation in three studies[79,82,102,103] and a history of more serious falls required for four studies.[66,77,80,84] Falls history was one of several risk factors assessed to qualify participants for four other interventions,[71,89,93,100] although fallers did not make up even half of the selected participants in two of these studies.[71,93] Use of falls history identified individuals along a spectrum of risk (as represented by the proportion of fallers in the control group in the subsequent year), even when supplemented by other risk factors (Appendix E Table 1).

Although effective interventions primarily addressed selected, higher-risk participants (or the benefits appeared to be primarily in this group), the methods for identifying higher-risk participants for these interventions also varied widely. When we examined a surrogate measure of actual falls risk among the selected study participants (as represented by the risk for falling in the control groups), we found that control-group fall risk in effective interventions were mostly 50% or greater, but at least exceeded the average community fall risk of 33% to 35% for the comprehensive assessment and exercise/physical therapy intervention types. For vitamin D interventions, benefits were seen even when the control-group fall rates were lower than "community" levels. Perhaps selecting participants for vitamin D supplementation should concentrate on older age (≥70 years) and vitamin D deficiency rather than falls history. Research

demonstrates that myopathy associated with vitamin D insufficiency contributes to gait instability, increased body sway, and falls.[132]

To address the dilemmas raised by the diversity of falls risk assessment approaches in the literature, others have proposed relatively consistent, evidence- and expert opinion-based algorithmic approaches to identifying higher-risk participants for falls interventions.[28,31,45,109] These authors all propose an approach that regularly assesses the frequency, context, and sequelae of falls during the previous year among older adults[28] or beginning at age 65[45,109] or 70[31] years. One group suggests that, among those that have not fallen during the previous year, clinicians should ask about gait, balance, or mobility problems with either a positive history of falls or problems with gait, balance, or mobility determining elevated falls risk status.[109] Two groups[28,45] suggest that, after screening for a history of falls, those reporting a single fall[28,45] or those considered to be at risk for falling[45] should be observed or tested for balance and gait deficiencies in order to detect elevated falls risk status. Another variation suggests that all participants be observed for gait and balance difficulties as well as having their falls history elicited, but essentially identifies the same group of participants as at elevated risk (i.e., those with two or more falls or with balance or gait difficulties).[31] These approaches all essentially agree that those selected as having an elevated risk for future falls by one of these brief screenings should undergo a more in-depth, multifactorial falls risk assessment, as should those presenting to the health care system for falls-related injuries or recurrent falls.[28,45] The multifactorial falls risk assessments recommended by various groups for those at elevated risk were fairly consistent across a range of falls risk factors, including circumstances of previous falls,[28,45] medical comorbidities,[28] cardiovascular and neurological assessment,[28,45] lower extremity joints and weakness,[28,45] medication use,[28,45,109] orthostatic hypotension,[45,109] visual impairment,[28,45,109] gait,[28,45,109] balance[28,45,109] and mobility concerns,[45,109] impaired functional activities,[28,45,109] environmental hazards,[28,45,109] cognitive impairment,[45,109] fear of falling,[45] and urinary incontinence.[45] This staged approach limits the receipt of the resource-intensive multifactorial falls risk assessment to those with the greatest risk. Among this group, the comprehensive assessment allows the clinician to define individual risk more precisely and to tailor interventions to the most important modifiable risk factors.

Recent systematic reviews have addressed the issue of risk factor assessment, but many questions remain for clinicians. One systematic review used multivariate analyses in prospective cohort studies to establish a clinically meaningful set of risk factors from among the large list of reported falls risk factors.[45] While 24 studies reported multivariate analyses, design and reporting differences limited the review to reporting only the proportion of studies with statistically significant or insignificant findings for each risk factor. This approach did not effectively reduce the number of risk factors or prioritize the falls risk factors that clinicians should consider in community-dwelling adults (e.g., falls history, gait deficit, balance deficit, mobility impairment, fear, visual impairment, cognitive impairment, urinary incontinence, home hazards).

A recent systematic review attempting to overcome the challenges of identifying participants for evidence-based falls interventions explored an approach based on identifying a subset of individuals whose absolute falls risk would theoretically exceed 50%.[109] These reviewers identified falls risk factors commonly used to identify participants for effective falls intervention trials (age, falls history, gait and balance impairment, orthostatic hypotension, medication usage, cognitive impairment, visual defects, limitations in basic or instrumental activities of daily living) and examined their prognostic value in 18 medium to large cohorts with prospective

ascertainment of any or recurrent falls over 6 to 12 months. The review examined the independent contribution of risk factors after adjustment for other risk factors through multiple regression analyses. The most consistently studied risk factors in multivariate analyses were gait and balance impairment (15 studies), age (11 studies), history of falls (11 studies), medication use (11 studies), visual impairment (11 studies), limitations in functional activities (10 studies), cognitive impairment (11 studies), and orthostatic hypotension (four studies). Among these eight risk factors, only three (history of falls, certain medication use, and gait and balance impairment) provided independent prognostic value in at least half of the applicable multivariate studies. All 11 studies that evaluated a history of falls found that falls during the previous year predicted falls during the following year. Specific medications, such as benzodiazepines or other psychoactive medications, were associated with increased falls risk after multivariate adjustment in about half (six of 11) of prognostic studies. In contrast, cognitive impairment and limitations in activities of daily living were not associated with increased falls risk after adjusting for other falls risk factors in most analyses (two of eight and three of 10, respectively). Among the four remaining falls risk factors (orthostatic hypotension, visual impairment, age, gait and balance impairment), only gait and balance impairment were related to future falls risk in the majority of multivariate studies (10 of 15 applicable studies). Using the likelihood ratios generated from the univariate relationship between the risk factor and subsequent falls, the authors pointed out that in a population with a pre-test probability of falls of 19% to 36% (the "community" rate), any risk factor with a likelihood ratio of at least 2 would increase the post-test probability of falling to 50%. Using this approach, one to three risk factors would be important (history of falls, gait or balance impairment, and psychotropic medication/use of more than four medications). The unadjusted likelihood ratio for falls in the next year in those with previous falls ranged from 2.8 to 3.8. For those with gait or balance impairment, the unadjusted likelihood ratio was 1.7 to 2.4. For medication use, a likelihood ratio of 1.7 to 1.9 was generally associated with psychotropic medications or use of four or more medications.

Considering our review and others', we can find no simple, validated way to identify participants most likely to benefit from evidence-based falls interventions. Clinicians may follow expert advice to screen based on falls history and simple gait and balance assessment. However, falls are the quintessential example of a clinical problem in which multiple small risks interact, and a problem for which different individuals will have different component risks as part of their risk profile.[133] Thus, most current approaches attempt to apply population risk factors to risk-stratify groups of individuals for a clinical problem for which there are markedly different component risks for individuals. The most fruitful approach may be to individualize absolute risk, as has been done using the Framingham risk profile for coronary artery disease.[134] Some researchers have attempted to construct risk indices for clinical prediction using multiple regression models,[135-138] but these have rarely identified the same set of predictors due in part to differences in cohorts, types of falls outcomes predicted (e.g., any vs. recurrent falls over 1 year or more), and the range of falls risk factors considered. Furthermore, many of these studies do not provide the sensitivity and specificity or discriminant abilities of their risk prediction models. For tools that have determined a clinical index with reasonable sensitivity and specificity, the indices have generally not been validated using another population. Creating good risk-prediction models and tools that are applicable to primary care could be an important step forward in reducing falls among community-dwelling older adults, but its realization will require a series of coordinated research efforts. For example, a recent systematic review of fall risk assessment tools in community settings examined validity and reliability studies for 23 different tools as reported

in14 studies.[139] Only three tools (Berg balance scale, functional reach test, and timed Get Up and Go test) were examined in more than one study. Of these, only the timed Get Up and Go test and functional reach test would be clearly feasible for primary care practitioners.

Cost-Effectiveness

There are very few studies examining the cost-effectiveness of interventions to prevent falls in older adults. Only four studies included in this report addressed cost-effectiveness, including two evaluating a comprehensive multifactorial assessment followed by direct provision of care (Yale Frailty and Injuries: Cooperative Studies of Intervention Techniques and VIP trials),[63,140] one evaluating a community-based exercise program,[141] and one evaluating cataract surgery.[142] We also found two additional studies evaluating a nurse-delivered home exercise program in older adults that were not included in our report because they were based on a nonrandomized controlled trial.[95,143] One of four cost-effectiveness studies was based on a trial conducted in the United States in the early 1990s,[140] while the other three were based on trials conducted in New Zealand and the United Kingdom. Thus, cost-effectiveness estimates are not easily applied to the current U.S. health care system.

Overall, the costs per fall prevented varied widely, with lowest cost (per fall prevented) in community-based exercise interventions[141] and highest cost (per fall prevented) in professionally-led in-home programs or comprehensive multifactorial assessment and management.[95,140,143] From two cost-effectiveness analyses that allowed calculation of costs per fall and per serious fall, it appears that the costs to prevent a serious fall resulting in injury are approximately twice the costs of preventing any fall.[95,141,143] It is difficult to compare these costs given the differences in cost valuation, country setting, and types of interventions evaluated. These analyses were generally well conducted and costs were based on costs incurred in the actual trials. However, all the analyses for these trials were based on a single trial that included moderate to small numbers of participants (approximately 300). Additionally, the cost analyses were limited to the time frames of the trials, which were at the most 2 years. Also, most of the analyses limited the costs incurred to the health care system, even those that stated that they used a societal perspective. We found only one cost-utility analysis using quality-adjusted life years (QALYs). This study evaluated the cost-effectiveness of a first eye cataract surgery in the United Kingdom from a societal perspective.[142] Unlike the other cost-effectiveness analyses, this study modeled longer-term costs beyond the trial's duration. The analyses found that the first eye cataract surgery was not cost-effective over the trial period (incremental cost per QALY, £35,704), owing to an increase in health care utilization during the 3 months post-surgery, but likely cost-effective over the participants' remaining lifetime (incremental cost per QALY, £13,172). The applicability of this analysis given the difference in health care costs in the United Kingdom and the United States is also unclear. If cost information is important to weighing the evidence, original cost-effectiveness analyses are needed for the interventions deemed effective.

Limitations

Limitations in the body of evidence. Overall, the research on preventing falls in older adults is of fair quality. Concerns about this research include the impracticality of double blinding, failure

to blind outcome assessors, significant attrition, less than ideal outcome measures, and heterogeneous treatment approaches. A major limitation of the existing evidence is the lack of data on important outcomes beside falls. Only 28 studies included any health outcomes, and only 13 reported fall-related fractures. The prevention of fractures, injuries, and other serious sequelae is the key reason for intervening to prevent falling.

Falls outcome measurement has improved, as recent trials are more likely to measure falls prospectively using diaries or calendars to minimize recall bias.[144] Many trials, such as those that evaluated vitamin D supplementation or exercise interventions, were not sufficiently powered to observe a significant reduction in risk for falling without pooling. Thus, despite some trial evidence, some interventions (e.g., protein supplementation or medication withdrawal) have insufficient evidence. Current research incompletely reports how the trials affected other important outcomes (both harms and benefits, such as disability or functional limitations). Recently the Prevention of Falls Network Europe published a consensus document describing a common data set for fall prevention interventions; the routine use of these assessment instruments and procedures will enhance the quality and comparability of future trials as well as expand the available data on health outcomes and other positive outcomes.[145] Although the consensus document does not address harms reporting, this is a critical need, particularly since harms were not systematically evaluated in the majority of fall prevention interventions in this review. Likewise, as the overall body of evidence is large, heterogeneity in the intervention approaches precludes the usefulness of one combined meta-analysis. Within these intervention types, specific limitations may also apply. For example, in the context of medication management by physicians, while use of psychoactive medications or a large number of medications is a clear risk factor for falls, there is not a clear model for clinicians to analyze overall medication use and to balance the benefits and harms of individual medications.[146] The absence of such tools limits the effectiveness of interventions evaluating medication management.

While identification of those groups of older adults who are most likely to benefit would help to target labor-intensive interventions,[147] inconsistency in the approaches used to identify populations at higher risk for falling makes it impossible to evaluate whether any single approach to identifying high-risk older adults is successful.[31,109]

While the older adults included in the interventions were heterogeneous with regard to age, fall risk, and overall health, they were homogeneous with regard to race/ethnicity and possibly socioeconomic status. The validity of these findings for nonwhite and lower socioeconomic status populations is an area for future research.

Limitations in our approach. Our review did not include questions examining specific components of the falls prevention programs that influenced the effectiveness of the programs. We limited the falls prevention interventions that we evaluated for the overarching evidence to trials that assessed falls; thus, it is possible that single clinical treatment trials with relevant health outcomes were not included if they did not also assess data on falls. Another limitation of our review is the narrow scope of the other positive outcomes of included fall-prevention interventions. It is possible that the included interventions resulted in other benefits that were not captured in our review. We included trials with varying lengths of followup (between 6 and 24 months) in our meta-analysis. However, the majority of trials assessed outcomes at 12 to 18 months. We used control-group fall risk in the subsequent year as a proxy for actual falls risk. While this measure is not a perfect proxy for what would happen without any contact, it allowed

us to illustrate the apparent range of fall risks identified by those selecting based on falls history or other risk factors. However, use of control-group risk for stratifying results should be viewed as suggestive.[148]

Emerging Issues/Next Steps

Studies addressing the effectiveness of all available clinically-feasible instruments to identify populations at high risk for falling were beyond the scope of this review, but are an important area of research for clinicians.

Ongoing research identifying common modifiable risk factors for falling, such as vestibular dysfunction,[149] should be incorporated in future reviews.

Future Research

While the number of studies on the effectiveness of interventions to prevent falls in older adults has dramatically increased since 1960,[147] many research questions related to fall prevention among older persons identified in 1994[131] remain active research questions today.

One outstanding question, relevant to most of the interventions studied in this review, is how to identify persons at high risk for falling. Currently there is no simple validated way to clinically identify community-dwelling older adults and subgroups of community-dwelling older adults most likely to benefit from evidence-based falls interventions. The development and validation of a standardized assessment of absolute fall risk would allow researchers to quantify individuals' fall risk and then target persons at different levels of risk with appropriate interventions. Creating good risk-prediction models and tools applicable to primary care would be an important step forward in reducing falls among community-dwelling older adults, but its realization will require a series of coordinated research efforts. Few studies of effective falls prevention interventions also reported the impact of these interventions on fall-related fractures, injuries, utilization, quality of life, disability, and mortality. Thus, these results may reflect selective reporting, and further research is needed.

The effectiveness of certain types of falls prevention interventions remains unclear. Research is needed on the effectiveness of home-hazard modifications for noninstitutionalized populations, and the impact of increased intensity of these interventions. Research is needed to develop a clear clinical model for analyzing and reducing medication use, and the benefits versus harms of such medication withdrawal. Additional research is needed to clarify the specific elements of successful interventions. For example, clarifying the components of a comprehensive multifactorial assessment and management intervention is an important topic of future research. Similarly, the effectiveness of differing intensity levels of exercise/physical therapy interventions, and the most effective components of such programs, remains unclear and deserves further study. In addition, questions remain as to the harms of effective falls prevention interventions and whether there are certain subgroups in whom the harms of such interventions outweigh the benefits. Research is also needed on the cost-effectiveness associated with falls prevention interventions. Finally, further research is needed on the effectiveness of falls

prevention interventions in nonwhite populations, and in populations of diverse socioeconomic status.

Conclusions

Falls prevention has been an area of active research since 1996. Falls are an important public health and clinical problem that will only increase as the U.S. population ages. Primary care relevant interventions have demonstrated beneficial effects on falling compared with no or minimal treatment. Specifically, comprehensive multifactorial assessment with direct provision of care, exercise and physical therapy, and vitamin D supplementation were associated with small to moderate reductions in fall risk, with estimates ranging from a 12% to 24% reduced risk. Only minor harms were identified for these interventions. Some evidence supports more robust effects on risk for falling when the interventions are targeted to those at high risk. Since evidence suggests that clinical interventions should target high-risk populations, further research on valid, reliable, clinically feasible tools to identify these populations is imperative. Despite reductions in fall risk, limited evidence supports a beneficial effect on health outcomes, including fall-related fractures, disability, and quality of life. Additional studies sufficiently powered to address these outcomes would be very beneficial. Tested interventions with no clear benefit in community-dwelling participants include visual deficit correction. Very limited evidence is available for protein supplementation or home hazard modification and clinical education or counseling alone.

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Table 1. Outcome Measures of Interventions to Prevent Falls

Measure	Description
6-meter Timed Walk	Assessment of the time to walk a measured length of 6 meters, either at maximal speed or at normal pace. For example, see Deary et al.[150]
Activities of Daily Living	Activities of daily living are considered to be the activities a person performs for self-care. They often include activities such as bathing, dressing, toileting, transferring, dressing, and eating. Questionnaires have been designed to assess the functional status of an individual in regards to activities of daily living. Common tools include: Katz ADL index[151] and the Barthel ADL Index.[152]
Berg Balance Scale	14-item performance assessment to measure balance during functional tasks.[153]
EuroQol	A self-administered questionnaire assessing five dimensions of generic health-related quality of life: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression.[154]
Fall	An unexpected event in which the participant comes to rest on the ground, floor, or lower level.[145]
Falls Efficacy Scale	10-item questionnaire to assess a person's fear of falling.[155]
Functional Reach Test	A quick functional assessment of balance evaluated by measuring the difference between arm's length and maximum reach forward.[156]
Instrumental Activities of Daily Living	Instrumental activities of daily living are generally considered to be the tasks a person would do to independently live in the community, such as meal preparation, shopping, finances, traveling, housework, using the telephone, and taking medications. Several questionnaires have been developed to measure a person's functional status in regards to these activities. A common tool is the Lawton IADL scale.[157]
SF-12	A 12-item questionnaire limited to assessing the Physical Components Summary and Mental Components Summary from the SF-36.[158]
SF-36	A 36-item questionnaire constructed to assess eight dimensions of health status, including: physical activities, social activities, limitations in role activities because of physical health problems, bodily pain, general mental health, limitations in role activities because of emotional problems, and general health perceptions.[159]
Timed Up & Go Test	A timed assessment of mobility that asks a person to stand from a chair, walk 3 meters, and return to a seated position.[160]
Performance Oriented Mobility Assessment	A 16-item assessment of gait and balance impairments that are likely to contribute to chance of falling.[161]

Table 2. Study Characteristics of Multifactorial Clinical Assessment Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ1)

For more details about each study, see Table 7 and Appendix C Table 1

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Comprehensive intervention (assessment + multifactorial treatment)			
Close 1999[80] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** *Mean change in Barthel score at 12 months* IG: -1.4 CG: -0.4 p=0.0001
Hogan 2001[82] Canada Fair	**Fracture rate per person-year:** NR **# fractures:** 5 fractures (3 femoral) in CG, 3 (2 femoral) in IG **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR
Tinetti 1994[69] Tinetti 1993[162] Buchner 1993[110] United States Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** IG: 4 (3%) CG: 7 (5%) p=NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR
Wagner 1994[78] United States Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** *Medical Outcomes Study physical function score (%)* IG CG *Change from BL to Year 1* Sustained High Function 27 24 Sustained Ltd Function 48 45 Improved 10 11 Worsened 15 20* *Change from BL to Year 2* Sustained High Function 25 24 Sustained Ltd Function 47 44 Improved 11 11 Worsened 17 21 *p≤0.01 for difference with IG

Table 2. Study Characteristics of Multifactorial Clinical Assessment Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ1)

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Targeted intervention (assessment + referral and targeted intervention or education)			
Elley 2008[79] New Zealand Good	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** *Physical component summary score, Median (IQR)* Baseline Followup IG: 35.4 (29.4-43.8) 39.4 (29.9-46.0) CG: 36.5 (29.7-43.9) 37.2 (29.0-45.4) p =0.25 *Mental component summary score, Median (IQR)* Baseline Followup IG : 57.5 (50.1-61.8) 56.7 (48.8-61.3) CG: 58.7 (53.1-62.5) 57.7(49.4-61.9) p=0.40 **EuroQol:** NR	**ADL:** Nottingham Extended Activities of Daily Living (range 0-22) *Median ADL score (IQR)* Baseline Followup IG: 19.0 (18.0-21.0) 18.0 (17.0-20.0) CG:19.0 (16.0-2.0) 19.0 (17.0-20.0) P=0.43 (group comparison at 12 months controlling for baseline value)
Hendriks 2008[84] Netherlands Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** *Mean (SD) at 12 months* IG: 0.70 (0.25) CG: 0.71 (0.28) *Difference (95% CI) (from multiple linear regression):* -0.012 (-0.06 to 0.03) p=0.59	**ADL & IADL:** Grogan Activity Restriction Scale (range 11-44) *Mean ADL/IADL score (SD) at 12-months* IG: 15.2 (1.8) CG: 15.4 (5.6) *Difference (95% CI) (from multiple linear regression):* -0.03 (-0.64 to 0.64) p=0.94
Referral only intervention (assessment + referral only)			
Lightbody 2002[77] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** Barthel Index *Mean (SD)* IG CG Baseline 19.0 (2.0) 19 (2.3) 6-mo follow-up 18.5 (2.37) 17.8 (3.6) p<0.04
Newbury 2001[81] Australia Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NS **EuroQol:** NR	**ADL:** NS **IADL:** NR

– number; % – percent; SF-36 – 36-item Short-Form Health Survey; SF-12 – 12-item Short-Form Health Survey; NR – not reported; NS – not significant; ADL –activities of daily living; IADL – instrumental activities of daily living; IQR – interquartile range; SD – standard deviation; BL – baseline; Ltd – limited
NOTE: Lord 2005[62] and Shumway-Cook 2007[83] report mortality data only, see Appendix C Table 1 for details.

Table 3. Study Characteristics of Clinical Management Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ1)

For more details of each study, see Table 9 and Appendix C Table 2

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Hip protectors			
Birks 2004[85] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** Hip fractures: No significant difference Total fractures (calculated): IG: 135/1388 (9.7%) CG: 310/2781 (11.1%) **# people sustaining multiple events:** Hip fracture: IG: 0/1388 (0%) CG: 3/2781 (0.1%)	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR
Cameron 2003[66] Australia Fair	Risk of hip fracture when falling while wearing hip protectors, compared with/fall with no hip protectors: RR=0.23 (95% CI, 0.08 to 0.67). No significant differences in falls causing injury requiring hospital care. **Fracture rate per person-year:** NR **# fractures:** Fracture site IG CG *Lower limb* Hip 21 22 Adjusted RR, 0.92 (95% CI, 0.51 to1.68) Pelvis 8 6 Other 3 6 *Upper limb* Wrist 12 6 Arms/shoulder 5 5 Other 3 4 **# people sustaining fractures:** IG: 31 peripheral, non-hip fractures in 25 people; 21 hip fractures CG: 27 peripheral non-hip fractures in 25 people; 22 hip fractures **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR
Vision correction			
Cumming 2007[90] Australia Fair	**Fracture rate per person-year:** NR **# (%) fractures:** NR **# (%) people sustaining fractures:** IG: 31 (10.0%) CG: 18 (5.7%) OR (95% CI): 1.74 (0.97 to 3.11) **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR

Table 3. Study Characteristics of Clinical Management Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ1)

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Foss 2006[91] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** IG: 5 CG: 3 p=NS **# people sustaining fractures:** IG: 5/120 (4%) CG: 2/119 (2%) p=NS **# people sustaining multiple events:** NS	**SF-12:** NR **SF-36:** NR **EuroQol:** No significant difference	**ADL:** *Mean* BL 6 mo difference (95% CI) IG 18.7 18.7 CG 18.9 18.8 −0.1 (−0.2 to 0.3) p= 0.61 **IADL:** NR
Harwood 2005[87] United Kingdom Good	**Fracture rate per person-year:** NR **# fractures:** IG: 4 CG: 12 **# people sustaining fractures:** IG: 4 CG: 12 RR (95% CI): 0.33 (0.1 to 1.0); p=0.04 **# people sustaining multiple events:** NR	**SF-12**: NR **SF-36:** NR **EuroQol:** *Mean* IG CG Baseline 0.70 0.70 6 months 0.73 0.67 Mean difference (95% CI): 0.06 (0.01 to 0.11); p=0.02	**ADL:** *Barthal index (mean)* IG CG Baseline 6.7 7.1 6 months 7.2 6.5 Mean difference (95% CI): 0.1 (-0.2 to 0.3); p=0.05 **IADL:** NR
Vitamin D			
Dhesi 2004[102] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36 mean scores (SD):** Baseline 6 months P Role-physical CG: 44.2 (40.2) 56.2 (42.4) 0.05 IG: No significant difference Social function CG: 66.3 (28.3) 76.8 (27.6) 0.03 IG: No significant difference Role-emotional CG: 78.6 (36.8) 89.3 (25.5) 0.04 IG: No significant difference Physical functioning: No significant difference Mental health: No significant difference Bodily pain: No significant difference General health: No significant difference Vitality: No significant difference **EuroQol:** NR	**ADL:** NR **IADL:** NR
Pfeifer 2000[98] Germany Fair	**Fracture rate per person-year:** NR **# fractures:** IG: 3 (4%); CG: 6 (9%); p=0.1367 **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR

Table 3. Study Characteristics of Clinical Management Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ1)

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Porthouse 2005[67] England Fair	**Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG: unequally allocated 34/714 (4.8%); equally allocated 24/607 (4.0%) CG: unequally allocated 69/1391 (5.0%); equally allocated 22/602 (3.7%) **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR
Prince 2008[89] Australia Fair	**Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG: 1 (0.7%) CG: 1 (0.7%) **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR

USPSTF – U.S. Preventive Services Task Force; # – number; % – percent; SF-36 – 36-item Short-Form Health Survey; SF-12 – 12-item Short-Form Health Survey; NR – not reported; ADL – activities of daily living; IADL – instrumental activities of daily living; BL – baseline; mo – month; CI – confidence interval; IG – intervention group; CG – control group; RR – relative risk

NOTE: Gray-Donald 1995[88] and Dukas 2004[92] only report mortality for data relevant for KQ 1. See Appendix C Table 2 for more detail.

Table 4. Study Characteristics of Clinical Education or Behavioral Counseling Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ 1)

For more details of this study, see Table 13 and Appendix C Table 3

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Clemson 2004[103] Australia Good	**Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** n (mean change +/-SD) *Mental health component* CG: 125 (-0.52±10.00) IG: 133 (0.01±9.65) Mean difference (95% CI): 0.53 (-2.95 to 1.88) *Physical component* CG:125 (0.68±9.04) IG: 133 (-0.02±8.34) Mean difference (95% CI): 0.70 (-2.94 to 1.88) **EuroQol:** NR	**ADL:** NR **IADL:** NR

USPSTF – U.S. Preventive Services Task Force; # – number; SF-36 – 36-item Short Form Health Survey; SF-12 – 12-item Short Form Health Survey; SD – standard deviation; CI – confidence interval; NR – not reported; ADL – activities of daily living; IADL – instrumental activities of daily living

Table 5. Study Characteristics of Home Hazard Modification Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ 1)

For more details of this study, see Table 12 and Appendix C Table 4

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Campbell 2005[63] New Zealand Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** NR

USPSTF – U.S. Preventive Services Task Force; # – number; SF-36 – 36-item Short Form Health Survey; SF-12 – 12-item Short Form Health Survey; NR – not reported; ADL – activities of daily living; IADL – instrumental activities of daily living

NOTE: This study only reported mortality for data that is relevant for KQ 1.

Table 6. Study Characteristics of Exercise/Physical Therapy Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ 1)

For more details of each study, see Table 10 and Appendix C Table 5

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Ashburn 2007[96] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** IG: 2/67 (3%) CG: 6/67 (9%) p=0.141 **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol Mean (SD):** IG: Baseline 63.1 (17.1); 8 weeks 61.3 (19.8); 6 months 63.0 (18.7) CG: Baseline 64.6 (14.5); 8 weeks 61.7 (14.5); 6 months 56.6 (16.9) Adjusted* Diff (95% CI): 8 weeks -0.7 (-5.6 to 4.3); 6 months 5.7 (0.47 to 11.0) p: 8 weeks 0.793; 6 months 0.033 *Adjusted for SAS, baseline, Berg Balance/Functional Reach/ EuroQol, and location	**ADL:** NR **IADL:** NR
Barnett 2003[104] Australia Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** Groups did not differ after 6 months **EuroQol:** NR	**ADL:** NR **IADL:** NR
Buchner 1997[105] Buchner 1993[106] United States Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** *General health*: Baseline CG 77 (14), IG(ET) 78 (18), IG(ST) 78 (10), IG(ET+ST) 71 (15); 6-month change -2 (14), 1 (10), 1 (9), 1 (11) *Bodily pain*: Baseline 76 (21), 78 (24), 74 (21), 73 (22); 6-month change 1 (20), -2 (19), 2 (22), -1 (19) *Role physical*: Baseline 71 (28), 73 (31), 65 (39), 72 (32); 6-month change 3 (38), 10 (38), 4 (47), -1 (29) **EuroQol:** NR	**ADL:** NR **IADL:** *# independent IADLs (out of 5): Mean (SD)* Baseline / 6-mo CG 4.6 (0.7) / 0.2 (0.7) IG (ET) 4.7 (0.6) / 0.2 (0.5) IG (ST) 4.8 (0.7) / 0.1 (0.7) IG (ET+ST) 4.6 (1.0) / 0.1 (0.4)
Campbell 1997[97] New Zealand Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** No differences between the group scores: median, 8.0; range, 0-8

Table 6. Study Characteristics of Exercise/Physical Therapy Interventions to Reduce Fall-Related Injury, Improve Quality of Life, or Reduce Disability (KQ 1)

Study reference, Setting, USPSTF quality rating	Fall-related injury	Quality of life	Disability
Green 2002[94] United Kingdom Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** IG n outcome / CG n outcome Baseline 85 18 (16-19) / 85 18 (16-19) 3 months 81 18 (16-19) / 80 18 (16-19) p=0.497 6 months 73 18 (16-19) / 77 18 (16-19) p=0.888 9 months 72 18 (16-19) / 74 18 (16-20) p=0.478 **IADL:** NR
Rubenstein 2000[100] United States Fair	**Fracture rate per person-year:** 0 (both groups) **# fractures:** 0 (both groups) **# people sustaining fractures:** 0 (both groups) **# people sustaining multiple events:** 0 (both groups)	**SF-12:** NR **SF-36:** Physical functioning: NS Role limits-physical: NS Health perceptions: NS Health question: IG CG Baseline 51.8±26.3 50.9±20.2 Post-test 67.9±21.4 46.3±22.7 ANOVA (group x time): F(1,53) = 8.5 p=0.005 **EuroQol:** NR	**ADL:** NR **IADL:** NR
Wolf 1996[107] United States Fair	**Fracture rate per person-year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:**NR	**SF-12:** NR **SF-36:** NR **EuroQol:** NR	**ADL:** NR **IADL:** No significant changes observed across groups

– number; % – percent; IG – intervention group; CG – control group; SF-36 – 36-item Short Form Health Survey; SF-12 – 12-item Short Form Health Survey; NR – not reported; ADL – activities of daily living; IADL – instrumental activities of daily living; Diff – difference; SD – standard deviation; CI – confidence interval; ANOVA – analysis of variance; ET – endurance training; ST – strength training

NOTE: Luukenin 2007[93], Robertson 2001[95], and Campbell 2005[63] only report mortality for data relevant to KQ 1. See Appendix C Table 5 for more detail.

Table 7. Study Characteristics of Multifactorial Clinical Assessment Interventions to Prevent Falls (KQ 2)

For more details about each study see Appendix C Table 1

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Risk category, % high risk	# (%) fallers, # (%) frequent fallers, Length of followup	High-risk status	Adverse effects
Comprehensive intervention (assessment + multifactorial treatment)					
Close 1999[80] United Kingdom Fair	**Randomized:** 397 IG: 184 CG: 213 **Mean age (SD):** 78.2 (7.5) IG: 77.3 (7.4) CG: 78.9 (7.6)	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers:** IG: 59/184 (32%) CG: 111/213 (52%) **# (%) frequent fallers (2+ falls):** NR **Followup:** 1 year	All are high risk	NR
Hogan 2001[82] Canada Fair	**Randomized:** 163 IG: 79 CG: 84 **Mean age (SD):** IG: 77.4 (7.3) CG: 77.9 (6.2)	**Risk category:** Other (fall history) **Proportion:** 1+ falls: 100% 2+ falls: 47.2%	**# (%) fallers:** IG: 54/75 (72.0%) CG: 61/77 (79.2%) **# (%) frequent fallers (2+ falls):** NR **Followup:** 1 year	In a post-hoc subgroup analysis, IG subjects with >2 falls in the 3 months pre-study were less likely to fall (p=0.046) and had a significantly longer time between falls (p<0.001) compared with CG. No significant differences between the CG and IG in cumulative # of falls (311 v. 241; p=0.34), having 1+ falls (79.2% v. 72.0%; p=0.30) or in the mean # of falls (4.0 vs 3.2; p=0.43).	NR
Lord 2005[62] Australia Fair	**Randomized:** 620 IG: 210 CG: 204 **Mean age (SD):** IG (EI): 80.3 (4.3) IG (MI): 80.7 (4.6) CG: 80.2 (4.6)	**Risk category:** Screening Tool: Physiological Profile Assessment (PPA) **Proportion:** 100%	**# (%) fallers:** IG: 93 (46.0) CG: 90 (44.8) **# (%) frequent fallers (2+ falls):** IG: 49 (24.3) CG: 45 (22.4) **Followup:** 1 year	All are high risk	NR
Tinetti 1994[69] Tinetti 1993[162] Buchner 1993[110] United States Fair	**Randomized:** 301 IG: 153 CG: 148 **Mean age (SD):** IG: 78.3 (5.3) CG: 77.5 (5.3)	**Risk category:** Medication specific, gait and/or balance impairment, other (inability to transfer safely to bathtub or toilet, environmental hazards for falls, impairment in leg or arm muscle strength or range of motion) **Proportion:** 100% had at least 1 risk factor	**# (%) fallers:** IG: 52 (35) CG: 68 (47) **# (%) frequent fallers (2+ falls):** NR **Followup:** 1 year	All are high risk	*Death* IG: 7 (5%) CG: 5 (3%) *Hospitalization* IG: 32 (21%) CG: 36 (24%) *Musculoskeletal symptoms* IG: 10 CG: none p=NS

Table 7. Study Characteristics of Multifactorial Clinical Assessment Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Risk category, % high risk	# (%) fallers, # (%) frequent fallers, Length of followup	High-risk status	Adverse effects
Wagner 1994[78] United States Fair	**Randomized:** 1,559 IG: 635 CG: 607 **Mean age:** IG: 72.5 IG (visit only): 72.6 CG: 72.5	**Risk category:** Visual impairment, prescription drug use, other (inadequate exercise, high-risk alcohol use, hearing impairment, increased fall risk) **Proportion:** Overall: NR By risk category: 5-73%	**# falls:** NR **# (%) fallers (calc):** IG CG Year 1 175 (27.5) 223 (36.8) Year 2 199 (31.4) 177 (29.2) **# (%) frequent fallers (2+ falls):** NR **Followup:** 2 years	NR	NR
Targeted intervention (assessment + referral and targeted intervention or education)					
Elley 2008[79] New Zealand Good	**Randomized:** 312 IG: 155 CG: 157 **Mean age (SD):** 80.8 (5.0) IG: 80.4 (4.8) CG: 81.1 (5.3)	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers:** IG: 106 (68.4) CG: 98 (62.4) **# (%) frequent fallers (2+ falls):** IG: 69 (44.5) CG: 54 (34.4) **Followup:** 1 year	All are high risk	NR
Lord 2005[62] Australia Fair	**Randomized:** 620 IG: 206 CG: 204 **Mean age (SD):** IG: 80.7 (4.6) CG: 80.2 (4.6)	**Risk category:** Screening Tool: Physiological Profile Assessment (PPA) **Proportion:** 100%	**# (%) fallers:** IG: 94 (48.5) CG: 90 (44.8) **# (%) frequent fallers (2+ falls):** IG: 37 (19.1) CG: 45 (22.4) **Followup:** 1 year	All are high risk	NR
Shumway-Cook 2007[83] United States Good	**Randomized:** 453 IG: 226 CG: 227 **Mean age (range):** 75.6 (65-96)	**Risk category:** Other: (fall history in previous 3 months) **Proportion:** IG: 27% CG: 28%	**# (%) fallers:** IG: 124 (55) CG: 130 (57) **# (%) frequent fallers (2+ falls):** NR **Followup:** 1 year	N IRR (95% CI) Yes 124 0.61 (0.34-1.10)* No 329 0.95 (0.68-1.33) *p=0.20	NR
Van Haastregt 2000[71] Netherlands Fair	**Randomized:** 316 IG: 159 CG: 157 **Mean age (SD):** IG: 77.2 (5.1) CG: 77.2 (5.0)	**Risk category:** Other (fall history, mobility limitation) **Proportion:** 100% had at least 1 risk factor	**# (%) fallers:** IG CG 12 mo 63 (50) 53 (44) 18 mo 68 (57) 58 (52) **# (%) frequent fallers (2+ falls):** IG CG 12 mo 34 (27) 29 (24) 18 mo 43 (36) 35 (31) **Followup:** 18 months	All are high risk	NR

Table 7. Study Characteristics of Multifactorial Clinical Assessment Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Risk category, % high risk	# (%) fallers, # (%) frequent fallers, Length of followup	High-risk status	Adverse effects
Referral only intervention (assessment + referral only)					
Hendriks 2008[84] Netherlands Fair	**Randomized:** 333 IG: 166 CG:167 **Mean age (SD):** IG: 74.5 (5.9) CG: 75.2 (6.9)	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers at 12-mo:** IG: 55 (46) CG: 61 (47) **# (%) frequent fallers (2+ falls):** IG: 32 (26) CG: 34 (26) **Followup:** 1 year	All are high risk	NR
Lightbody 2002[77] United Kingdom Fair	**Randomized:** 348 IG: 171 CG: 177 **Median age (IQR):** IG: 75 (70-82) CG: 75 (70-81)	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers:** IG: 39 (25%) CG: 41 (26%) **# (%) frequent fallers:** NR **Followup:** 6 months	All are high risk	IG had higher rate of fall-related GP attendance
Newbury 2001[81] Australia Fair	**Randomized:** 100 IG: 50 CG: 50 **Median age (range):** IG: 78.5 (75-88) CG: 80 (75-91)	**Risk category:** NR **Proportion:** NR	**# (%) fallers:** IG: 12 (26.7) CG: 17 (38.6) **# (%) frequent fallers (2+ falls):** NR **Followup:** 1 year	NA	NR

N – number; # – number; % –percent; USPSTF – U.S. Preventive Services Task Force; IG – intervention group; CG – control group; SD – standard deviation; NR – not reported; IQR – interquartile range; EI – extensive intervention; MI – minimal intervention; SF-36 – 36-item Short Form Health Survey; IRR – incident risk ratio; CI – confidence interval

Table 8. Multifactorial Clinical Assessment Trials: Components

	Multifactorial Assessment							Assessment-Based Intervention
Study ID	**Orthostatic hypotension**	**Visual acuity**	**Gail and balance examination**	**Medication use**	**Cognition**	**Home environment**	**Other**	
Close 1999[80]	X	X	X	X	X	X	Disability, psychological	Referral plus comprehensive intervention
Elley 2008[79]	X	X	X	X		X	Continence, cardiovascular, bone health	Referral and targeted intervention (exercise)
Hendriks 2008[84]	X	X	X	X	X	X	Hearing, range of motion, foot assessment, psychological, disability	Referral only
Hogan 2001[82]	X	X	X	X		X	Behavior, alcohol use, disability	Referral plus comprehensive intervention
Lightbody 2002[77]	X	X	X	X	X	X	Hearing, cardiovascular, foot assessment, psychological	Referral only
Lord 2005[62]		X	X				Physiological tests including strength and reaction time	IG1: Referral plus comprehensive intervention IG2: Referral plus education
Newbury 2001[81]		X		X		X	Hearing, alcohol use, disability, nutrition, social, psychological	Referral only
Shumway-Cook 2007[83]		X	X	X			Physical activity, alcohol use, psychological, disability	Referral and targeted intervention (exercise)
Tinetti 1994[69]	X		X	X		X	Disability	Referral plus comprehensive intervention
Van Haastregt 2000[71]				X	X	X	Disability, psychological, social, general examination	Referral plus education
Wagner 1994[78]		X		X		X	Physical activity, alcohol use, hearing	Referral plus comprehensive intervention

Table 9. Study Characteristics of Clinical Management Interventions to Prevent Falls (KQ 2)

For more details of each study see Appendix C Table 2

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Intervention and control description, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Hip protectors						
Birks 2004[85] United Kingdom Fair	**Randomized:** 4,169 IG: 1388 CG: 2781 **Mean age (SD):** IG: 77.9 (5.7) CG: 77.8 (5.5)	**Intervention:** Hip protectors **Control:** Leaflet **Followup:** Median 28 mo	**Risk category:** Other (≥1 risk factor for hip fracture) **Proportion:** 100%	**# (%) fallers:** IG CG 12 mo 261 (27.7) 726 (37.5) 24 mo 111 (24.1) 304 (30.5) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Cameron 2003[66] Australia Fair	**Randomized:** 600 IG: 302 CG: 298 **Mean age (SD):** 83 IG: 83.2 (5.1) CG: 83.0 (4.9)	**Intervention:** Hip protectors **Control:** Not explicit **Followup:** 24 mo	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** IG: 139 (46) CG: 131 (44)	All are high risk	IG: 3 fractures while wearing hip protectors; 5 significant bruises; 16 (5%) had skin irritation/ infection
Pharmacological/nutrition intervention						
Campbell 1999[112] New Zealand Fair *(study also located in Exercise/PT)*	**Randomized:** 93 (3 IGs) MW: 24 CG: 24 **Mean age (SD):** MW: 74.6 (5.5) CG: 75.2 (5.6)	**Intervention:** Medication reduction **Control:** Original medication in study capsules **Followup:** 44 wks	**Risk category:** Medication specific (taking psychotropics **Proportion:** 100%	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR (Article reports fall rate per person-year and total # of falls)	All are high risk	NR
Gray-Donald 1995[88] Canada Fair	**Randomized:** 50 IG: 25 CG: 25 **Mean age (SD):** IG: 76 (7) CG: 79 (8)	**Intervention:** Cans of liquid supplement and home visits **Control:** Home visits **Followup:** 12 wks	**Risk category:** Other (nutritional risk) **Proportion:** 100%	**# (%) fallers:** Baseline 12 wks IG 6 (25) 0 (0) IG 5 (33) 0 (0) (≥7 cans/wk) CG: 1 (4) 5 (21) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Vision correction						
Cumming 2007[90] Australia Fair	**Randomized:** 616 IG: 309 CG: 307 **Mean age (SD):** IG: 80.9 (6.3) CG: 80.3 (5.7)	**Intervention:** Eye exam and treatment **Control:** Usual care **Followup:** 1 yr	**Risk category:** Other (frailty) **Proportion:** 100%	**# (%) fallers:** IG: 201 (65.0) CG: 153 (49.8) **# (%) frequent fallers (2+ falls):** IG: 117 (37.9) CG: 153 (30.6)	Effect similar in those with and wothout history of falls in past yr (RR, 2.11 [1.44-3.08] vs. RR, 1.52 [1.09-2.10])	Increased fall and fracture risk in the IG

Table 9. Study Characteristics of Clinical Management Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Intervention and control description, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Day 2002[61] Australia Fair *(study also located in Exercise/PT & HH)*	**Randomized:** 1,107 **Continued:** 1,090 (7 IGs) IG: 139 CG: 137 **Mean age (SD):** All: 76.1 (5.0)	**Intervention:** Those with poor vision went to usual eye care provider, rest got leaflet **Control:** Waitlist control **Followup:** 18 mo	**Risk category:** NR **Proportion:** NA	**# (%) fallers:** IG: 84 (60.4) CG: 87 (63.5) **# (%) frequent fallers (2+ falls):** NR	NA	NR
Foss 2006[91] United Kingdom Fair	**Randomized:** 239 IG: 120 CG: 119 **Mean age (range):** IG: 79.2 (70-90) CG: 79.9 (70-92)	**Intervention:** Cataract surgery **Control:** Routine wait for surgery **Followup:** 1 yr	**Risk category:** Eye disease, visual impairment **Proportion:** 100%	**# (%) fallers:** IG: 48 (40) CG: 41 (34) **# (%) frequent fallers (2+ falls):** IG: 22 (18) CG: 22 (18)	All are high risk	Iris damage, posterior capsular rupture, posterior capsular opacification noted at 6 months
Harwood 2005[87] United Kingdom Good	**Randomized:** 306 IG: 154 CG: 152 **Median age (range):** IG: 78.8 (70-95) CG: 78.1 (70-90)	**Intervention:** Cataract surgery **Control:** Routine wait for surgery **Followup:** 1 yr	**Risk category:** Eye disease, visual impairment **Proportion:** 100%	**# (%) fallers:** IG: 76 (49) CG: 69 (45) **# (%) frequent fallers (2+ falls):** IG: 28 (18) CG: 38 (25)	All are high risk	Iris damage, posterior capsular rupture, posterior capsular opacification noted at 6 months
Vitamin D						
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] United States Fair	**Randomized:** 445 IG: 219 CG: 226 **Mean age (SD):** IG: women: 71 (5) men: 70 (4) CG: women: 71 (5) men: 71 (5)	**Intervention:** Vitamin D **Control:** Placebo **Followup:** 3 yrs	**Risk category:** Other (female sex, less physically active, and lower 25-OHD levels) **Proportion:** Female: 55.3% Female + less physically active: 43.5% Male + less physically active: 40.2% 25-OHD<32 ng/mL: NR	**# (%) fallers:** IG: 107 (49) CG: 124 (55) **# (%) frequent fallers (2+ falls):** NR	Reduced odds of falling in ambulatory older women by 46% and less-active women by 65%. 69 (50%) less active and 65 (61%) more active women fell. 36 (46%) less active and 60 (50%) more active men fell. Vit D/calcium reduced odds of falling in women (OR, 0.54 [0.30-0.97]) but not men (OR, 0.93 [0.50-1.72]). Fall reduction most pronounced in less active women (OR, 0.35 [0.15-0.81]).	NR
Dhesi 2004[102] United Kingdom Fair	**Randomized:** 139 IG: 70 CG: 69 **Mean age (SD):** IG: 77.0 (6.3) CG: 76.6 (6.1)	**Intervention:** Vitamin D **Control:** Placebo **Followup:** 6 mo	**Risk category:** Other (fall history) **Proportion:** 100%	**# (%) fallers (calc):** IG: 11 (15.7) CG: 14 (20.3) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR

Table 9. Study Characteristics of Clinical Management Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Intervention and control description, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Dukas 2004[92] Switzer-land Fair	**Randomized:** 378 IG: 193 CG: 187 **Mean age (SD):** IG: 75.0 (4.4) CG: 75.0 (4.1)	**Intervention:** Vitamin D **Control:** Placebo **Followup:** 36 wks	**Risk category:** Other (low calcium intake) **Proportion:** IG: 50.0% CG: 48.4%	**# (%) fallers:** IG: 40 (20.8) CG: 46 (24.7) **# (%) frequent fallers (2+ falls):** NR	**# falls:** *≥512 mg/d daily Ca intake* IG: 28 (29) CG: 22 (24) *<512 mg/d daily Ca intake* IG: 18 (19) CG: 29 (30) **# (%) fallers:** *≥12 mg/d daily Ca intake* IG: 24 (25) CG: 20 (22) *<512 mg/d daily Ca intake* IG: 16 (17) CG: 26 (27)	6 (1 in CG, 5 in IG) had slight transient hypercalcemia, 2 in IG had mild asymptomatic hypercalcemia; no significant diff in serious adverse effects attributable to treatment
Pfeifer 2000[98] Germany Fair	**Randomized:** 148 IG: 74 CG: 74 **Mean age (SD):** IG: 74.8 (0.5) CG: 74.7 (0.5)	**Intervention:** Vitamin D and calcium **Control:** Placebo and calcium **Followup:** 1 yr	**Risk category:** Other (vitamin D deficient) **Proportion:** 100%	**# (%) fallers:** IG: 11 (16) CG: 19 (28) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Porthouse 2005[67] England Fair	**Randomized:** 3454 IG: 1321 CG: 1993 **Mean age (SD):** IG: 77.0 (5.10) CG: 76.7 (5.02)	**Intervention:** Nurse visit and supply of Ca and vit D. Brochure on general falls prevention and appropriate Ca/vit D intake from dietary sources **Control:** Brochure only **Followup:** Median 25 mo	**Risk category:** N/A **Proportion:** N/A	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR Odds of falling by 12 mo after supplementation, 0.98 (95% CI, 0.79-1.2)	N/A	NR
Prince 2008[89] Australia Fair	**Randomized:** 302 IG: 151 CG: 151 **Mean age (SD):** IG: 77.0 (4.2) CG: 77.4 (5.0)	**Intervention:** Vitamin D and calcium **Control:** Calcium **Followup:** 1 year	**Risk category:** Other (vitamin D deficient and fall history) **Proportion:** 100%	**# (%) fallers:** IG: 80 (53.0) CG: 95 (62.9) **# (%) frequent fallers (2+ falls):** NR	All are high risk	No diff in cancer, ischemic heart disease, stroke, constipation, or fracture rates; 1 in IG had mild asymptomatic hypercalcemia

N – number; # – number; % – percent; USPSTF – U.S. Preventive Services Task Force; IG – intervention group; CG – control group; SD – standard deviation; NR – not reported

Table 10. Study Characteristics of Exercise/Physical Therapy Interventions to Prevent Falls (KQ 2)

For more details of each study see Appendix C Table 5

Study reference, Setting, USPSTF quality rating	N patients randomized, Age, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Ashburn 2007[96] United Kingdom Fair	**Randomized:** 142 IG: 70 CG: 72 **Mean age (SD):** IG: 72.7 (9.6) CG: 71.6 (8.8) **Followup:** 6 mo	**Risk category:** Parkinson's disease **Proportion:** 100%	**# (%) fallers:** IG CG 8 wks 37 (57) 42 (66) 6 mo 46 (73) 49 (78) **# (%) frequent fallers (2+ falls):** IG CG 8 wks 21 (32) 28 (44) 6 mo 35 (56) 42 (68)	All are high risk	NR
Barnett 2003[104] Australia Fair	**Randomized:** 163 IG: 83 CG: 80 **Mean age (SD):** IG: 74.4 (4.9) CG: 75.4 (6.0) **Followup:** 1 yr	**Risk category:** Gait and/or balance impairment **Proportion:** 100%	**# (%) fallers/nonfallers:** IG: 27 (35.5) CG: 37 (50.0) **# (%) frequent fallers (2+ falls):** IG: 8 (10.8) CG: 18 (24.3)	All are high risk	NR
Buchner 1997[105] Buchner 1993[106] United States Fair	**Randomized:** 105 to FICSIT IG (ET): 25 IG (ST): 25 IG (ET+ST): 25 CG: 30 **Mean age:** IG(ET): 75 IG(ST): 75 IG(ET+ST): 74 CG: 75 **Followup:** 6 mo	**Risk category:** Other (balance and/or gait impairment) **Proportion:** 100%	**# (%) fallers:** *Year 1* IG: 32 (42) CG: 18 (60) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Campbell 1997[97] New Zealand Fair	**Randomized:** 233 IG: 116 CG: 117 **Mean age (SD):** IG: 84.1 (3.1) CG: 84.1 (3.4) **Followup:** 1 yr	**Risk category:** Unselected (authors describe as a high risk population because all are female) **Proportion:** NA	**# (%) fallers (calc):** IG: 53 (46) CG: 62 (53) **# (%) frequent fallers (2+ falls):** IG: 22 (19) CG: 34 (29)	All are high risk	NR
Campbell 1999[112] New Zealand Fair *(study also located in Clinical Mgmt)*	**Randomized:** 93 (3 IGs) OM + Ex: 21 CG: 24 **Mean age (SD):** OM + Ex: 73.1 (6.3) CG: 75.2 (5.6) **Followup:** 44 wks	**Risk category:** Medication-specific (taking psychotropics) **Proportion:** 100%	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR (Fall rate per person-year and total # of falls reported)	All are high risk	NR

Table 10. Study Characteristics of Exercise/Physical Therapy Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Campbell 2005[63] New Zealand Fair *(study also located in Home Hazard)*	**Randomized:** 391 (3 IGs) IG (Otago): 97 CG: 96 **Mean age (SD):** IG (Otago): 83.4 (4.9) CG: 84.0 (4.9) **Followup:** 1 yr	**Risk category:** Eye diseases/ visual impairment **Proportion:** 100%	**# (%) fallers:** IG (Otago): 47 (48) CG: 59 (61) **# (%) frequent fallers (2+ falls):** IG (Otago): 27 (28) CG: 29 (30)	All are high risk	NR
Day 2002[61] Australia Fair *(study also located in Clinical Mgmt & Home Hazard)*	**Randomized:** 1107 (7 IGs) **Continued:** 1090 IG (ex): 135 CG: 137 **Mean age (SD):** All: 76.1 (5.0) **Followup:** 18 mo	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** IG (ex): 76/135 (56.3) CG: 87/137 (63.5) **# (%) frequent fallers (2+ falls):** NR	NA	NR
Green 2002[94] United Kingdom Fair	**Randomized:** 170 IG: 85 CG: 85 **Mean age (SD):** IG: 71.5 (8.7) CG: 73.5 (8.3) **Followup:** 9 mo	**Risk category:** Cerebrovascular disorder (stroke) **Proportion:** 100%	**# (%) fallers:** IG CG BL-3 months 13 (16) 809 (11) 3-6 months 16 (22) 15 (19) 6-9 months 17 (24) 10 (14) Overall 30 (35) 23 (27) **# (%) frequent fallers (2+ falls):** NR	All are high risk	
Li 2005[116] United States Fair	**Randomized:** 256 IG: 125 CG: 131 **Mean age (SD):** IG: 76.94 (4.69) CG: 77.99 (5.14) **Followup:** 1 yr	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** IG CG During 27 (28) 43 (46) 6 mo after 15 (16) 43 (46) **# (%) frequent fallers (2+ falls):** IG CG During 7 (7) 21 (22) 6 mo after NR NR	NA	NR
Lord 1995[108] Australia Fair	**Randomized:** 374 IG: 187 CG: 187 **Mean age (SD):** IG: 71.6 (5.5) CG: 71.7 (5.3) **Followup:** 1 yr	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** IG: 26 (34.7) CG: 33 (35.1) **# (%) frequent fallers (2+ falls):** IG: 8 (10.7) CG: 12 (12.8)	NA	NR
Luukinen 2007[93] Finland Fair	**Randomized:** 486 IG: 243 CG: 243 **Mean age (SD):** IG: 88 (3) CG: 88 (3) **Followup:** 16 mo	**Risk category:** Other (various) **Proportion:** 100% had 1+ risk factors	**# (%) fallers:** IG: 126 (58) CG: 136 (62) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR

Table 10. Study Characteristics of Exercise/Physical Therapy Interventions to Prevent Falls (KQ 2)

Study reference, Setting, USPSTF quality rating	N patients randomized, Age, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Morgan 2004[113] United States Fair	**Randomized:** 294 IG: 119 CG: 110 Lost before BL: 49 Incomplete data: 16 (IG: 8, CG: 8) **Mean age (SD):** IG: 81.0 (7.6) CG: 80.1 (7.4) **Followup:** 1 yr	**Risk category:** Other (recent hospitalization or bed rest) **Proportion:** 100%	**# (%) fallers:** IG: 34 (28.6) CG: 34 (30.9) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Robertson 2001[95] New Zealand Fair	**Randomized:** 240 IG: 121 CG: 119 **Mean age (SD):** IG: 80.8 (3.8) CG: 81.1 (4.5) **Followup:** 1 yr	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR (Fall rate per person-year and total # of falls reported)	NA	One participant fell while exercising as instructed
Rubenstein 2000[100] United States Fair	**Randomized:** 59 IG: 31 CG: 28 **Mean age (SD):** IG: 76.4 (4.9) CG: 74.4 (43.4)* *Reported SD appears to be a typo **Followup:** 12 wks	**Risk category:** Gait and/or balance impairment **Proportion:** 100%	**# (%) fallers:** IG: 12 (38.7) CG: 9 (32.1) **# (%) frequent fallers (2+ falls):** NR	All are high risk	NR
Voukalatos 2007[115] Australia Good	**Randomized:** 702 IG: 353 CG: 349 **Mean age (SD):** 69 (6.5) IG: 69 CG: 69 **Followup:** 6 mo	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** IG CG 16 wks 61 (17.6) 70 (20.8) 24 wks 71 (20.5) 81 (24.0) **# (%) frequent fallers (2+ falls):** IG CG 16 wks 8 (2.3) 13 (3.9) 24 wks 15 (4.3) 27 (8.0)	NA	NR
Wolf 1996[107] United States Fair	**Randomized: 200** IG(TC): 72 IG(BT): 64 CG: 64 **Mean age (SD):** IG(TC): 76.9 (4.8) IG(BT): 76.3 (5.1) CG: 75.4 (4.1) **Followup:** 4 mo	**Risk category:** Unselected **Proportion:** NA	**# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR (Total # of falls reported)	NA	NA

N – number; # – number; % – percent; USPSTF – U.S. Preventive Services Task Force; IG – intervention group; CG – control group; SD – standard deviation; NR – not reported; NA – not applicable; BL – baseline; FICSIT – Frailty and Injuries: Cooperative Studies of Intervention Techniques; ET – endurance training; ST – strength training; OM – original medication; Ex – exercise; TC – Tai Chi; BT – balance training

Table 11. Components of Exercise/Physical Therapy Interventions

Study reference, Sample size (n)	Intervention components	Format and delivery of intervention (individual vs group-based, location, by whom)	Intensity* of physical activity interventions (hours)	Effect size (95% CI) for proportion of fallers
Ashburn 2007[96] n=142	**Gait, balance, functional training:** range of movement, balance training **Strength resistance exercise:** progressive muscle strengthening **General (walking, aerobic, endurance):** walking exercises **Other:** strategies for fall prevention and movement initiation/ compensation	Individual In-home by physiotherapist	Very low	0.94 (0.77 to 1.15)
Barnett 2003[104] n=163	**Gait, balance, functional training:** functional exercises, balance and coordination exercises **Strength resistance exercise:** strength work **General (walking, aerobic, endurance):** aerobic activity **Other:** home-based exercise program with diaries to record participation, written information on practical strategies for avoiding falls, such as hand and foot placement if loss of balance occurred	Individual and group Classes in community setting by accredited exercise instructor, plus home exercise	Medium	0.71 (0.49 to 1.04)
Buchner 1997[105] n=105	**Gait, balance, functional training:** None **Strength resistance exercise:** one or two sets of 10 reps of resistence training with weight machines **General (walking, aerobic, endurance):** stationary bicycles **Other:** None	Group-based Location and instructor NR	Medium	0.71 (0.48 to 1.05)
Campbell 1997[97] n=233	**Gait, balance, functional training:** balance exercises **Strength resistance exercise:** strength exercises **General (walking, aerobic, endurance):** walking plan **Other:** None	Individual In-home by physiotherapist	High	0.86 (0.66 to 1.12)
Campbell 1999[112] n=93	**Gait, balance, functional training:** balance training **Strength resistance exercise:** muscle strengthening **General (walking, aerobic, endurance):** walking plan **Other:** None	Individual In-home by physiotherapist	Low	0.67 (0.47 to 0.95)
Campbell 2005[63] n=391	**Gait, balance, functional training:** balance exercises **Strength resistance exercise:** strength exercises **General (walking, aerobic, endurance):** walking plan **Other:** None	Individual In-home by physiotherapist	High	0.79 (0.61 to 1.02)
Day 2002[61] n=1107	**Gait, balance, functional training:** exercises to improve flexibility and balance **Strength resistance exercise:** exercises to improve leg strength **General (walking, aerobic, endurance):** None **Other:** None	Individual and group Classes plus home exercise, location and instructor NR	Low	0.83 (0.71 to 0.97)
Green 2002[94] n=170	**Gait, balance, functional training:** details NR **Strength resistance exercise:** None **General (walking, aerobic, endurance):** None **Other:** None	Individual Assessed at a PT center; intervention at home or in outpatient rehabilitation center by physiotherapist	Very low	1.34 (0.87 to 2.07)
Li 2005[116] n=256	**Gait, balance, functional training:** Tai Chi following the 24-form Yang style and synchronized breathing **Strength resistance exercise:** None **General (walking, aerobic, endurance):** None **Other:** None	Group-based Location NR, Tai Chi instructors	High	0.61 (0.42 to 0.91)

Table 11. Components of Exercise/Physical Therapy Interventions

Study reference, Sample size (n)	Intervention components	Format and delivery of intervention (individual vs group-based, location, by whom)	Intensity* of physical activity interventions (hours)	Effect size (95% CI) for proportion of fallers
Lord 1995[108] n=374	**Gait, balance, functional training:** activities for flexibility and hand-eye and foot-eye coordination **Strength resistance exercise:** strenghthening exercises **General (walking, aerobic, endurance):** aerobic exercises and activities for endurance **Other:** None	Group-based Classes at a community hall and a public hospital, instructor NR	High	0.99 (0.65 to 1.50)
Luukinen 2007[93] n=486	**Gait, balance, functional training:** home exercises in a standing position if possible, sitting if not, lying if neither **Strength resistance exercise:** None **General (walking, aerobic, endurance):** walking exercises **Other:** None	Individual and group-based Exercises in small groups, location NR; self-care exercises at home, by physiotherapist and occupational therapist	Very low	0.94 (0.81 to 1.10)
Morgan 2004[113] n=294	**Gait, balance, functional training:** exercise to directly affect neuromuscular functioning , balance, and gait **Strength resistance exercise:** exercise for neuromuscular functioning includes element of muscle strength **General (walking, aerobic, endurance):** None **Other:** None	Group-based Location NR, physical therapist and physical therapy assistant	Low	0.92 (0.62 to 1.38)
Robertson 2001[95] n= 240	**Gait, balance, functional training:** progressive balance retraining **Strength resistance exercise:** progressive muscle stregthening **General (walking, aerobic, endurance):** walking plan **Other:** None	Individual In-home, by nurses and physiotherapist	High	Cannot calculate
Rubenstein 2000[100] n=59	**Gait, balance, functional training:** balance training **Strength resistance exercise:** strength training **General (walking, aerobic, endurance):** endurance training **Other:** None	Group-based Classes at VA Ambulatory Care Center by exercise physiology graduate students	Medium	1.20 (0.60 to 2.42)
Voukalatos 2007[115] n=702	**Gait, balance, functional training:** Tai Chi, generally Sun style **Strength resistance exercise:** None **General (walking, aerobic, endurance):** None **Other:** None	Group-based Classes at community venues by experienced or accredited Tai Chi instructors	Low	0.85 (0.64 to 1.13)
Wolf 1996[107] n=200	**Gait, balance, functional training:** Tai Chi or balance training (standing on a platform and moving cursor on screen to target by moving center of mass, without foot displacement) **Strength resistance exercise:** None **General (walking, aerobic, endurance):** None **Other:** None	**Tai Chi:** group-based Location NR and instructor NR **Balance training:** individual Location and instructor NR	Low	Cannot calculate

N – sample size; CI – confidence interval; NR – not reported; PT – physical therapy; VA – Veterans Administration

NOTE: Control group descriptions are not shown. Control groups were true controls (e.g., usual care, minimal intervention, or attention control).

Table 12. Study Characteristics of Home Hazard Modification Interventions to Prevent Falls (KQ 2)

For more details of each study see Appendix C Table 4

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Intervention and control description, Length of followup	Risk category, % high risk	# (%) fallers # (%) frequent fallers	High risk status	Adverse effects
Campbell 2005[63] New Zealand Fair *(study also located in Exercise/PT)*	**Randomized:** 391 (3 IGs) IG: 100 CG: 96 **Mean age (SD):** IG: 83.1 (4.5) CG: 84.0 (4.9)	**Intervention:** Home safety assessment and modification **Control:** Social visits **Followup:** 1 year	**Risk category:** Eye disease, visual impairment **Proportion:** 100%	**# (%) fallers:** IG: 36 (36) CG: 59 (61) **# (%) frequent fallers (2+ falls):** IG: 16 (16) CG: 29 (30)	All are high risk	NR
Day 2002[61] Australia Fair *(study also located in Clinical Mgmt, Exercise/PT)*	**Randomized:** 1,107 **Continued:** 1,090 (7 IGs) IG: 136 CG: 137 **Mean age (SD):** All: 76.1 (5.0)	**Intervention:** Home hazards removed or modified **Control:** Waitlist control **Followup:** 1 year	**Risk category:** NR **Proportion:** NA	**# (%) fallers:** IG: 78 (57.4) CG: 87 (63.5) **# (%) frequent fallers (2+ falls):** NR	NA	NR
Stevens 2001[70] Australia Fair	**Randomized:** 1,879 IG: 635 CG: 1,244 **Mean age:** IG: 76 CG: 76	**Intervention:** Home hazard assessment, education, and installation of safety devices **Control:** Home visits **Followup:** 1 year	**Risk category:** NR **Proportion:** NA	**# (%) fallers:** NR Only reported Adjusted OR: 0.97 (0.74 to 1.28) **# (%) frequent fallers (2+ falls):** NR Reported OR for fall rate: 1.02 (0.83 to 1.27)	NA	NR

N – number; # – number; % – percent; USPSTF – U.S. Preventive Services Task Force; IG – intervention group; CG – control group; SD – standard deviation; NR – not reported; NA – not applicable

Table 13. Study Characteristics of Clinical Education/Behavioral Counseling Interventions to Prevent Falls (KQ 2)

For more details of each study see Appendix C Table 4

Study reference, Setting, USPSTF quality rating	N patients randomized, Age	Intervention and control description, Length of followup	Risk category, % high risk	# (%) fallers, # (%) frequent fallers	High risk status	Adverse effects
Clemson 2004[103] United Kingdom Good	**Randomized:** 310 IG: 157 CG: 153 **Mean age (SD):** IG: 78.31 (5.26) CG: 78.47 (5.66)	**Intervention:** Community-based falls education and a home visit **Control:** Social visits **Followup:** 14 months	**Risk category:** Other (fall history or concern about falling) **Proportion:** 100%	**# (%) fallers:** IG: 82 (52) CG: 89 (58) **# (%) frequent fallers (2+ falls):** IG: 40 (26) CG: 53 (35)	All are high risk	NR

N – number; # – number; % – percent; USPSTF – U.S. Preventive Services Task Force; IG – intervention group; CG – control group; SD – standard deviation; NR – not reported

Table 14. Selection of High-Risk Populations for Interventions to Prevent Falls

Study	Fall history									Disease history							Medication		Visual impairment			Age, yrs		
	ED visit, fall 1° diagnosis	≥ 1 last year	Reported concern about falling	≥ 1 last 8 wks	≥ 2 last 6 mos	≥ 2, or 1 requiring hospital admit, in last year	≥ 1 last 6 mos	≥ 2 in last year	≥ 1 last 3 mos	Parkinson's Disease	Postural hypertension	Stroke in last year	Gait / balance impairment	Mobility limitation	Environmental falls hazards	1+ hip fracture risk factors	≥ 4 meds	Current psychotropics	Distance visual acuity	Poor vision	Cataract	70+	75+	80+
Ashburn 2007[96]										X														
Barnett 2003[104]													X											
Birks 2004[85]																X						X		
Buchner 1997[105], 1993[106]													X											
Cameron 2003[66]						X																X		
Campbell 1997[97]																								X
Campbell 1999[112]																		X						
Campbell 2005[63]																			X				X	
Clemson 2004[103]		X	X																			X		
Close 1999[80]	X																							
Cumming 2007[90]																						X		
Day 2002[61]																						X		
Dhesi 2004[102]				X																				
Dukas 2004[92]																						X		
Elley 2008[79]		X																					X	
Foss 2006[91]																					X	X		
Gray-Donald 1995[88]																								
Green 2002[94]												X												
Harwood 2005[87]																					X	X		
Hendriks 2008[84]	X																							
Hogan 2001[82]									X															
Li 2005[116]																						X		
Lightbody 2002[77]	X																							
Lord 2005[62]													X										X	
Luukinen 2007[93]								X					X							X				X
Morgan 2004[113]																								
Newbury 2001[81]																							X	
Pfeifer 2000[98]																						X		
Porthouse 2005[67]																						X		
Prince 2008[89]		X																				X		
Robertson 2001[95]																							X	
Rubenstein 2000[100]							X						X											
Stevens 2001[70]																						X		
Tinetti 1994[69] Buchner 1993[110]											X		X	X	X		X	X				X		
van Haastregt 2000[71]					X									X								X		
Wolf 1996[107]																						X		

Table 14. Selection of High-Risk Populations for Interventions to Prevent Falls

Study	Female (all female)	Frail	Vitamin D deficient	Recent hospital admit, bed rest >2 days in last month	Involuntary weight loss	Other	Notes
Ashburn 2007[96]							
Barnett 2003[104]							Gait/balance impairment: lower limb weakness, poor balance, or slow reaction time (inability to stand from a chair in <2 sec; inability to maintain balance in near-tandem balance test; or inability to catch a rod dropped from above in 300 msec).
Birks 2004[85]	X						Hip fracture risk factors: low body weight, smoking, prior fracture, family history of hip fracture.
Buchner 1997[105] Buchner 1993[106]							Mobility limitation: unable to do 8-step tandem gait w/out errors, <50th percentile in knee extensor strength for age, sex, height, or weight.
Cameron 2003[66]	X						
Campbell 1997[97]	X						
Campbell 1999[112]							
Campbell 2005[63]							
Clemson 2004[103]							Either checked factor considered.
Close 1999[80]							
Cumming 2007[90]		X					
Day 2002[61]							
Dhesi 2004[102]			X				Required both recent fall AND vitamin D deficient (25-hydroxyvitamin D ≤12µg/l).
Dukas 2004[92]							
Elley 2008[79]							
Foss 2006[91]	X						
Gray-Donald 1995[88]					X		Involuntary loss >5% of weight in last month, >7.5% last 3 months, or >10% last 6 months + BMI <27; or BMI <24.
Green 2002[94]							
Harwood 2005[87]	X						
Hendriks 2008[84]							
Hogan 2001[82]							
Li 2005[116]							
Lightbody 2002[77]							
Lord 2005[62]							Gait/balance impairment: physiological profile assessment falls risk scores < -1.
Luukinen 2007[93]						X	Any checked factors considered. Gait/balance impairment: impaired balance or chair rise or slow walking speed; Other: loneliness, depression, or poor self-rated health, hearing, or cognition.
Morgan 2004[113]				X			
Newbury 2001[81]							
Pfeifer 2000[98]	X		X				25-hydroxycholecalciferol < 50 nmol/liter.
Porthouse 2005[67]							
Prince 2008[89]	X		X				25-hydroxyvitamin D concentration <24.0 ng/mL.
Robertson 2001[95]							
Rubenstein 2000[100]							Any checked risk factors considered. Gait/balance impairment: lower extremity weakness, impaired gait, or impaired balance.
Stevens 2001[70]							
Tinetti 1994[69] Buchner 1993[110]							Any checked risk factors considered. Mobility limitation: unsafe toilet or tub transfer, impaired leg/arm muscle strength, or impaired range of motion.
van Haastregt 2000[71]							Mobility limitation: score of 3+ on mobility control scale (short version of Sickness Impact Profile).

Table 15. Summary of Evidence By Key Question

# of trials	Design	Limitations	Consistency	Applicability	Overall quality	Summary of findings
KQ1. Is there direct evidence that primary care interventions reduce fall-related injury, improve QOL, reduce disability, or reduce mortality when used alone or in combination to reduce falls in community-dwelling older adults? ***1a. Do these interventions reduce injury, improve QOL, reduce disability, or reduce mortality in older adults specifically identified as high risk for falls?***						
Clinical assessment						
10	RCT	Few of the studies reported health outcomes. Hetero-geneity along many dimensions, including age of participants, baseline risk of falling, intervention approach, country, treat-ment intensity, and duration of followup; high attrition in many trials; failure to blind assessors. Limited duration of followup.	Hampered by inconsistent assessment and measurement of health outcomes.	Fair: RCTs conducted in US, UK, Netherlands, Australia, and Canada. Nonwhite populations not well represented.	Fair	No evidence for reduced mortality in pooled analysis. No evidence that multifactorial clinical assessment was associated with fall-related fractures or QOL. Mixed results for disability. Three trials reported reduced disability but 3 others found no effect on disability.
Clinical management						
11	RCT	Few of the studies reported health outcomes.	No significant statistical heterogeneity in pooling estimates for vitamin D supplementation or hip protectors.	Fair: Trials evaluating vitamin D and hip protectors included only women. Nonwhite populations not well represented. Primarily conducted in high-risk populations.	Fair	No evidence for reduced mortality in pooled analysis. Vitamin D supplementation (with or without calcium), vision correction, and hip protectors were not associated with significant reductions in fall-related fractures or mortality in high risk populations. Vitamin D was also not associated with improved QOL.
Clinical education/behavioral counseling						
1	RCT	Relaxed selection criteria to include people who were afraid of falling in addition to those with a history of a fall during the past year.	Only one study.	Fair: ≥70 years, no dementia and not homebound; recruited through ads in community. All w/history of fall in past year or fear of falling. Conducted in Australia. Ethnicity and SES status NR.	Good	Community-based group behavioral counseling of moderate intensity was not associated with improved QOL in populations selected to have higher fall risk.
Home hazard modification						
1	NA	NA	NA	NA	NA	Only included in the pooled mortality analysis. No evidence for reduced mortality in pooled analysis.

Table 15. Summary of Evidence By Key Question

# of trials	Design	Limitations	Consistency	Applicability	Overall quality	Summary of findings
Exercise/physical therapy						
10	RCT	Few of the studies reported health outcomes. Hetero-geneity along many dimensions, including age and gender of participants, baseline risk of falling, intervention approach, country, treatment intensity, and duration of followup; high attrition in many trials; failure to blind assessors. Relatively small sample size. Limited duration of followup.	Six of the studies were conducted in populations selected for high risk for falling.	Fair: Several studies restricted to populations with chronic disease (stroke, Parkinson's disease) or recent hospitalization.	Fair	No consistent evidence of improvement in QOL or reduction in fall-related fractures or disability. No evidence for reduced mortality in pooled analysis.
KQ2. Do primary care interventions used alone or in combination in community-dwelling older adults reduce risk for or rate of falls/fallers? 2a. Do these interventions reduce falls in older adults specifically identified as high risk for falls? 2b. Are there positive outcomes other than reduced falls, and related morbidity and mortality, that result from primary care falls interventions?						
Clinical assessment						
11	RCT	Heterogeneity along many dimensions, including age of participants, baseline risk of falling, intervention approach, country, treatment intensity, and duration of followup; high attrition in many trials; failure to blind assessors. Significant heterogeneity.	Most comprehensive interventions were associated with lower risk for falling.	Fair: RCTs conducted in US, UK, Netherlands, Australia, and Canada. Nonwhite populations not well represented. More compre-hensive treatments may not be feasible for health care systems to offer given current barriers.	Fair	Comprehensive multifactorial clinical assessment interventions reduced falls among primarily high-risk older adults (RR, 0.75 [95% CI, 0.58 to 0.98]), while 6 noncomprehensive interventions following multifactorial clinical assessment did not (RR, 1.05 [95% CI, 0.97 to 1.15]). Limited evidence that these interventions also prevent reductions in fall efficacy.

Table 15. Summary of Evidence By Key Question

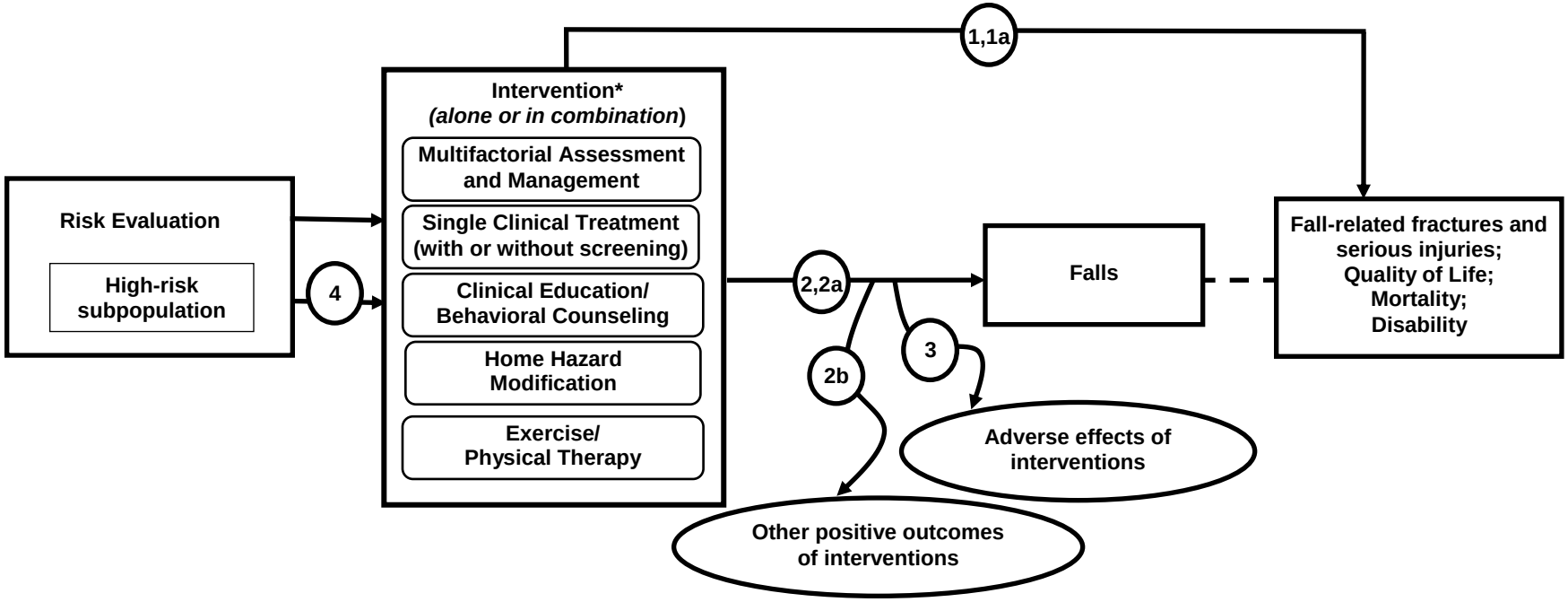
# of trials	Design	Limitations	Consistency	Applicability	Overall quality	Summary of findings
Clinical management						
Overall: 14 Vitamin D: 6 Vision correction: 4 Hip protectors: 2 Medication withdrawal: 1 Protein supplement: 1	RCT	**Vitamin D:** Heterogeneity in dosing and duration of followup. Most not powered to observe a significant reduction in fall risk. **Vision correction:** 2 evaluated vision assessment and treatment and 2 evaluated expedited cataract surgery. **Hip protectors:** Heterogeneity in attention to adherence. **Medication withdrawal:** One small study (n=72). **Protein supplement:** Very small study (n=50) with only 3 months of followup.	No significant statistical hetero-geneity in pooling estimates for vitamin D supplementation or hip protectors. Both of the hip protector trials were conducted in high risk populations and provided participants with semi-rigid shields that were sewn into modified underwear.	**Vitamin D:** Dose ranged from 400 IU to1 mg/d to 1 intramuscular injection of 600,000 IU. 3 of the studies conducted in vitamin D deficient populations. 4 conducted in populations >70 years. **Vision correction:** Majority high-risk women. **Hip protectors:** All high-risk women. **Medication withdrawal:** Primarily women, all taking psychotropic medications. **Protein supplement:** Frail older adults with recent involuntary weight loss.	Fair	**Vitamin D:** Pooled results consistent with reduced risk for falling. Reductions were larger in vitamin D deficient populations. **Vision correction:** Vision correction was not associated with a reduced risk for falling, although it was associated with significantly higher confidence of not falling). 1 study reported significantly increased risk for falling. **Hip protectors:** Mixed results on fall risk. 1 large trial consistent with a significant reduction in risk and other smaller trial showed no benefit. Adherence low. No evidence of effect on falls efficacy. **Medication withdrawal:** Medication withdrawal not associated with reduced risk for falling. **Protein supplement:** Too small and limited followup for reliable estimates.
Clinical education/behavioral counseling						
1	RCT	Relaxed selection criteria to include people who were afraid of falling in addition to those with a history of a fall during the past year.	One study	Fair: ≥70 years, no dementia and not homebound; recruited through ads in community. All w/history of fall in past year or fear of falling. Conducted in Australia. Ethnicity and SES status not reported	Good	Clinical education/behavioral counseling not associated with reduced risk for falls or improved falls efficacy.
Home hazard modification						
3	RCT	Heterogeneity in intervention approach and approach to selecting high risk population.	All participants ≥75 years, primarily female.	Fair: ≥70 years, primarily female. Trials conducted in Australia and New Zealand.	Fair	1 trial that used occupational therapists to conduct the intervention demonstrated a significant reduction in falls risk in a high-risk population; other 2 studies without professionals conducting the intervention showed nonsignificant reductions in fall risk in unselected populations.

Table 15. Summary of Evidence By Key Question

# of trials	Design	Limitations	Consistency	Applicability	Overall quality	Summary of findings
Exercise/physical therapy						
16	RCT	Heterogeneity along many dimensions, including age and gender of participants, baseline risk of falling, intervention approach, country, treatment intensity, and duration of followup; high attrition in many trials; failure to blind assessors.	9 of the studies were conducted in populations selected for high risk. Majority include gait, balance, or functional training. No significant statistical hetero-geneity in pooling estimates.	Fair: Unselected populations tend to be relatively healthy. High risk populations are highly selected based on disease or recent hospitalization.	Fair	Physical activity interventions were associated with a significant reduction in risk for falling, with some suggestion that benefits were primarily in those with higher than average risk for falling. Limited evidence that the physical activity interventions improved performance-based measures of physical function.
KQ3. What are the adverse effects associated with interventions to reduce falls?						
63	62 RCT 1 SER	Few RCTs stated a priori that harms were assessed.	Good	Fair	Fair to Good	No evidence to suggest serious harms of multifactorial clinical assessment, hip protectors, medication withdrawal, liquid protein-energy supplementation, vitamin D supplementation, clinical education and counseling, home hazard modification, or exercise and physical therapy interventions.
KQ4. How are high-risk older adults identified for primary care falls interventions?						
41	41 RCT	Few studies used standard, clinically feasible instruments to identify those at risk for falling. Heterogeneity in the definition of same risk factor.	Most of the trials selected a high-risk population.	Fair	Fair	37 trials restricted inclusion to high-risk populations. History of falling was most common criteria used to identify high-risk population (12 studies). The next most common risk factors used was age ≥70 years (8 studies) and gait and balance limitation (7 studies).

NR – not reported; NA – not applicable; # – number; CI – confidence interval; RCT – randomized controlled trial; QOL – quality of life; KQ – key question; UK – United Kingdom; SES – socioeconomic status

Figure 1. Analytic Framework and Key Questions



Key Question 1. Is there direct evidence that primary care interventions reduce fall-related injury, improve quality of life, reduce disability, or reduce mortality when used alone or in combination to reduce falls in community-dwelling older adults?

1a. Do these interventions reduce injury, improve quality of life, reduce disability, or reduce mortality in older adults specifically identified as high risk for falls?

Key Question 2. Do primary care interventions used alone or in combination in community-dwelling older adults reduce risk for or rate of falls/fallers?

2a. Do these interventions reduce falls in older adults specifically identified as high risk for falls?

2b. Are there positive outcomes other than reduced falls, and related morbidity and mortality, that result from primary care falls interventions?

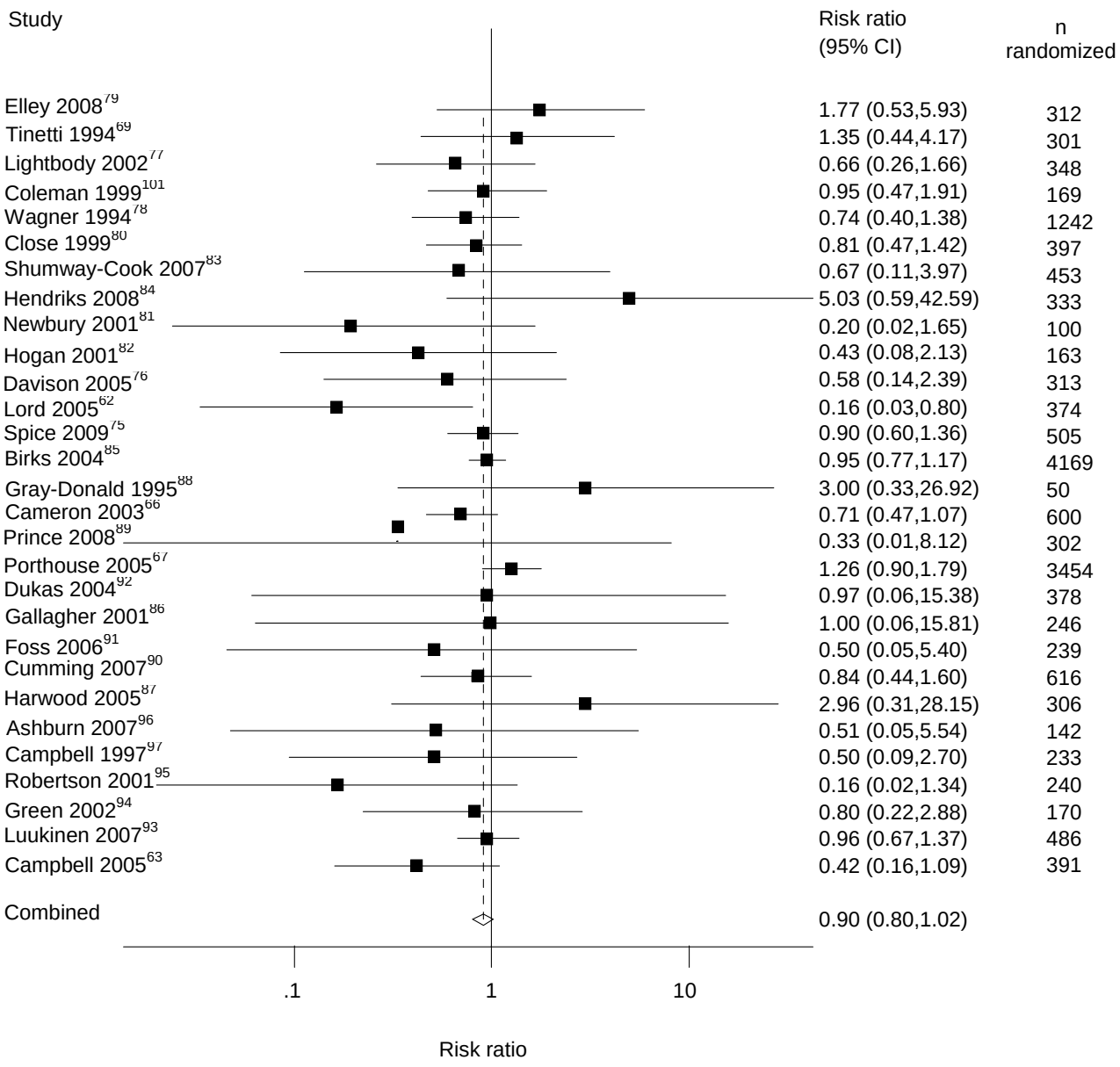
Key Question 3. What are the adverse effects associated with interventions to reduce falls?

Key Question 4. How are high-risk older adults identified for primary care falls interventions?

* Expanded intervention list:

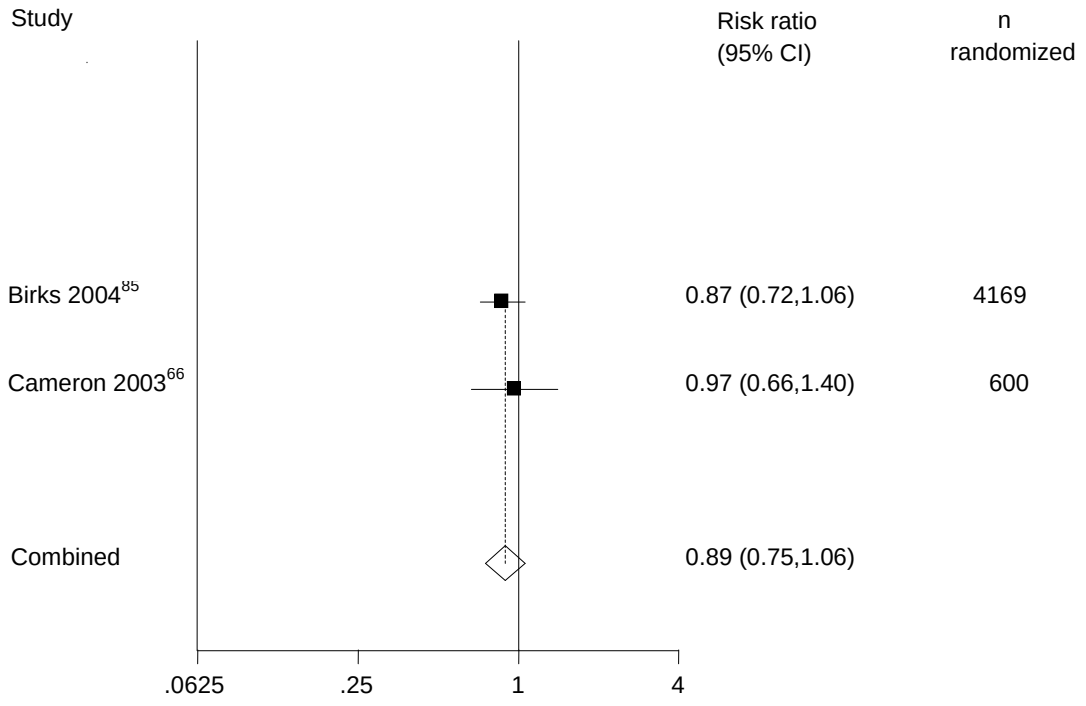
- Multifactorial assessment and management includes: multifactor risk assessment, comprehensive geriatric assessment, or one or more of the following screenings for fall risk: vision, gait, mobility, strength, medication review, cognitive impairment, and orthostatic hypotension.
- Single clinical treatment (with or without screening) includes: vision correction, medication optimization/adjustment, assistive device prescription, pharmacological/nutritional interventions, treatment for orthostatic hypotension, urinary incontinence, and hip protectors.
- Clinical education/behavioral counseling includes: exercise, fall risk reduction, and home hazard checklist.
- Home hazard modification includes: identifying and removing potential fall hazards, adding grab bars and handrails, and modifying the environment to improve mobility and safety.
- Exercise/physical therapy includes: physical exercise, mobility and gait training, muscle strengthening, balance training, and training for recurrent fallers.

Figure 2. Pooled Analysis: All-Cause Mortality of Primary Care Interventions to Prevent Falls (KQ1)



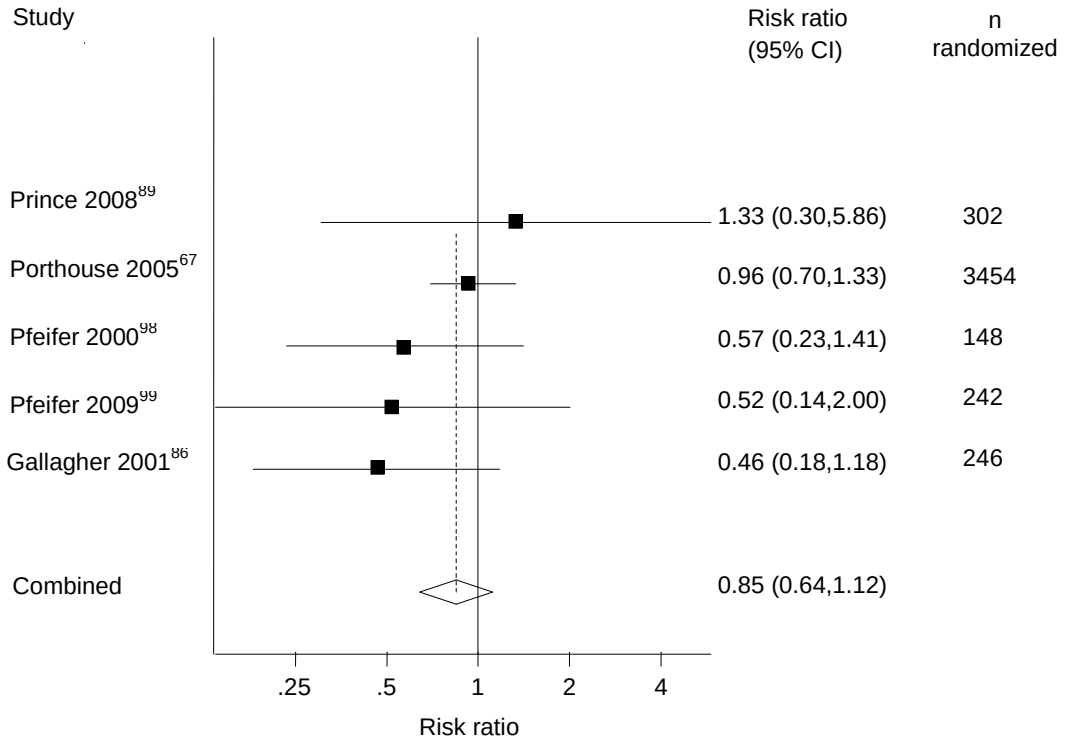
Outcome=deaths, all intervention types
Heterogeneity: chi-square=26.80% (d.f.=28); p=0.529
Between-study variance: tau-square=0.000
RR=1; z=1.67; p=0.096; chi-square=0%

Figure 3. Pooled Risk for Fall-Related Fractures in Single Clinical Treatment Interventions: Hip Protector Trials (KQ 1)



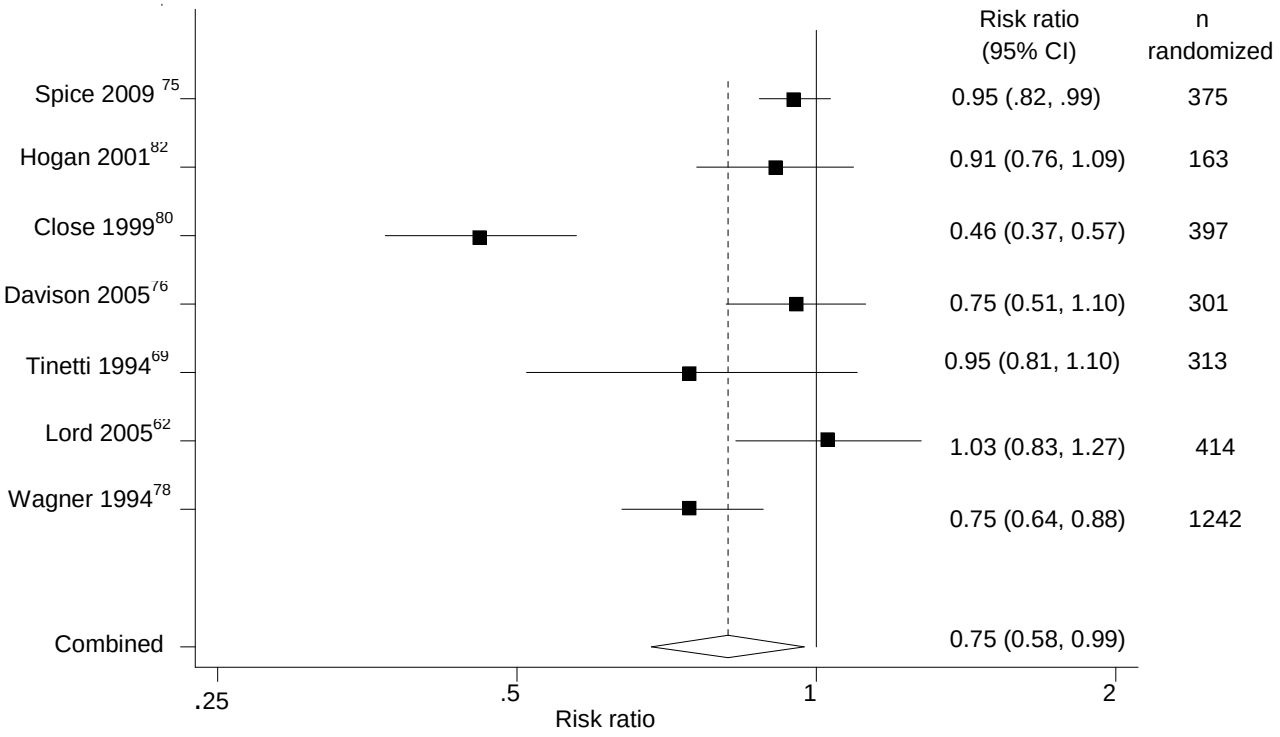
Heterogeneity: Q=0.22 (d.f.=1); p=0.635; chi-square=0%
Between-study variance: tau-square=0.000
RR=1; z=1.32; p=0.185

Figure 4. Pooled Risk for Fall-Related Fractures in Single Clinical Treatment Interventions: Vitamin D Trials (KQ 1)



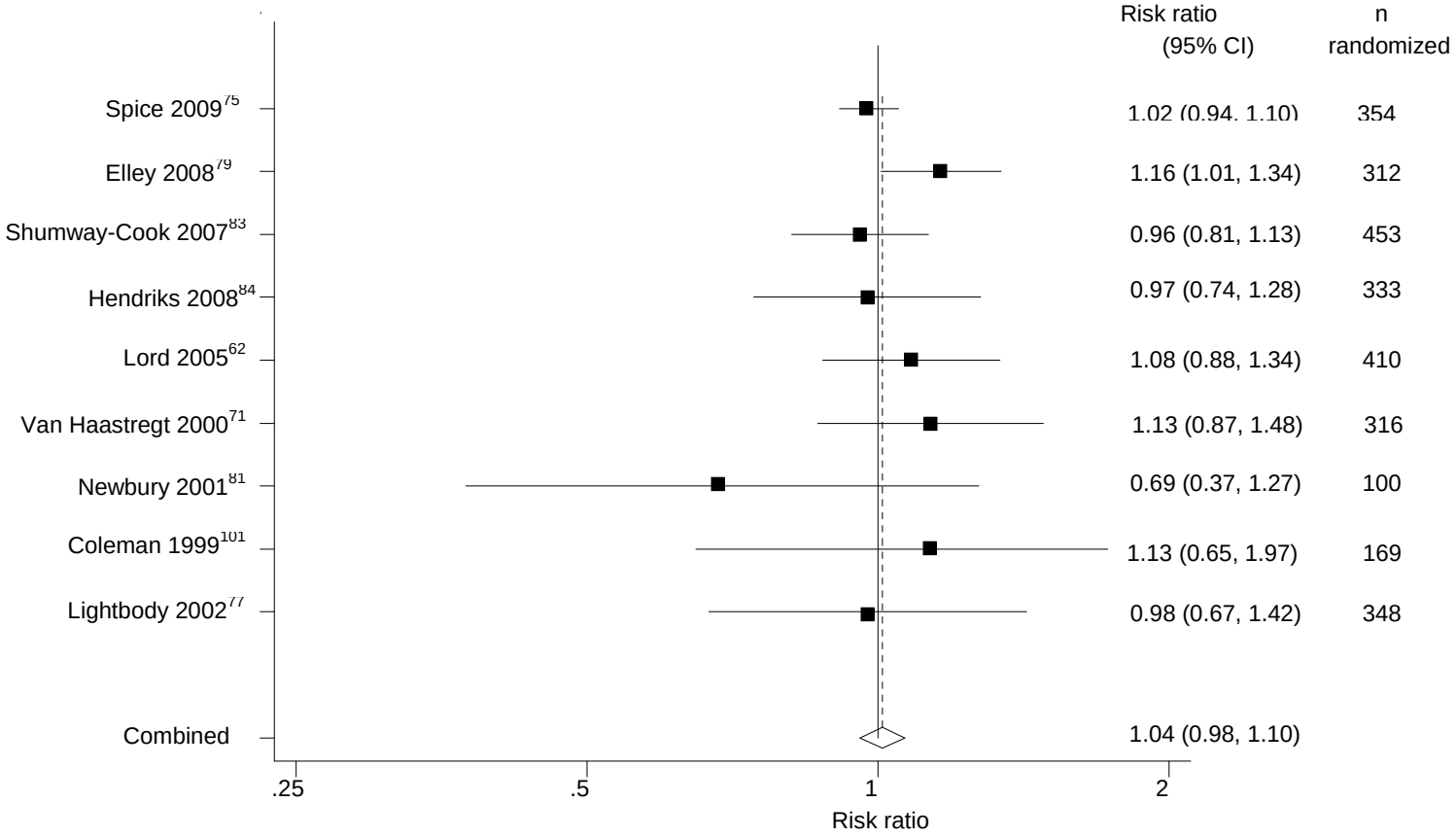
Heterogeneity: Q=3.80 (d.f.=4); p=0.434; chi-square=0%
Between-study variance: tau-square=0.000
RR=1; z=1.18; p=0.237

Figure 5. Pooled Risk for Falling in Comprehensive Multifactorial Assessment and Management Interventions (KQ 2)



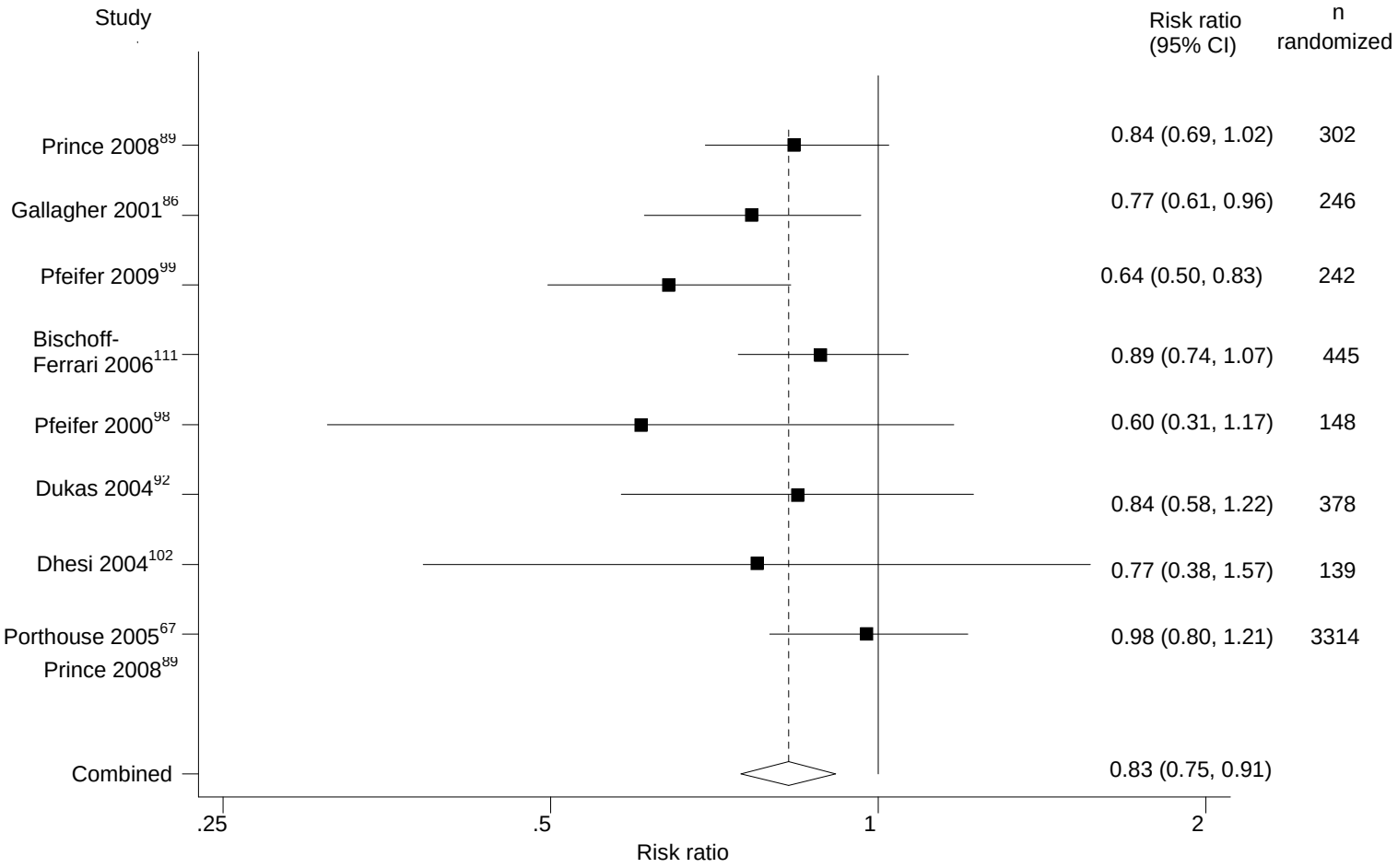
Pooled estimate (95% CI): 0.75 (0.58 to 0.99)
Heterogeneity: Q=43.993 (d.f.=6); p=0.000; chi-square=86.4%
Between-studies variance: tau-square=0.046

Figure 6. Pooled Risk for Falling in Noncomprehensive Multifactorial Assessment and Management Interventions (KQ 2)



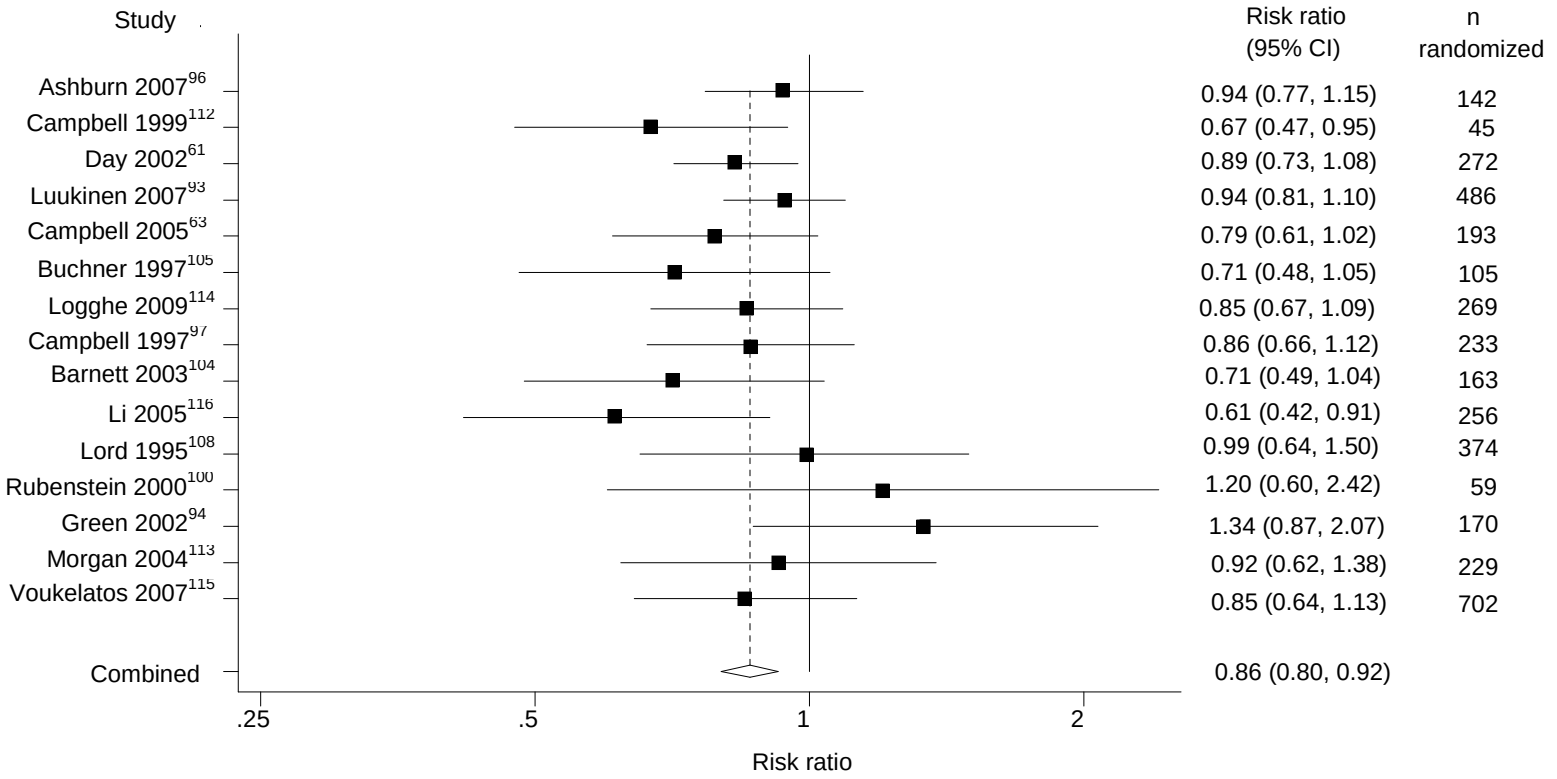
Pooled estimate (95% CI): 1.035 (0.978 to 1.095)
Heterogeneity: Q=6.236 (d.f.=8); p=0.621; chi-square=0%
Between-studies variance: tau-square=0.000

Figure 7. Pooled Risk for Falling In Single Clinical Treatment Interventions: Vitamin D (KQ 2)



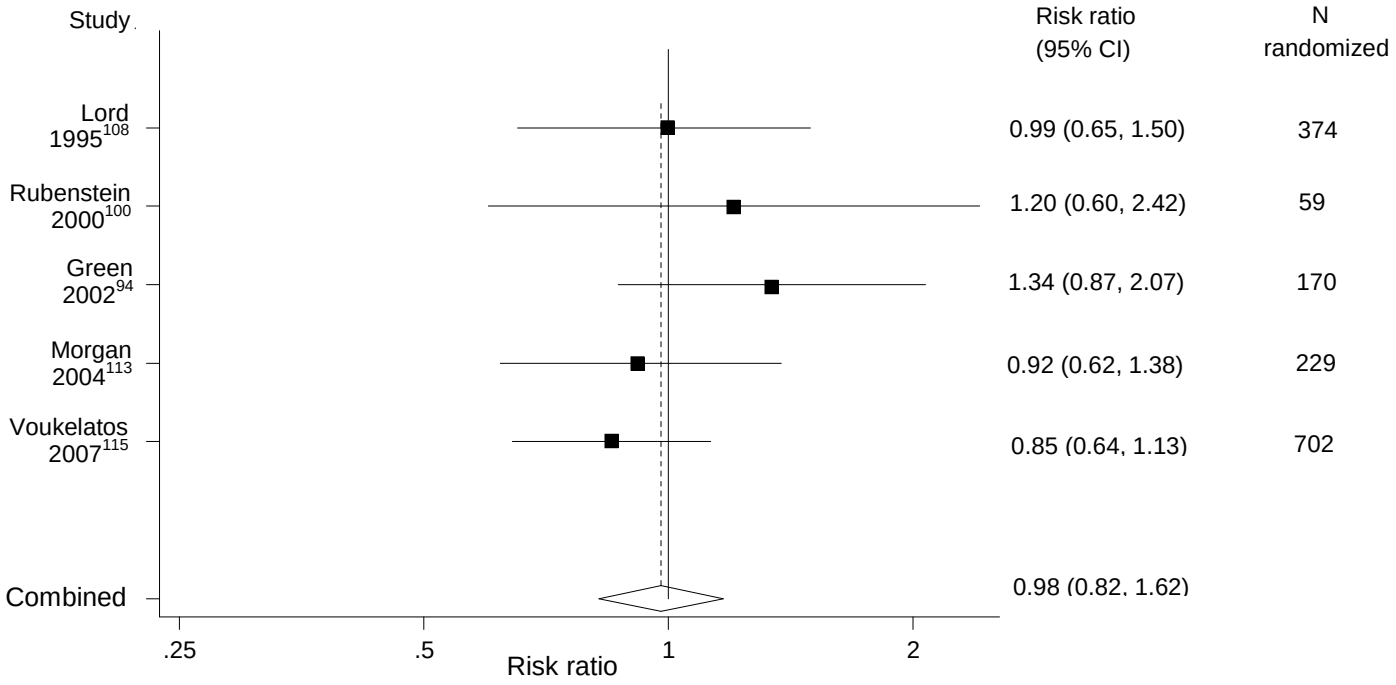
Pooled estimate (95% CI): 0.827 (0.748 to 0.914)
Heterogeneity: Q=8.226 (d.f.=7); p=0.313; chi-square=14.6%
Between-studies variance: tau-square=0.003

Figure 8. Pooled Risk for Falling in Exercise/Physical Therapy Interventions (KQ 2)



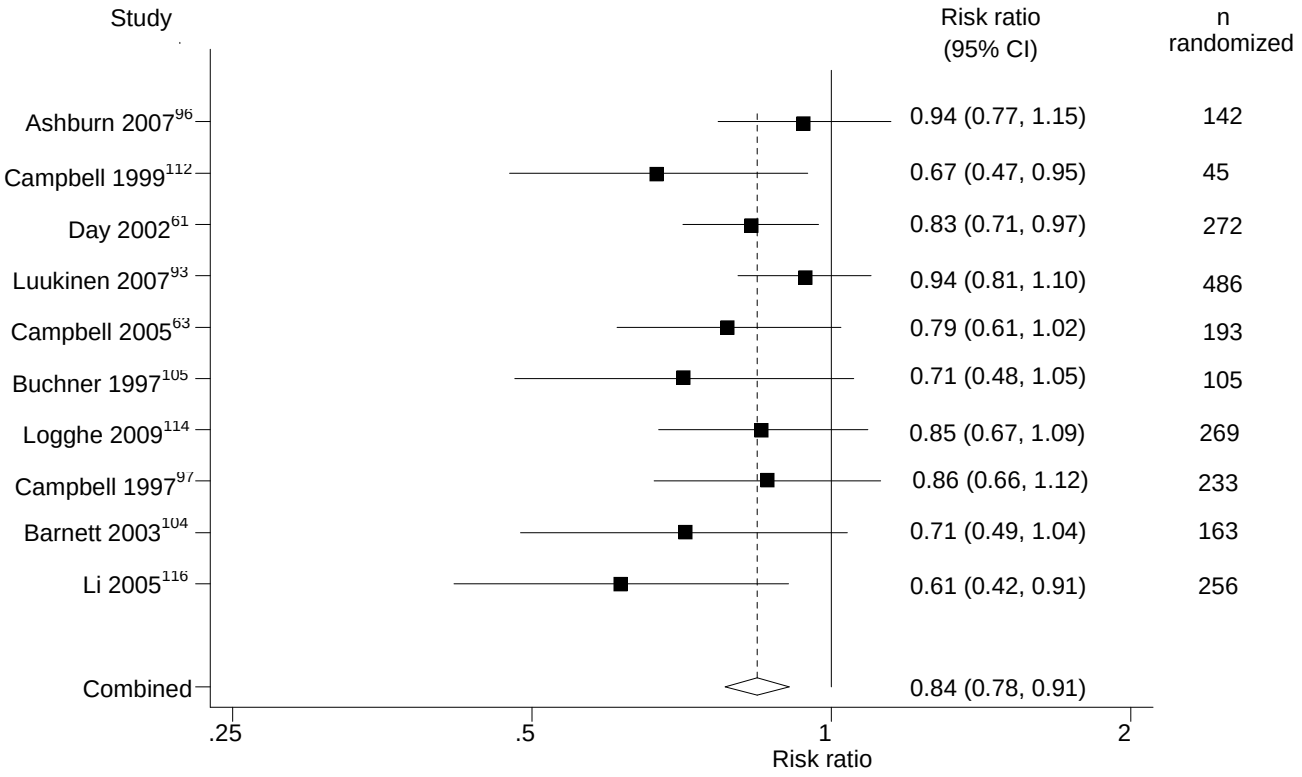
Pooled estimate (95% CI): 0.860 (0.801 to 0.924)
Heterogeneity: Q=14.845 (d.f.=14); p=0.389
Between-studies variance: tau-square=0.001; chi-square=5.4%

Figure 9. Pooled Risk for Falling in Exercise/Physical Therapy Interventions (KQ 2): Low-Risk Populations*



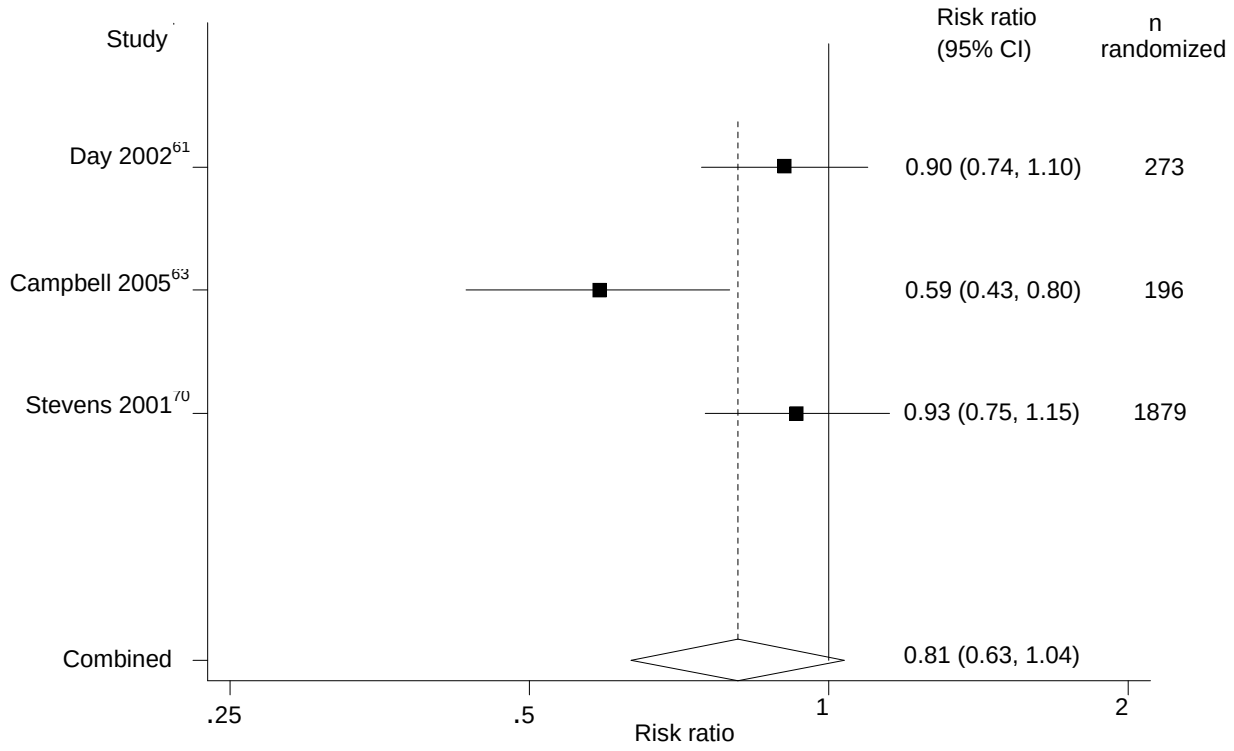
*Risk for falling in control group ≤35%
Pooled estimate (95% CI): 0.0979 (0.821 to 1.618)
Heterogeneity: Q=3.370 (d.f.=4); p=0.498; chi-square=0%
Between-studies variance: tau-square=0.000

Figure 10. Pooled Risk for Falling in Exercise/Physical Therapy Interventions (KQ 2): High-Risk Populations*



*Risk for falling in control group >35%
Pooled estimate (95% CI): 0.842 (0.781 to 0.907)
Heterogeneity: Q=9.105 (d.f.=9); p=0.428; chi-square=1.1%
Between-studies variance: tau-square=0.000

Figure 11. Pooled Risk for Falling in Home Hazard Modification Interventions (KQ 2)



Pooled estimate (95% CI): 0.810 (0.632 to 1.036)
Heterogeneity: Q=6.753 (d.f.=2); p=0.034
Between-studies variance: tau-square=0.033; chi-square=70.4%

Appendix A. Terminology and Abbreviations

Balance: Stability produced by even distribution of weight on each side of the vertical axis.

Behavioral counseling: Activities delivered by primary care clinicians and related health care staff to assist patients in adopting, changing, or maintaining behaviors proven to affect health outcomes and health status.

Multifactorial assessment and management: Detailed medical examination and multifactor assessment of fall-related or generic problems or professional assessment by means of a scoring method with or without enforced protocol for acting upon the results. These include multifactorial risk assessment for falls, comprehensive geriatric assessment, or two or more of the following screenings specifically for falls risk: vision, gait, mobility, strength, medication review, cognitive impairment, or orthostatic hypotension. These interventions were stratified as:

1. *Comprehensive interventions*: trials that provide multifactorial treatments based on the assessment results;
2. *Noncomprehensive interventions*: trials that provided only referral, based on assessment results, limited intervention (e.g., exercise), or knowledge.

Clinical education: Activities delivered by primary care clinicians and related health care staff (e.g., health educator, social worker, nursing staff) to assist patients in adopting, changing, or maintaining behaviors related to fall risk, including exercise, fall risk reduction, and home hazard checklists. Education/counseling is delivered to individuals or small groups and does not primarily involve group-level interventions outside the primary care setting or more than 8 group sessions.

Single clinical treatment: Treatment of a single fall-related risk factor, including vision correction, medication optimization/adjustment, assistive device prescription, pharmacological/nutritional interventions, treatment for orthostatic hypotension, urinary incontinence, and hip protectors.

Fall: An unexpected event in which the participant comes to rest on the ground, floor, or lower level.

Falls efficacy: A measure of fear of falling based on the operational definition of fear as “low perceived self-efficacy or confidence at avoiding falls.”

Gait: A manner of walking or moving on foot.

Home hazard modification: Includes home visits to identify and remove potential fall hazards, adding grab bars and handrails, and modifying the environment to improve mobility and safety.

Intervention: The act, fact, or method of interfering with the outcome or course, especially of a condition or process (as to prevent harm or improve functioning).

Intensity: A categorization of interventions by number of contact hours. High intensity is >75 hours, moderate intensity is 26–75 hours, low intensity is 10–26 hours, and very low intensity is 0–9 hours.

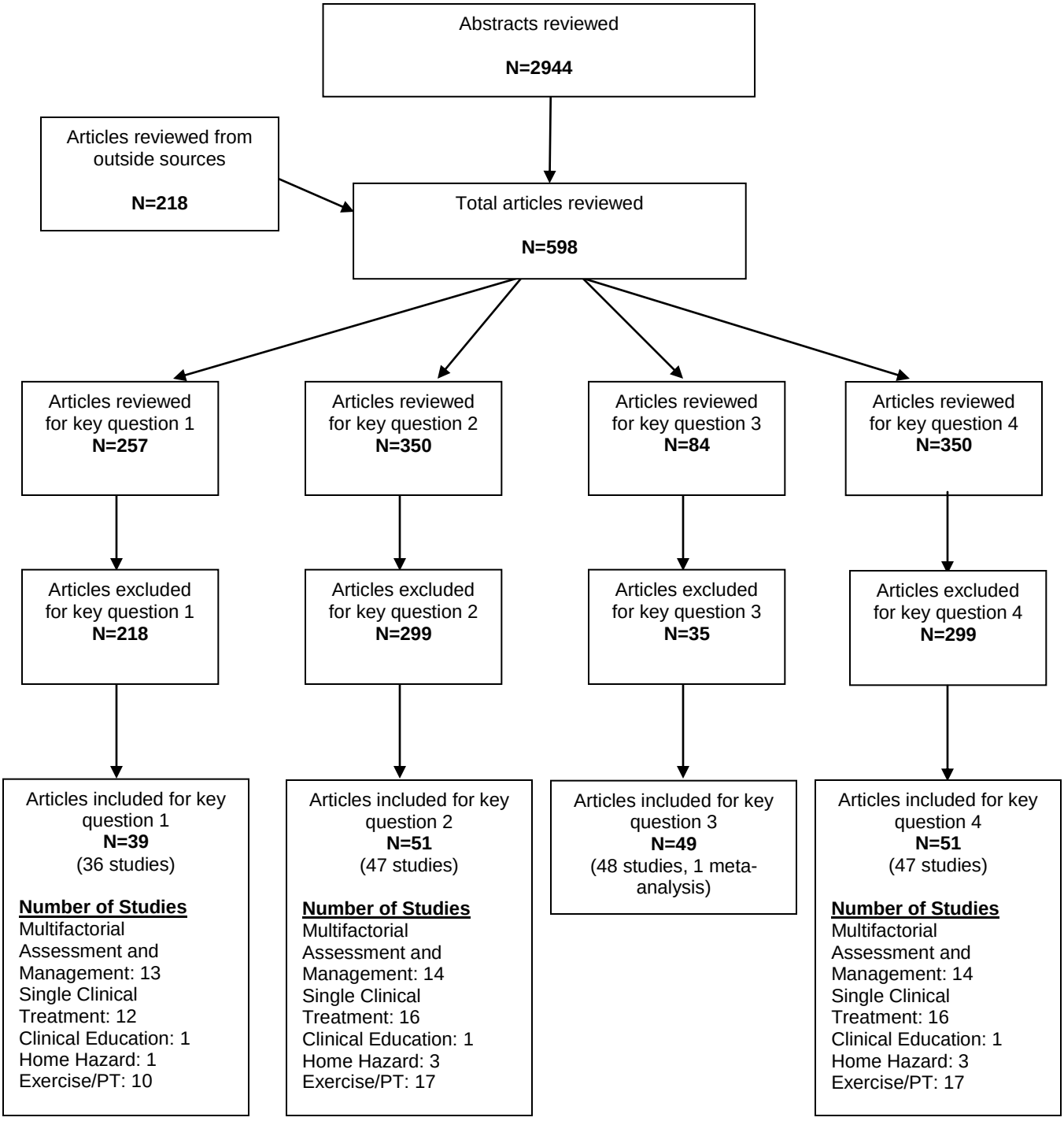
Multifactorial: Having, involving, or produced by a variety of elements or causes.

Exercise: Organized program for individuals or small groups that is part of a health care setting or widely available for referral in most communities; includes general physical activity, mobility/gait training, muscle strengthening, balance training, or training for recurrent fallers.

Primary care feasible: Conducted in a primary care research setting or judged to be feasible in “usual” primary care. Delivery usually involves primary care physicians, other physicians, nurses, nurse practitioners, physician assistants, or related clinical staff (e.g., health educators, other counselors) or is seen as connected to the health care system by the participant.

Primary care referable: Conducted as part of a health care setting or widely available for referral in most communities. Delivery is usually through community groups that are nationally available or through other health professionals/clinical staff (e.g., occupational therapists conducting home hazard modifications or physical therapists conducting mobility/gait training).

Appendix B Figure 1. Search Results and Article Flow



Appendix B Table 1. Search Strategies

Systematic Reviews
Databases: CDSR, DARE, HTA, NICE, PubMed
1991 to October 2007

1. "Accidental Falls"[MeSH]
2. "Accidental Falls"[MeSH] Limits: Aged: 65+ years, 80 and over: 80+ years
3. geriatrics[mesh] OR geriatric[tw] OR older*[tiab] OR elder*[tiab] OR geriatric*[tiab] OR senior*[tiab]
4. #1 AND #3
5. fall[ti] OR falls[ti] OR falling[ti]
6. older*[tiab] OR elder*[tiab] OR geriatric*[tiab] OR senior*[tiab] OR aged[tiab]
7. #5 AND #6
8. #7 AND (in process[sb] OR publisher[sb])
9. #2 OR #4 OR #8
10. #9 AND systematic[sb]
11. #9 AND systematic[sb] Limits: English
12. #11 AND jsubsetaim
13. #11 AND Limits: added to PubMed in the last 1 year

Databases: MEDLINE, AHRQ
1992 to September 2008

1. "Cataract Extraction/adverse effects"[Majr:NoExp] AND systematic[sb] Limits: Publication Date from 1994 to 2008, English
2. "Estrogen Replacement Therapy/adverse effects"[Majr:NoExp] OR "Estrogen Replacement Therapy/mortality"[Majr:NoExp] OR "Hormone Replacement Therapy/adverse effects"[Majr:NoExp] OR "Hormone Replacement Therapy/mortality"[Majr:NoExp]) AND systematic[sb] Limits: Publication Date from 2002 to 2008, English
3. "Vitamin D"[Mesh:noexp] AND systematic[sb] AND ("adverse effects "[Subheading:NoExp] OR adverse*[tiab] OR harm*[tiab]) Limits: Publication Date from 2002 to 2008, English
4. "vitamin d"[ti] OR "hormone replacement"[ti] OR "cataract surgery"[ti]) AND (in process[sb] OR publisher[sb] OR pubmednotmedline[sb]) AND systematic[sb] Limits: English
5. #1 OR #2 OR #3 OR #4

Interventions to Prevent Falls (KQ 2), Fall-Related Injuries, Mortality, Disability, and Improve Quality of Life (KQ 1) and Identification of High-Risk Older Adults (KQ 4)
Databases: MEDLINE, CCRCT, CINAHL
2002 to February 2009

1. Accidental Falls/
2. (falls or faller or fallers).ti,ab.
3. (fall or falling).ti.
4. 1 or 2 or 3
5. limit 4 to ("all aged (65 and over)" or "aged (80 and over)")
6. aged/ or "aged, 80 and over"/ or frail elderly/
7. Geriatric Assessment/
8. Geriatrics/
9. Health Services for the Aged/
10. geriatric$.ti,ab.
11. older.ti,ab.
12. senior$.ti,ab.
13. elder$.ti,ab.
14. aged.ti,ab.
15. 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14
16. 4 and 15
17. 5 or 16
18. limit 17 to (controlled clinical trial or meta analysis or randomized controlled trial or clinical trial)
19. controlled clinical trial/ or randomized controlled trial/ or clinical trial/
20. meta-analysis/
21. (control$ adj3 trial$).ti,ab.
22. random$.ti,ab.
23. clinical trial$.ti,ab.
24. 19 or 20 or 21 or 22 or 23

25. 24 and 17
26. 18 or 25
27. limit 26 to english language
28. limit 27 to yr="2002 - 2009"
29. from 28 keep 1-500

Harms of Clinical Assessment, Home Hazard Modification, Clinical Education/Behavioral Counseling, and Exercise/Physical Therapy Interventions to Prevent Falls (KQ 3)
Databases: MEDLINE, CINAHL
1992 to February 2009

1. Accidental Falls/
2. (falls or faller or fallers).ti,ab.
3. (fall or falling).ti.
4. 1 or 2 or 3
5. Geriatric Assessment/
6. (multifactorial or multifaceted or multidimensional).ti,ab. and (assessment$ or intervention$).ti,ab,hw.
7. geriatric assessment$.ti,ab.
8. Patient Education as Topic/
9. Patient education.ti,ab.
10. Health Education/
11. Health Education.ti,ab.
12. education$ intervention$.ti,ab.
13. Counseling/
14. Directive Counseling/
15. counsel$.ti,ab.
16. Cognitive Therapy/
17. House Calls/
18. home visit$.ti,ab.
19. ((home hazard$ or home safety) and (modification$ or program$)).ti,ab.
20. hazard reduction.ti,ab. and home.ti,ab,hw.
21. Exercise/
22. Exercise Therapy/
23. exercise therapy.ti,ab.
24. Physical Therapy.ti,ab.
25. Physical Therapy Modalities/
26. Exercise Movement Techniques/
27. exercise training.ti,ab.
28. tai chi.ti,ab.
29. Tai Ji/
30. gait training.ti,ab.
31. balance training.ti,ab.
32. mobility training.ti,ab.
33. muscle strengthening.ti,ab.
34. recurrent faller$.ti,ab.
35. recurrent falls.ti,ab.
36. Accidental Falls/pc
37. or/5-36
38. adverse effects.fs.
39. adverse$.ti,ab.
40. harm$.ti,ab.
41. psychology.fs.
42. "fear of falling".ti,ab.
43. falls efficacy.ti,ab.
44. or/38-43
45. 4 and 37 and 44
46. or/21-33
47. injuries.fs.
48. injur$.ti,ab.
49. 47 or 48
50. 4 and 46 and 49

51. 45 or 50
52. limit 51 to "all child (0 to 18 years)"
53. limit 52 to "all aged (65 and over)"
54. 52 not 53
55. 51 not 54
56. limit 55 to english language
57. limit 56 to yr="1992 - 2009"
58. remove duplicates from 57
59. from 58 keep 1-500

Harms of Clinical Management (Vision Correction, Hip Protectors, and Liquid Supplement) Interventions to Prevent Falls (KQ 3)
Databases: MEDLINE, CINAHL
1992 to February 2009

1. Eyeglasses/
2. spectacles.ti,ab.
3. eyeglasses.ti,ab.
4. glasses.ti,ab. and (vision or visual or eye$).ti,ab,hw.
5. 1 or 2 or 3 or 4
6. Dietary Supplements/
7. Dietary Proteins/
8. 6 and 7
9. (protein adj2 supplement$).ti,ab.
10. (ensure plus or ensure).rn.
11. 8 or 9 or 10
12. Protective Clothing/
13. Protective Devices/
14. Orthotic Devices/
15. 12 or 13 or 14
16. hip fractures/ or femoral neck fractures/
17. (fracture$ adj2 (hip or femur$ or femor$)).ti,ab.
18. 16 or 17
19. 15 and 18
20. (hip adj (protector$ or pad$)).ti,ab.
21. 19 or 20
22. 5 or 11 or 21
23. adverse effects.fs.
24. adverse$.ti,ab.
25. harm$.ti,ab.
26. 23 or 24 or 25
27. 22 and 26
28. aged/ or "aged, 80 and over"/ or frail elderly/ or middle aged/
29. geriatric$.ti,ab.
30. older.ti,ab.
31. senior$.ti,ab.
32. elder$.ti,ab.
33. aged.ti,ab.
34. 28 or 29 or 30 or 31 or 32 or 33
35. 27 and 34
36. limit 35 to english language
37. limit 36 to yr="1992 - 2009"
38. remove duplicates from 37

Appendix B Table 2. Exclusion Criteria for Key Questions

Exclusion Criteria Applied to All Key Questions

Population:
- Conducted in population that is not comparable with primary care (e.g., persons in hospitals, nursing or care homes, rehabilitation centers, or other long-term care facilities)
- Conducted in population that does not have an average age of ≥65 years

Setting:
- Intervention not conducted in primary care or other setting with primary care-comparable population (e.g., hospital, nursing or care home, rehabilitation center, other long-term care facility)
- Intervention not conducted in countries culturally comparable with the United States as evidenced by a United Nations Human Development Index value of <0.900

Design:
- Editorials, letters, nonsystematic reviews, opinions, comparative effectiveness

Quality:
- Does not meet quality criteria

Other:
- Fall prevention not primary or secondary focus
- Precedes search period
- Article already covered by an included systematic review
- Provides no data not otherwise covered in other articles
- Systematic review used as source document only
- Language other than English

Additional Exclusion Criteria Specific to Each Key Question

Key Question 1. Is there direct evidence that primary care interventions reduce fall-related injury, improve quality of life, reduce disability, or reduce mortality when used alone or in combination to reduce falls in community-dwelling older adults?

1a. Do these interventions reduce injury, improve quality of life, reduce disability, or reduce mortality in older adults specifically identified as high risk for falls?

Intervention:
- Community interventions not generally accessible (e.g., senior residence program)
- Social marketing (e.g., media campaign)
- Policy (e.g., local and State public or health policy)
- Institutional methods (e.g., use of restraints)

Design:
- Clinical controlled trial, case-control, cohort

No relevant outcomes:
- Fall-related injuries other than fractures
- Quality of life measures other than SF-12, SF-36, and EuroQOL
- Disability measures other than activities of daily life and instrumental activities of daily life

Key Question 2. Do primary care interventions used alone or in combination in community-dwelling older adults reduce risk for or rate of falls/fallers?

2a. Do these interventions reduce incidence of falls in older adults specifically identified as high risk for falls?

2b. Are there positive outcomes other than reduced falls, and related morbidity and mortality, that result from primary care falls interventions?

Intervention:
- Community interventions not generally accessible (e.g., senior residence program)
- Social marketing (e.g., media campaign)
- Policy (e.g., local and State public or health policy)

Appendix B Table 2. Exclusion Criteria for Key Questions

- Institutional methods (e.g., use of restraints)

Design:

- Clinical controlled trial, case-control, cohort

No relevant outcomes:

- Positive outcome measures other than falls: Falls Efficacy Scale, Performance-Oriented Mobility Assessment, Timed Get Up & Go Test, 6-meter timed walk, Functional Reach Test, and Berg Balance Scale

Key Question 3. What are the adverse effects associated with interventions to reduce risk for or rate of falls/fallers?

No relevant outcomes:

- Harms of interventions that do not have sufficient evidence of being effective or ineffective

Appendix B Table 3. Quality Rating Criteria

Design	USPSTF Quality Rating Criteria	NICE Methodology Checklists	QUADAS Tool
Systematic reviews and meta-analyses	• Comprehensiveness of sources considered/search strategy used • Standard appraisal of included studies • Validity of conclusions • Recency and relevance are especially important for systematic reviews	• Study addresses an appropriate and clearly focused question • Description of the methodology used is included • Literature search is sufficiently rigorous to identify all relevant studies • Study quality is assessed and taken into account • Enough similarities between selected studies to make combining reasonable	Not applicable
Case-control studies	• Accurate ascertainment of cases • Nonbiased selection of cases/controls with exclusion criteria applied equally to both • Response rate • Diagnostic testing procedures applied equally to each group • Measurement of exposure accurate and applied equally to each group • Appropriate attention to potential confounding variables	• Study addresses an appropriate and clearly focused question • Cases and controls are taken from comparable populations • Same exclusion criteria are used for both cases and controls • Percentage of each group (cases and controls) participating in study is noted • Comparison made between participants and nonparticipants to establish similarities or differences • Cases are clearly defined and differentiated from controls • It is clearly established that controls are noncases • Measures have been taken to prevent knowledge of primary exposure influencing case ascertainment • Exposure status is measured in a standard, valid, and reliable way • Main potential confounders are identified and taken into account in the design and analysis • Confidence intervals are provided	Not applicable
Randomized controlled trials	• Initial assembly of comparable groups employs adequate randomization, including first concealment and whether potential confounders were distributed equally among groups • Maintenance of comparable groups (includes attrition, crossovers, adherence, contamination) • Important differential loss to follow-up or overall high loss to follow-up • Measurements are equal, reliable, and valid (includes masking of outcome assessment) • Clear definition of the interventions • All important outcomes considered	• Study addresses an appropriate and clearly focused question • Assignment of subjects to treatment groups is randomized • Adequate concealment method is used • Subjects and investigators are kept blind about treatment allocation • Treatment and control groups are similar at start of the trial • Only difference between groups is treatment under investigation • All relevant outcomes are measured in a standard, valid, and reliable way • Percentage of the individuals or clusters recruited into each treatment arm that dropped out before completion is reported • All subjects are analyzed in the groups to which they were randomly allocated (often referred to as intention-to-treat analysis) • When the study is carried out at more than one site, results are comparable for all sites	Not applicable
Cohort studies	• Initial assembly of comparable groups employs consideration of potential confounders with either restriction or measurement for adjustment in the analysis; consideration of inception cohorts • Maintenance of comparable groups (includes attrition, crossovers, adherence, contamination) • Important differential loss to follow-up or overall high loss to follow-up	• Study addresses an appropriate and clearly focused question • Two groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation • Study indicates how many people were asked to take part and did so, in each of the groups being studied • Likelihood that some eligible subjects might have the outcome at the time of enrollment is assessed and taken into account in the analysis • Percentage of individuals or clusters recruited into each arm that dropped out before the completion is reported • Comparison is made between full participants and those lost to follow-	Not applicable

Appendix B Table 3. Quality Rating Criteria

Design	USPSTF Quality Rating Criteria	NICE Methodology Checklists	QUADAS Tool
	• Measurements are equal, reliable, and valid (includes masking of outcome assessment) • Clear definition of interventions • All important outcomes considered	up, by exposure status • Outcomes are clearly defined • Assessment of outcome is blind to exposure status • Where blinding is not possible, there is some recognition that knowledge of exposure status could have influenced the assessment of outcome • Measure of assessment of exposure is reliable • Evidence from other sources is used to demonstrate that the method of outcome assessment is valid and reliable • Exposure level or prognostic factor is assessed more than once • Main potential confounders are identified and taken into account in the design and analysis • Confidence intervals are provided?	
Diagnostic accuracy studies	• Screening test relevant, available for primary care, adequately described • Study uses a credible reference standard, performed regardless of test results • Reference standard interpreted independently of screening test • Handles indeterminate result in a reasonable manner • Spectrum of patients included in study • Sample size • Administration of reliable screening test	• Nature of test being studied is clearly specified • Test is compared with an appropriate gold standard • Where no gold standard exists, a validated reference standard is used as a comparator • Patients for testing are selected either as a consecutive series or randomly, from a clearly defined study population • Test and gold standard are measured independently (blind) of each other • Test and gold standard are applied as close together in time as possible • Results are reported for all patients that are entered into the study • Pre-diagnosis is made and reported	• Spectrum of patients are representative of patients who will receive the test in practice • Selection criteria are clearly described • Reference standard is likely to correctly classify target condition • Time period between reference standard and index test is short enough to be reasonably sure that target condition did not change between the two tests • Whole sample or a random selection receives verification using a reference standard of diagnosis • Patients receive the same reference standard regardless of index test result • Reference standard is independent of index test • Execution of index test and reference standard are described in sufficient detail to permit replication • Index test results are interpreted without knowledge of reference standard results • Reference standard results are interpreted without knowledge of index test results • Same clinical data is available when test results are interpreted as would be available when test is used in practice • Uninterpretable/ intermediate test results are reported • Study withdrawals are explained

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Close 1999[80] Fair	**Location:** Researchers are in London; not explicitly stated **Target population:** Aged ≥65 years, community dwelling, presented to an accident / ED with a fall **Recruitment strategy:** 12/95-6/96: Potential participants identified by a computerised registration system from accident / ED; wrote to patients who were discharged home after their fall, with an info sheet about the study; then contacted by phone	**Inclusion:** Aged ≥65 years, community dwelling, presented to an accident / ED with a fall **Exclusion:** Cognitive impairment (score on the abbreviated mental test (AMT) <7 and no regular carer; not local; no English Note: Patients admitted to hospital as a result of their fall were identified but not recruited until discharge from hospital	**Assessed for eligibility:** 1031 **Excluded:** 634 **Not meeting inclusion criteria:** 315 **For other reasons:** 124 refused, 195 not reached **Randomized:** 397 **IG:** 184 **CG:** 213 **Age: mean (SD)** 78.2 (7.5) IG: 77·3 (7·4) CG: 78·9 (7·6) **Female:** 68% IG 68%, CG 67% **Ethnicity:** NR **SES:** NR **Fall History:** IG CG fell in last yr 64% 66% recurrent falls 27% 30%	**Risk category:** Other - previous falls collected but results not presented by previous fall status (A599) **Definition:** Attended the accident and emergency department with a primary diagnosis of a fall **Proportion:** 100% **Instrument:** Attended the accident and emergency department with a primary diagnosis of a fall

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Close 1999[80] Fair	**Category:** Clinical Assessment -- medical, OT assessment and referrals, advice / safety ed **Description** **IG:** Detailed medical and occupational-therapy assessment with referral to relevant services if indicated **CG:** Usual care **Format (single or combo, individual or group, where)** **IG:** Combo, individual; med assessment at the hospital; OT at home **CG:** Single, individual, NA **Intensity (frequency and duration)** **IG:** 1 time, duration NR **CG:** 1 time, duration NR **Delivery** **IG:** med NR; OT by an Occupational Therapist **CG:** NA	**Fall-related fracture:** Falls with serious injury reported via postal questionnaire every 4 months for 1 year **List of additional injury measures:** All serious fall-related injuries reported hospital visits, admits **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** Barthel score taken at baseline and 1 year **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Inadvertently coming to rest on the ground or other lower level with or without loss of consciousness and other than as a consequence of sudden onset of paralysis, epileptic seizure, excess alcohol intake, overwhelming external force **Rate or risk of falls/fallers:** Given a "falls diary" with 12 monthly sheets to assist with recall. Mailed questionnaires every 4 months. **Length of followup:** 1 year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Close 1999[80] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **OTHER:** **pts reporting serious injury from falls** IG = 8/184 (4%) CG = 16/213 (8%) **Mortality** IG: 19/184 CG: 27/213 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Close 1999[80] Fair	**ADLs:** *Mean (SD) Barthel score at 12 months* IG: 18·6 (2·5) p = 0.017 CG: 17·3 (3·7) *Mean change in Barthel score at 12 months* IG: -1.4 CG: -0.4 p=0.0001 **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** IG = 183/184, CG = 510/213, p=0·0002 **# (%) fallers:** IG = 59/184 (32%) CG = 111/213 (52%) **# (%) frequent fallers (2+ falls):** NR ***THEY REPORT 3+ only*** IG = 21/184 (11%) CG = 55/213 (26%) **Among high risk:** NR

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Close 1999[80] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** In UK; recently went to ER for a fall Fall risk significantly reduced in IG (OR 0·39 [0·23–0·66]) as was the risk of recurrent falls (0·33 [0·16–0·68]). In the Discussion, authors say "The 50% reduction in fracture rate seen in our trial…" yet fractures are never mentioned until that point.

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Coleman 1999[101] RM #177 Coleman 1998 RM #3290 Fair	**Location:** Western Washington **Target population:** Frail older adults from a large HMO **Recruitment strategy:** A computer-based predictive index identified people at risk for hospitalization and functional decline. For each of 9 practices, 36 patients with the highest risk scores were selected and approved by their physicians and sent an invitation letter	**Inclusion:** Aged 65 and older. Automated data regarding age, gender, presence in system-wide disease registries for diabetes and heart disease, history of hospitalization or more than 6 outpatient visits in the prior 12 months, and the Chronic Disease Score (a pharmacy-based comorbidity index) comprised the individual predictive variables used to identify frail elders **Exclusion:** Reside in a nursing home, terminal illness, moderate to severe dementia, and too ill as determined by their PCPs	**Assessed for eligibility:** approximately 50,000 of HMO enrollees were aged 65 and older **Identified by computer index:** 324 **Excluded:** 155 **Not meeting inclusion criteria:** 69 **For other reasons: 86** **refusals:** 86 no contact: 2 **Randomized:** 169 **IG:** 96 **CG:** 73 **Mean age:** IG: 77.3 CG: 77.4 **Female:** IG: 47.9% CG: 49.3% **Non-white:** IG: 2.8% CG: 4.1% **SES:** *≥12 yrs education* IG: 77.1% CG: 66.7% *<$15k income* IG: 15.8% CG: 14.0% **Fall History:** IG: 44.2% CG: 48.6%	**Risk category:** "Frail" defined by a number of factors -- Other (A500) **Definition:** Highest scores from a computer-based predictive index using the following predictor variables: age, gender, included in diabetes registry, included in heart disease registry, hospitalization in the past year, 6+ doctor visits in past year, and Chronic Disease Score **Proportion:** 100% **Instrument:** Computer-based predictive index developed by the authors based on the self-report Pra questionnaire

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Coleman 1999[101] RM #177 Coleman 1998 RM #3290 Fair	**Category:** Multi-factor risk assessment and clinical management **Description** **IG:** Chronic Care Clinics: treatment plan developed with physician and team nurse aimed at reducing disability, pharmacist consultation, self-management class, health status assessment **CG:** Usual care (details NR) **Format (single or combo, individual or group, where)** **IG:** Combination, individual and group, in the clinic **CG:** NR **Intensity (frequency and duration)** **IG:** Half-day visits every 3-4 months. Followup period was 24 months **CG:** NR **Delivery** **IG:** Physicians, team nurses, pharmacists, and social workers for each ppt **CG:** NR	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** Physical function only taken at BL, 12 months and 24 months **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 24 months	**Definition of fall:** NR **Rate or risk of falls/fallers:** Standardized questionnaire at BL, 12 months and 24 months **Length of followup:** 24 months

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Coleman 1999[101] RM #177 Coleman 1998 RM #3290 Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** CES-D Depression scale, high risk medication fills, and urinary incontinence **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: IG: 15 (causes NR) CG: 12 (causes NR) **QOL** **SF-12:** NR **SF-36 Physical Function:** IG: 47.7 (Baseline), 43.9 (12 months), 37.5 (24 months) CG: 43.8 (Baseline), 44.5 (12 months), 37.5 (24 months) P: 0.72 (Baseline), 0.73 (12 months), 0.99 (24 months) Adjusted P*: -- (Baseline), 0.64 (12 months), 0.97 (24 months) **Adjusted for BL value and other BL covariates using GEE* **EuroQol:** **Among high risk**: All are high risk

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Coleman 1999[101] RM #177 Coleman 1998 RM #3290 Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers (calc):** IG CG P Adjusted P* Baseline 43 (44.2) 36 (48.6) 0.56 -- 12 months 42 (43.5) 28 (37.9) 0.37 0.27 24 months 42 (43.5) 26 (35.6) 0.35 0.63 **Adjusted for BL value and other BL covariates using GEE* **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Coleman 1999[101] RM #177 Coleman 1998 RM #3290 Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Frail HMO members Disruption in the delivery system - volunteer severance packages offered and two of the nine physicians involved in the study accepted the offer

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Davison 2005[76] Fair	**Location:** United Kingdom **Target population:** Aged ≥65 years presenting to Accident & Emergency with a fall or fall-related injury and ≥1 fall in the preceding year **Recruitment strategy:** Accident & Emergency records scanned and questionnaires mailed to determine fall history	**Inclusion:** Aged ≥65 years presenting to Accident & Emergency with a fall or fall-related injury and ≥1 additional fall in the preceding year **Exclusion:** Cognitively impaired (MMSE <24), >1 previous epidsode of syncope, immobile, lived >15 mils from Accident & Emergency, registered blind, aphasic, clear medical explanation for their fall, or were enrolled in another study	**Assessed for eligibility:** 5090 **Excluded:** 4777 **Not meeting inclusion criteria:** 3516 **For other reasons:** 1261 **Randomized:** 313 **IG:** 159 **CG:** 154 **Age: mean (SD)** IG: 77 (7) CG: 77 (7) **Female:** IG: 73% CG: 72% **Ethnicity:** NR **SES:** NR **Fall History:** 100%	**Risk category:** Fall history (A599) **Definition:** Presenting to Accident & Emergency with a fall or fall-related injury and ≥1 additional fall in the preceding year **Proportion:** 100% **Instrument:** Accident & Emergency records, and self-report on mailed questionnaire for fall in previous year
Elley 2008[79] Good	**Location:** New Zealand **Target population:** Community living people aged 75 and over (Maori or Pacific ≥ 55) who had fallen in past 12 months **Recruitment strategy:** Through participating family physicians from 2 large primary care organizations: all people in age group on patient register mailed form with study details and eligible patients were provided with form as they entered practice waiting rooms. Forms were returned to research center	**Inclusion:** Aged ≥ 75 (≥ 55 if Maori); History of falls in previous 12 months; on patient register of participating family physician **Exclusion:** Inability to understand study information and consent process, unstable or progressive medical condition, severe physical disability, and dementia	**Assessed for eligibility:** Assesed 3,434 for eligibility **Excluded:** 3122 **Not meeting inclusion criteria:** 2915 **For other reasons:** Refused to participate 154 **Randomized:** 312 **IG:** 155 **CG:** 157 **Analyzed:** Same as randomized for fall rate (for other outcomes, including fallers) **IG**: 135 **CG:** 145 **Age: mean (SD) 80.8 (5.0)** **IG:** 80.4 (4.8) **CG:** 81.1 (5.3) **Female:** **IG:** 68% **CG:** 70% **Ethnicity:** 6 Maori; 3 Pacific **SES:** NR **Fall History:** **IG:** 100% **CG:** 100%	**Risk category:** Other - fall in past 12 months (A599) **Definition:** Had confirmed fall in the previous 12 months **Proportion:** 100% **Instrument:** Self report questionnaire

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Davison 2005[76] Fair	**Category:** Multifactorial Clinical Assessment - medical, physiotherapy, and occupational therapy assessments, and tailored interventions **Description** **IG:** Medical assessment including medications and vision, cardiovascular assessment to assess for orthostatic hypotension, cartoid sinus hypersensitivity, and vasovagal hypersensitivity, blood tests and electrocardiograms. Gait and balance assessed. Environmental hazards assessed via checklist. Individualized intervention based on assessment results **CG:** No medical or therapy assessment, no further detail **Format (single or combo, individual or group, where)** **IG:** Combination, individual, medical assessment at hospital, physiotherapy and occupational therapy assessments in home. Interventions various locations **CG:** Not specified **Intensity (frequency and duration)** **IG:** Assessments performed once, intervention frequency and duration varied **CG:** Not specified **Delivery** **IG:** NR **CG:** NR	**Fall-related fracture:** Weekly falls diaries returned every 4 weeks, followup phone calls to maximise compliance. Hospital records checked retrospectively at 1 year **List of additional injury measures:** Hospitalization, fall-related outpatient attendance **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR, obtained as secondary outcome **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Inadvertently coming to rest on the ground or other lower level with or without loss of consciousness or injury **Rate or risk of falls/fallers:** Weekly falls diaries returned every 4 weeks, followup phone calls to maximise compliance **Length of followup:** 1 year
Elley 2008[79] Good	**Category:** Clinical assessment **Description** **IG:** Falls-and-fracture nurse coordinator visted intervention participants at home and used a standardized health assessment and an evidence-based algorithm to assess risk of falls and refer participants to their family physician, an optomotrist, podiatrist, physical therapist, or occupational therapist and to receive a home-based exercise program to address identified risks **CG:** Falls prevention leaflet and offered 2 social visits from an accredited provider for older people (nursing student or medical student) **Format (single or combo, individual or group, where)** **IG:** Combo, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Single visit by nurse to conduct the following brief assessments: health assessment, home hazards assessment, bone health assessment, Otago Exercise Program. Referal to Otago Exercise program delivered by trained health practitioner or physical therapist for 1 year during home visits at weeks 1, 2, 4, and 8 and after 6-months. Nurse instigated referal as indicated by assessments. Nurse telephoned 2-4 weeks after assessment to ensure that referral consultations had taken place. **CG:** Mailed leaflet once, 2 social visits of unreported duration **Delivery** **IG:** Falls-and-fracture nurse coordinator with substantial gerontological experience trained by clinical investigators and at an established community-based fall-prevention program (2 days) **CG:** Social visits by nursing or medical student	**Fall-related fracture:** NR **List of additional injury measures:** **Fall-related injury:** Moderate (bruising, sprains, cuts, abrasions, seeking medical attention, or decrease in physical function for 3 days or more) or serious (a fracture, hospital admission, or sutures) **QOL** **SF-12:** NR **SF-36:** Assessed at 12-months in person's home **EuroQol:** NR **Mortality:** Assessed as part of attrition reporting **Disability** **ADLs:** Notingham Extended Activities of Daily Living Profile assessed at baseline and 12-months **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** "An unexpected event in which the participants come to rest on the ground, floor, or other lower level" **Rate or risk of falls/fallers:** Participants recorded their falls prospectively using postcard calendars, completed daily and mailed monthly to the research team. A follow-up telephone call confirmed the fall details and also followed up with those not returning calendars. **Length of followup:** 1 year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Davison 2005[76] Fair	**Falls Efficacy Scale:** Activities-specific Balance Confidence Scale administered at 3, 6 and 12 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** MMSE **Length of followup:** 1 year	**Fall-related injury**: **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** Fracture of neck or femur: IG: 1/144 (1%) CG: 2/149 (1%) RR 0.48 (0.04-5.29) Other fracture: IG: 6/144 (4%) CG: 11/149 (7%) RR (95% CI): 0.53 (0.20-1.39) **# people sustaining multiple events:** NR **Mortality:** IG: 3/159 (2%) CG: 5/154 (3%) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk
Elley 2008[79] Good	**Falls Efficacy Scale: Modified version** Range 0-10 **Tinetti Gait & Balance (modified POMA)**: NR **Timed Up & Go:** Assessed in participant's home by research nurse blinded to intervention status. **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** 30 second chair stand test, four-test balance scale from the FICSIT, 7.5-cm block step test, level of physical activity **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR *Other non-hip fractures: NR* **# people sustaining multiple events:** NR **Mortality:** IG - 7/155 (4.5%) CG - 4/157 (2.5%) **QOL** **SF-12:** NR **SF-36:** Physical component summary score, Median (IQR) Baseline Followup **IG:** 35.4 (29.4-43.8) 39.4 (29.9-46.0) **CG:** 36.5 (29.7-43.9) 37.2 (29.0-45.4) p-value=0.25 Mental component summary score, Median (IQR): Baseline Followup **IG** : 57.5 (50.1-61.8) 56.7 (48.8-61.3) **CG:** 58.7 (53.1-62.5) 57.7(49.4-61.9) p-value=0.40 **EuroQol:** NR **Among high risk:** All high risk

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Davison 2005[76] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Fall rate per person-year:** NR **# falls/# in group:** IG: 435/145 CG: 1251/150 *Two outliers excluded:* IG: 387/144 CG: 617/149 **# (%) fallers:** IG: 95 (66%) CG: 103 (69%) *Two outliers excluded:* IG: 94 (65%) CG: 102 (68%) RR (95% CI): 0.95 (0.81-1.12) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk
Elley 2008[79] Good	**ADLs:** Nottingham Extended Activities of Daily Living score (range 0-22) Median ADL score (IQR) Baseline Followup IG: 19.0 (18.0-21.0) 18.0 (17.0-20.0) CG:19.0 (16.0-2.0) 19.0 (17.0-20.0) [likely that 2.0=20.0] P=0.43 (group comparison at 12 mo controlling for baseline value) **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 285/155 CG: 299/157 IRR for falls in IG vs CG: 0.96 (95% CI 0.70, 1.34) **Total follow-up, person time:** IG: 148.53 CG: 148.85 **Falls/person year (mean, 95% CI):** IG: 1.91 (1.70-2.16) CG: 2.01 (1.79-2.25) **# (%) fallers:** IG: 106 (68.4) CG: 98 (62.4) **# (%) frequent fallers (2+ falls):** IG: 69 (44.5) CG: 54 (34.4) **Among high risk:** All are high risk

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Davison 2005[76] Fair	**Falls Efficacy Scale:** *Activities-specific Balance Confidence mean score (SD)* IG CG Baseline 59 (27) 59 (27) 1 year 61 (28) 53 (29) RR (95% CI): 7.5 (0.7-14.2) **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** Recurrent fallers who sought fall-related medical attention
Elley 2008[79] Good	**Modified Falls Efficacy Scale (range 0-10):** Median score (IQR) Baseline Followup IG: 8.5 (7.0-9.5) 8.4 (6.9-9.4) CG: 8.6 (7.1-9.5) 8.1 (6.0-9.4) P=0.49 (group comparison at 12 mo controlling for baseline value) **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go (seconds):** Median (interquartile range) Baseline Followup IG: 12.0 (10.0-16.0) 11.2 (10.0-14.6) CG: 12.0 (1.0-17.4)* 12.0 (10.0-17.5) P=0.72 (group comparison at 12 mo controlling for baseline value) *reporeted 1.0 may be typographical error **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** OK - Only 6 Maori, limited to 75+ (except 55+ for Maori) fallen in past year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Hendriks 2008[84] Fair	**Location:** The Netherlands **Target population:** Community-dwelling Dutch people aged 65 and over who were seen in Emergency Department after fall **Recruitment strategy:** People 65+ presenting to University Hospital Maastricht or General Practioner's Cooperative after a fall were invited to participate.	**Inclusion:** Community-dwelling, aged 65 years or older who attended ED or after hours care in Maastricht for a fall **Exclusion:** Unable to speak Dutch, cognitively impaired (score <4 on the Abbreviated Mental Test 4), had been admitted for more than 4 weeks to a hospital or another institution, or were permanently wheelchair-dependent or bedridden.	**Assessed for eligibility:** 2,362 **Excluded:** 2029 **Not meeting inclusion criteria:** 744 **For other reasons:** 1285 **Randomized:** 333 **IG:** 166 **CG:**167 **Analyzed (12 months):** **IG:** 124 **CG:**134 **Age: mean (SD)** **IG:** 74.5 (5.9) **CG:** 75.2 (6.9) **Female:** % **IG:** 66.9 **CG:** 70.1 **Ethnicity:** NR **SES:** **Primary school education or less (%)** **IG:** 25.3 **CG:** 31.1 **Fall History:** **IG:** 100% **CG:**100%	**Risk category:** Other - fall (A599) **Definition:** Presented to emergency department or after hours clinic with consequences of a fall **Proportion:** 100% **Instrument:** NR Subgroup analyses were performed on fall outomces on participants at higher fall risk: people with history of 2+ falls in previous year, people with mobility impairments (defined as reporting some problems with walking or worse on the mobility item of the EuroQol, poor ADL functioning (defined as score < 30 on the Frenchay Activity Index, and older age (80+ years)

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Hendriks 2008[84] Fair	**Category:** Clinical Assessment **Description** **IG:** Medical and OT assessments to evaluate potential risk factors for new falls. Included standard examination, blood pressure, vision, sense of hearing, locomotor apparatus, feet and footwear, peripheral nervous system, balance and mobility, anthropometric indices, cognition, affect, heart, blood tests, medicaiton, functional assessment, environmental hazards, psychological consequences of fall. Summary of assessments were sent to GP and participants were recommended to contact GP about results and referrals. GPs could take action as desired. Home assessment included daily functioning assessment, occupational therapy checklist, environmental hazard checklist. Adaptations or additional support delivered by social and community services. **CG:** Usual care **Format (single or combo, individual or group, where)** **IG:** Combo, individual, hospital-based assessment **CG:** Usual care **Intensity (frequency and duration)** **IG:** Medical assessment scheduled within 1 month after baseline, home assessment scheduled within 1 month after medical assessment. Summary of results and recommendations sent to GP. 2. **CG:** Usual care **Delivery** **IG:** Assessments were performed by geriatrician and geriatric nurse, rehab physician. Home visit by **CG:** Usual care	**Fall-related fracture:** NR **List of additional injury measures:** Injurious falls: percentage of particpants who sought medical care after a fall. **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** EuroQol converted into utilities according to Dolans' tariffs assessed via self-administered q'aire at baseline, 4 months, 12 months. **Mortality:** Assessed as part of attrition reporting **Disability** **ADLs:** Groningen Activity Restriction Scale **IADLs:** Groningen Activity Restriction Scale **Length of followup:** 1 year	**Definition of fall:** NR **Rate or risk of falls/fallers:** Participants recorded their falls prospectively using calendar for 12 months. A monthly followup telephone call collected information on the falls. **Length of followup:** 1 year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Hendriks 2008[84] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA)**: NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Recuperation from index fall, health complaints, mental health, fear of falling (1 item), activity avoidance **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR *Other non-hip fractures: NR* **# people sustaining multiple events: NR** **Mortality:** IG - 5/166 (3% calc) CG - 1/167 (0.6% calc) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** *Mean (SD) at 12 months* IG: 0.70 (0.25) CG: 0.71 (0.28) Difference, 95% CI (from multiple linear regression): -0.012, -0.06 - 0.03, p=0.59 **Among high risk:** No sub-group differences. Injurious falls reported: no significant differences

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Hendriks 2008[84] Fair	**ADLs and IADLs:** **Grogan Activity Restriction Scale: Activity of faily living and instrumental activity of daily living disability (range 11-44)** *Mean ADL/IADL score (SD) at 12-months* IG: 15.2 (1.8) CG: 15.4 (5.6) Difference, 95% CI (from multiple linear regression): -0.03 (-0.64 to 0.64) p-value = 0.94 **Among high risk:** No significant differences	**# falls/# in group:** NR **Total follow-up, person time:** NR **Falls/person year (mean, 95% CI):** NR **# (%) fallers at 12-months:** IG: 55 (46) CG: 61 (47) OR (95% CI) = 0.86 (0.50-1.49), p=0.59 **# (%) frequent fallers (2+ falls):** IG: 32 (26) CG: 34 (26) OR (95% CI) = 0.95 (0.51-1.78), p=0.87 **Among high risk:** No differences in the subgroups between IG and CG

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Hendriks 2008[84] Fair	**Falls Efficacy Scale:** NR **Fear of Falling** (Single item) was reported at 12 months, *n(%):* IG: 79 (64) CG: 81 (60) p=0.42 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go (seconds):** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** No adverse events or side effects were reported. **External validity:** OK - 86% of assessed patients were excluded, primarily because did not meet inclusion criteria. 72.3% adherent to intervention. Possible that usual care in Dutch setting provides more care than typical US.

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Hogan 2001[82] Fair	**Location:** Calgary, Aberta, Canada **Target population:** Calgary residents aged 65 and up with recent fall **Recruitment strategy:** Between 6/97-06/99 ; self-referral, identified by health care professionals	**Inclusion:** Aged ≥65 years; fallen within previous 3 months (not during vigorous or high-risk activities, while in hospital, or because of syncope or an acute stroke; & fall could not have resulted in a lower extremity fracture); community-dwelling; ambulatory; competent to give consent **Exclusion**: NR	**Assessed for eligibility:** NR **Excluded:** NR **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 163 **IG:** 79 **CG:** 84 **Age: mean (SD)** IG: 77.4 (7.3) CG: 77.9 (6.2) **Female:** IG 69.6% CG 73.8% **Ethnicity:** NR **SES:** NR **Fall History:** 100%	**Risk category:** A599 (other): recent falls **Definition:** Fall in the 3 months pre-study ; subgroup analyzed was those with 2+ falls in 3 months prior **Proportion:** 100% 1+ falls, 47.2% 2+ falls **Instrument:** Instrument NR

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Hogan 2001[82] Fair	**Category:** Clinical Assessment **Description** **IG:** In-home assessment in conjunction with an individualized treatment plan, including an exercise program for those likely to benefit. After initial assessment by one assessor, all assessors met to agree on an individualized plan to decrease subject's risk of falling; recommendations were communicated to the subject, the attending physician and the source of the referral (if different). Subjects were referred to an exercise class for elderly people who had fallen, if they had performed poorly on the balance and gait measures, were not attending an exercise program and agreed to the referral. were also given instruction in a home exercise program. IF no rails to aid getting in or out of bathtub or shower, given advice on how to obtain grab bars; refer to supplier. If gait abnormality suggest referral for detailed assessment (e.g., by PT), to exercise program, & advice on assistive devices or referral to supplier. If impaired vision, refer to optometrist or ophthalmologist; If climbing on chairs / using unsafe stepstool to reach items, advise against this, suggest moving items to more accessible cupboards; IF lower-extremity disability suggest exercises, refer to exercise program; IF use of sedative–hypnotic, antidepressant, neuroleptic or narcotic medications, suggest review, advise attempt to taper off, suggest options for insomnia; IF drop of ≥20 mm Hg in systolic BP when standing suggest review of medication, elevate head of bed; correct salt intake. **CG:** Usual care; home visit with a leisure assessment **Format (single or combo, individual or group, where)** **IG:** Combo; individual; at home; classes in a geriatric day hospital **CG:** Single, individual, at home **Intensity (frequency and duration)** **IG:** Initial visits took 1–2 hours, 1 x 20-minute discussion among assessors **CG:** 1 visit lasting 1-2 hours **Delivery** **IG:** Assessors were a specialist in geriatric medicine, 2 nurses, 2 occupational therapists and a physiotherapist **CG:** Recreational therapist	**Fall-related fracture:** Subjects asked to record the date of any fall(s) on a calender, to be returned monthly by mail. A research associate visited at 3 and 6 months, and called at 12 months post-randomization also **List of additional injury measures:** Fall-related emergency department visit, fall-related admission to hospital **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Unintentionally coming to rest on the ground, floor or other lower level **Rate or risk of falls/fallers:** Subjects asked to record the date of any fall(s) on a calender, to be returned monthly by mail. An RA visited at 3 and 6 months, and called at 12 months post-randomization also **Length of followup:** 1 year

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Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Hogan 2001[82] Fair	**Falls Efficacy Scale:** At baseline **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Emergency department visits, hospital admissions - general AND for falls specifically **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR # **fractures:** 5 fractures (3 femoral) in CG, 3 (2 femoral) in IG # **people sustaining fractures:** NR # **people sustaining multiple events:** NR **Mortality** IG 2/79 CG 5/84 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Hogan 2001[82] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 241/75 CG: 311/77 **# (%) fallers:** 54/75 (72.0%) 61/77 (79.2%) **# (%) frequent fallers (3+ falls): note 3+ (2+ NR)** IG: 26 (34.7%) CG: 35 (45.5%) **Among high risk:** In a post hoc subgroup analysis, IG subjects with >2 falls in the 3 months pre-study were less likely to fall (p = 0.046) and had a significantly longer time between falls (p < 0.001), compared with CG. 80% or more had fewer falls than those with adherence rate < 80%, but not significant. No significant differences between the CG, IG in cumulative number of falls (311 v. 241, p = 0.34), having 1+ falls (79.2% v. 72.0%, p = 0.30) or in the mean number of falls (4.0 v.3.2, p = 0.43). Cox analysis: no significant difference between groups in % having 1+ falls (p =0.55), but a significantly (p < 0.001) longer time between falls in the IG. Median number of falls was 2.0 for the CG, 1.6 for IG. IG adjusted RR of falling per day = 0.74 (0.62–0.88) that of CG

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Hogan 2001[82] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** OK except exclusion data NR **General:** Subjects who adhered to recommendations ≥80% or more had fewer falls than those with adherence rate < 80%, but not significant. no significant differences between the CG, IG in cumulative number of falls (311 v. 241, p = 0.34), having 1+ falls (79.2% v. 72.0%, p = 0.30) or in the mean number of falls (4.0 v.3.2, p = 0.43). Cox analysis: no significant difference between groups in % having 1+ falls (p =0.55), but a significantly (p < 0.001) longer time between falls in the IG. median number of falls was 2.0 for the CG, 1.6 for IG. IG adjusted RR of falling per day = 0.74 (0.62–0.88) that of CG

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Lightbody 2002[77] Fair	**Location:** Large teaching hospital (University Hospital Aintree), Liverpool, UK **Target population:** Older (≥65) people discharged from an Accident and Emergency Department after a fall **Recruitment strategy:** Consecutive patients attending the Accident and Emergency Depart between July and December 1997 with a primary diagnosis of "fall" were identified and contacted to provide consent	**Inclusion:** Attended emergency department with primary diagnosis of 'fall' **Exclusion:** Admitted to hospital as a result of the index fall, lived in institutional care, refused or unable to consent, out of the catchment area	**Assessed for eligibility:** 33432 **Excluded:** 1111/1459 (fallers presented to A&E dept aged 65+) = 76.1% **Not meeting inclusion criteria:** 596 **(excluded because admitted)**; 515 would / could not consent or were retrospectively identified **Randomized:** 348 (23.9% of 1459) **IG:** 171 **CG:** 177 **Age: median (interquartile range)** IG: 75 (70-82) CG: 75 (70-81) **Female:** **IG:** 131 (77%) **CG:** 128 (72%) **Ethnicity: NR** **SES: NR** **Fall History:** IG: 72 (42%) CG: 74 (42%)	**Risk category:** Previous falls (A400) **Definition:** Patients all recently discharged from emergency department for a fall (i.e., index fall). Fall was defined as "patient failing to maintain a stable position and inadvertently coming to rest on the ground or lower level, with or without loss of consciousness, but not as the result of acute medical events (e.g., stroke) or extraordinary environmental factors (e.g., traffic accident). Coming to rest against furniture or a wall was not deemed a fall. **Proportion:** 100% **Instrument:** Medical record

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Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Lightbody 2002[77] Fair	**Category:** Clinical Assessment **Description** **IG:** Nurse intervention: within 4 weeks -- recived a home assessment to assess easily modifiable risk factors for falls (medications, ECG, blood pressure, cognition, viisual acuity, hearing, vestibular dysfunction, balance, mobility, feet and footwear using adapted version of the falls checklist and "s" test); advice and education about general safety in the home. Environmental assessment of adequate lighting, tripping hazards, unsuitable furniture. Simple modifications made with consent. Fall Risk factors requiring further action were referred to relatives, community therapy services, social services, and or primary care team. Direct refererals were not made to hosptial outpaitents or day hospital. Identified problems: 74% target meds; 50% abnormal EKG; 15% cognition; 51% vision; 31% hearing; 46% dizziness; 37% balance; 47% mobility; 37% foot / footwear; 77% environment; also lists % referred to chiropody, PT, OT **CG:** Usual care (not described) **Format (single or combo, individual or group, where)** **IG:** single, at home **CG:** NA **Intensity (frequency and duration)** **IG:** One time intervention **CG:** NA **Delivery** **IG:** Home assessment by a nurse **CG:** NA	**Fall-related injury:** Fall injuries were recorded daily in a fall diary for up to 6 months. Reattendence at the Accident and Emergency Dept., hospital admits; measured through review of GP records. GP records reviewed and hospital databases searched for attendances and admisions. **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** Baseline assessment and postal questionnaires sent at 6 months -asked about functional ability via Barthel index. **IADLs:** NR **Length of followup:** 6-months	**Rate or risk of falls/fallers:** Further falls (after index fall; see definition in high risk column) by 6 months; recorded daily by patients in a diary; postal questionnaires sent at 6 months -asked about # of falls **Length of followup**: 6 months

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Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Lightbody 2002[77] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA)**: NR **Timed Up & Go**: NR **6-meter timed walk**: NR **Functional reach**:NR **Berg Balance Scale**:NR **List of additional measures:** Medications Mood (via Yale) Resource use (e.g., fall-related hospital admissions, fall-related bed days, AED fall or problem, fall-related GP attendance) **Length of followup**: 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG: 7/177 (4%); CG: 11/171(6%) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

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Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Lightbody 2002[77] Fair	**ADLs:** *Barthel Index (Mean (SD))* IG CG Baseline 19.0 (2.0) 19 (2.3) 6-mo follow-up 18.5 (2.37) 17.8 (3.6) Mean Diff (calc) 0.5 1.2 **IADLs:** NA **Among high risk:** All are high risk	**Fall rate per person year:**NR **Time to first fall:** NR **# falls:** IG:141 CG: 171 **# fallers:** IG: 39 (25%) CG:41 (26%) **Among high risk:** All are high risk

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Lightbody 2002[77] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** IG had higher rate (number) of fall-related GP attendance **External validity:** Only 25% approached were consented; conducted in UK so usual care may not be similar to US. Identified in Accident and Emergency Department

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Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Lord 2005[62] Fair	**Location:** Sydney, Australia **Target population:** Aged 75 years or older **Recruitment strategy:** Randomly drawn from a health insurance company membership database	**Inclusion:** Aged 75 and older **Exclusion:** Minimal English language skills, blind, had Parkinson's disease or a Short Portable Mental Status Quesionnaire score <7, not at increased risk of falls according to physiological profile assessment (PPA)	**Assessed for eligibility:** 2,468 **Excluded:** 1,848 **Not meeting inclusion criteria:** 80 **For other reasons:** 1,768 **Randomized:** 620 **IG (extensive intervention (EI)):** 210 **IG (minimal intervention (MI)):** 206 **CG:** 204 **Age: mean (SD)** IG (EI): 80.3 (4.3) IG (MI): 80.7 (4.6) CG: 80.2 (4.6) **Female:** IG (EI): 66.7% IG (MI): 62.1% CG: 69.1% **Ethnicity:** NR **SES:** NR **Fall History:** *Previous falls, mean (SD)* IG(EI): 0.85 (1.53) IG(MI): 0.62 (0.92) CG: 0.73 (0.11)	**Risk category:** Screning Tool - PPA (A509) **Definition:** z score < -1 **Proportion:** 100% **Instrument:** PPA

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Lord 2005[62] Fair	**Category:** Multi-factor risk assessment and clinical management **Description** **IG (EI):** PPA report, a profile of test results, specific written recommendations for preventing falls. Individualized exercise interventions, vision interventions, and/or peripheral sensation counseling based on assessment scores **IG (MI):** PPA report, a profile of test results, specific written recommendations for preventing falls. Given instruction sheets for exercise, vision and/or peripheral sensation as well as local resources based on assessment scores **CG:** Waitlist control - received MI after the 12-month trial **Format (single or combo, individual or group, where)** **IG (EI):** Combo, group exercises and individual vision interventions, various locations **IG (MI):** Combo, individual, at-home **CG:** NA **Intensity (frequency and duration)** **IG (EI):** Exercise classes 1 hour 2 times per week for 4 10-12 week terms over 12 months. Vision and peripheral sensation counseling frequency and duration NR **IG (MI):** Had one visit and no follow-up **CG:** NA **Delivery** **IG (EI):** Fitness instructors, eye care specialist, and peripheral sensation counseling NR **IG (MI):** NR **CG:** NA	**Fall-related fracture:** Not reported separately, only included among "fall-related injury" **List of additional injury measures:** Fall-related injuries which included bruises, strains, cuts and abrasions, back pain, and fractures. Self-report on monthly calendars and followed up by phone for details and for those who did not return calendars monthly **QOL** **SF-12:** Only at baseline **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Events that resulted in a person coming to rest unintentionally on the ground or other lower level, not as the result of a major intrinsic event or overwhelming hazard **Rate or risk of falls/fallers:** Self-report on monthly fall calendars, followup phone call for fall details and to those who did not return calendars monthly **Length of followup:** 1 year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Lord 2005[62] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** PPA and sit-to-stand (STS) test at baseline and 6 months **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality (causes NR)**: IG (EI): 2 IG (MI): 0 CG: 6 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Lord 2005[62] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** **RR** IG (EI): 183/202 1.03 (0.78, 1.35) IG (MI): 152/194 0.90 (0.69, 1.17) CG: 175/201 Reference **# (%) fallers:** **RR** IG (EI): 93 (46.0) 1.03 (0.83, 1.27) IG (MI): 94 (48.5) 1.08 (0.88, 1.34) CG: 90 (44.8) Reference **# (%) frequent fallers (2+ falls):** IG (EI): 49 (24.3) 1.08 (0.76, 1.54) IG (MI): 37 (19.1) 0.85 (0.58, 1.26) CG: 45 (22.4) Reference **Among high risk:** All are high risk

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Lord 2005[62] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** High attrition from assessment. Poor performance on PPA only eliminated 9% -- so are the remaining really high-risk? Differential baseline characteristics: EI had worst function and MI had best function

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Newbury 2001[81] Fair	**Location:** Adelaide, South Australia **Target population:** Aged ≥75 years **Recruitment strategy:** Random sample (by age, sex) drawn from 6 general practice registers; invites sent until 100 persons agreed; BL data taken between 8/98-2/99	**Inclusion:** Aged ≥75 years, community dweller **Exclusion:** NR	**Assessed for eligibility:** 164 **Excluded:** 64 **Not meeting inclusion criteria:** 19 **For other reasons:** 45 declined **Randomized:** 100 **IG:** 50 **CG:** 50 **Age: Median (range)** IG: 78.5 (75-88) CG: 80 (75-91) **Female:** IG: 66% CG: 60% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** NR **Definition:** NA **Proportion:** NA **Instrument:** NA
Shumway-Cook 2007[83] Good	**Location:** 2 Washington state sites: Pierce County in eastern Washington **Target population:** Aged 65 years and older **Recruitment strategy:** Enrollment activities conducted 9/03-4/04. Recruited through press releases, ads in papers, senior newsletters, a commercial advertising mailing service, and cable television programming	**Inclusion:** Community-living; aged ≥65 years; English speaking, have a PCP seen within the previous 3 years, independent ambulators (could use a cane or walker), willingness to participate in group exercise classes for at least 6 months, access to transportation, minimal hearing and vision impairments, and no regular exercise in the previous 3 months; able to complete a 10-foot Timed Up and Go Test in <30 seconds and to pass the Pfeiffer Short Portable Mental Status Questionnaire with fewer than 5 errors **Exclusion:** NR	**Assessed for eligibility:** 659 **Excluded:** 206 **Not meeting inclusion criteria:** 142 **For other reasons:** 64 declined after screen **Randomized:** 453 (88%) **IG:** 226 **CG:** 227 **Age: mean (SD)** 75.6 (65-96) **% 65-70 %71-80 %81+** IG: 20 54 26 CG: 22 48 30 **Female:** IG 77% CG 76% **Ethnicity:** *White* IG: 94% CG: 96% **SES:** NR **Fall History:** NR	**Risk category:** A599 (other) - recent falls **Definition:** fall in last 3 months **Proportion:** Falls in last 3 mo n(%) IG CG 0 165 (73) 165 (73) 1 38 (17) 40 (18) 2 23 (10) 22 (10) **Instrument:** Health History Questionnaire

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Newbury 2001[81] Fair	**Category:** Clinical assessment - comprehensive geriatric health assessment **Description** **IG:** 75+HA health assessment which includes the following components: hearing, vision, physical condition, medication, compliance, vaccinations, alcohol and tobacco, cognition, mood, ADL, mobility, nutrition, social, housing no further detail; SF-36 **CG:** SF-36 only **Format (single or combo, individual or group, where)** **IG:** Single, individual, at home **CG:** Single, individual, at home **Intensity (frequency and duration)** **IG:** 1 time; 90 mins, offered again at 12 months **CG:** 1 time, offered the 75+HA and SF-36 again at 12 months **Delivery** **IG:** Nurse; results reported to general practitioner **CG:** Nurse	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** Baseline and 12 months **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** Barthel score at BL and 12 months IG only **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** NR **Rate or risk of falls/fallers:** # reporting falls at 12 months **Length of followup:** 1 year
Shumway-Cook 2007[83] Good	**Category:** Clinical assessment **Description** **IG:** Group exercise, fall prevention education, comprehensive falls risk assessment results sent to primary health care provider with a copy of the Guideline for the Prevention of Falls in Older Persons **CG:** Written materials on falls prevention **Format (single or combo, individual or group, where)** **IG:** Combo; ind/group; exercise classes at the study exercise class community site of choice (3 older adult residential facilities, 2 senior centers, 2 parks & rec facilities, 1 fitness facility). Each class 30 mins moderate-intensity aerobic conditioning, 20 of progressive strength training, 10 of flexibility and balance exercises known to impact fall risk. IG received telephone follow-up if monthly class attendance fell <70% to determine reasons for low participation and to encourage resumption of exercise. education component: falls risk / prevention, exercising after illness / injury, home safety, medication safety, footwear / use of gait devices, strategies for exercise adherence **CG:** Single, individual, given at enrollment **Intensity (frequency and duration)** **IG:** Ex: 1 hour 3 times/week group exercise for up to 12 months Ed: 6 1-hour classes - fall prevention education **CG:** 1 time at enrollment **Delivery** **IG:** Exercise classes: trained exercise instructors;	**Fall-related fracture:** NR **List of additional injury measures:** By self report - supplied 12 monthly calendars; called if calendar not received and (in the event of a fall) to determine if the fall was injurious / required medical attn. **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** Unintentional descent to the ground / other supporting surface **Rate or risk of falls/fallers:** By self report - supplied 12 monthly calendars; called if calendar not received and (in the event of a fall) to determine if the fall was injurious / required medical attn. **Length of followup:** 1 year

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Newbury 2001[81] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** number of problems ID'd, # persons with problems, cognitive function, admission to institution, self rated health, depression score **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG: 1/50 CG: 5/50 **QOL** **SF-12:** NR **SF-36:** Similar at Baseline; scores not sig diff between groups at follow up (data NR) **EuroQol:** NR **Among high risk:** NR
Shumway-Cook 2007[83] Good	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline and 12 months **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** At baseline and 12 months **List of additional measures:** lower extremity strength (Repeated Chair Stand test) **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG: 2 CG: 3 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

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Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Newbury 2001[81] Fair	**ADLs:** *Median Barthel ADL score (range) at 12 months* CG: 90 (50-100) IG: 100 (80-100) *P=0.16 (Wilcoxon rank sums)* *Mean Barthel ADL score (SD) in IG* BL: 96.7 (6.0) 12 months: 96.3 (4.9) RR (95%CI): -0.8 (-9.4-7.8) *P=0.36* **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** NR **# (%) fallers:** IG: 12 (26.7%) CG: 17 (38.6%) difference NS *P=0.32* Comparing IG BL to 1 year data: BL 20 (45%) vs 1 year 12 (26.7%); p = 0.33 (McNemar test) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR
Shumway-Cook 2007[83] Good	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Falls per person-year:** IG: 1.33 CG: 1.77 P=NS **# falls/# in group:** IG: 297/226 CG: 398/227 **# (%) fallers:** IG: 124 (55) CG: 130 (57) P=0.61 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** *Among those with falls in past 3 mo at baseline* N IRR CI p Yes (fell) 124 0.61 0.34–1.10 0.20 No 329 0.95 0.68–1.33

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Newbury 2001[81] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** ≥75
Shumway-Cook 2007[83] Good	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** IG CG BL mean (SD) 8.6 (3.3) 8.5 (3.7) Final mean (SD) 9.1 (3.5) 10.1 (4.4) adjusted mean difference 0.7 (1.2 -0.2) p<0.001 **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** IG CG BL mean (SD) 50.3 (5.6) 50.2 (6.0) final mean (SD) 51.1 (6.2) 49.4 (7.4) adjusted mean difference +1.5 points (0.8–2.3) p<0.001 **Among high risk:** NR	**Adverse effects:** NR **External validity:** All white, non exercisers

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Spice 2009[75] Winchester Falls Project Fair	**Location:** United Kingdom **Target population:** Aged 65 years and older with 2+ falls in the previous year **Recruitment strategy:** All 19 general practices within the Mid-Hampshire Primary Care Trust area were invited, one declined	**Inclusion:** Aged ≥65 years, 2+ falls in previous year **Exclusion:** Life expectancy <1 year, plan to move from the area within 1 year, abbreviated mental test score of <7, nursing home residents, presented to emergency department with most recent fall	**Assessed for eligibility:** 728 **Excluded:** 212 **Not meeting inclusion criteria:** 102 **For other reasons:** 110 declined **Randomized:** 516 **IG (primary care(PC)):** 141 **IG (secondary care(SC)):** 213 **CG:** 162 **Age: mean (SD)** **IG (PC):** 83 (6.7) **IG (SC):** 81 (6.6) **CG:** 83 (6.6) **Female (calc):** **IG (PC):** 74.3% **IG (SC):** 71.4% **CG:** 76.1% **Ethnicity:** NR **SES:** NR **Fall History:** 100%	**Risk category:** History of falls - Other (A599) **Definition:** 2+ falls in the previous year **Proportion:** 100% **Instrument:** Interviewed by community-based health professionals an social services staff during recruitment. Fall defined as "inadvertently coming to rest on the ground or otehr lower level with or without loss of consciousness and other than as a consequence of a sudden onset of paralysis, epileptic seizure, excess alcohol intake, or overwhelming external force"
Tinetti 1994[131] Buchner 1993[106] Tinetti 1993[162] Yale FICSIT Fair	**Location:** Connecticut **Target population:** Aged 70 years or older, enrolled in an HMO **Recruitment strategy:** 16 out of 17 physicians in the HMO that had ≥ 100 pts aged ≥ 70 or older agreed to participate. From a list of pts aged 70 years or older per physician, pts were randomly selected for screening to see if participating in other longitudinal aging study. The first 20 (± 5) per practice that met this criteria were mailed a letter then contacted by phone for further screening	**Inclusion:** Aged 70 years or older, ambulatory at least within own home, score >20 on the Mini-mental State Examination, possesion of at least 1 of the targeted risk factors (postural hypertension; sedative-hypnotics; ≥ 4 medications; toilet or tub transfer unsafe; environmental hazard; impaired gait or balance; impaired leg or arm muscle strength or range of motion) **Exclusion:** Resident of a nursing home, currently enrolled in another aging study, too physically active (walking ≥ 1/2 mile without stopping or participation in vigorous sports within the past month)	**Assessed for eligibility:** 2,229 **Excluded:** 1,928 **Not meeting inclusion criteria:** 1,595 **For other reasons:** 333 **Randomized:** 301 **IG:** 153 **CG:** 148 **Age: mean (SD)** IG: 78.3 (5.3) CG: 77.5 (5.3) **Female:** IG: 69% CG: 69% **Ethnicity:** NR **SES:** *Education beyond high school* IG: 36% CG: 25% **Fall History:** IG: 41% CG: 44%	**Risk category:** Medication specific (A600); Gait and/or balance impairment (A507), Others - inability to transfer safely to bathtub or toilet, environmental hazards for falls, impairment in leg or arm muscle strength or range of motion (A599) **Definition:** Medication specific: Taking sedative-hypnotic and/or ≥4 medications Gait and/or balance impairment: < normal per baseline assessment Inability to transfer safely to bathtub or toilet: unsafe Environmental hazards: Any on hazard checklist Impairment in leg or arm muscle strength or range of motion: <90º flexion or <10º of full extension for hip, knee, shoulder, hand, elbow; lack neutral dorsi/plantar flexion; <30% of mean for age and sex for hand-dynomanometer measurement; <90º abduction, <150º flexion, <20º extension for shoulder; <140º flexion or <20º extension for elbow **Proportion:** 100% had at least one risk factor **Instrument:** Medication specific: Nurse practitioner recorded names and dosages of all meds from the containers at the baseline home visit Gait and/or balance impairment: Developed for this study using usual rehabilitative practice Inability to transfer safely to bathtub or toilet: "Using standard protocols" Environmental hazards: Checklist developed for this study Muscle testing and range of motion: Protocols developed by the American Academy of Orthopedic Surgeons

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Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Spice 2009[75] Winchester Falls Project Fair	**Category:** Multi-factor risk assessment and clinical management **Description** **IG (PC):** Risk factor assessment, referral to appropriate professionals, and individualized management **IG (SC):** Attended multi-disciplinary clinic with referral for investigations, interventions (including Homecheck) and followup if necessary **CG:** Risk factor assessment only **Format (single or combo, individual or group, where)** **IG (PC):** Various, individualized treatment **IG (SC):** Various, individualized treatment, multi-disciplinary clinic **CG:** Single, individual, location NR **Intensity (frequency and duration)** **IG (PC):** Various, individualized treatment, mean of 71 minutes of intervention **IG (SC):** Various, individualized treatment, mean of 121 minutes of intervention time **CG:** One time **Delivery** **IG (PC):** Assessment by nurse, various professionals from referrals **IG (SC):** Various professionals at multi-disciplinary clinic **CG:** Assessment by nurse	**Fall-related fracture:** Self-report on monthly falls cards, followup calls for unreturned cards **List of additional injury measures:** Fall-related admissions **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** Assessed as secondary outcome **Disability** **ADLs:** Barthel taken at baseline and 1 year **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Inadvertently coming to rest on the ground or otehr lower level with or without loss of consciousness and other than as a consequence of a sudden onset of paralysis, epileptic seizure, excess alcohol intake, or overwhelming external force **Rate or risk of falls/fallers:** Self-report on monthly falls cards, followup calls for unreturned cards **Length of followup:** 1 year
Tinetti 1994[131] Buchner 1993[106] Tinetti 1993[162] Yale FICSIT Fair	**Category:** Clinical Assessment **Description** **IG:** Interventions based on risk factors identified including behavioral recommendations, med evaluation and education, gait, balance, and/or transfer skills training, exercise, and home hazard modification. Risk factors were prioritized for intervention. Intervention period followed by maintenance period which included contact from study staff **CG:** Social home visits with structured life-review interviews **Format (single or combo, individual or group, where)** **IG:** Combination, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Depended on ppt's risk factors and prioritization plan. Education and behavioral interventions 1-2 times per week and exercise, gait balance and transfer training 1-2 times per week for 3 months, extended if health problems temporarily interfered with exercise. Maintenance period 1 contact per month from end of intervention to 6 months after enrollment **CG:** Number of visits was matched to estimated number of visits for a ppt in IG with comparable risk factors; ranged from 2-18 times over a 3-month period **Delivery** **IG:** Nurse practitioner, physical therapist, optional research staff carpenter for home hazard modification **CG:** Social work students	**Fall-related fracture:** NR **List of additional injury measures:** Serious injury, which included fractures, head injuries, joint dislocations, severe sprains, lacerations requiring suturing **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** NR **Rate or risk of falls/fallers:** Self-report on calendar mailed at the end of each month, followup phone calls to fallers and ppts who did not turn in calendar **Length of followup:** 1 year

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Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Spice 2009[75] Winchester Falls Project Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Timed Get Up & Go **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG (PC): 29/136 (21.3%) OR (95% CI)=0.85 (0.53-1.37), p=0.514 IG (SC): 40/210 (19.0%) OR = 0.90 (0.61-1.34), p = 0.617 CG: 35/159 (22.0%) **# people sustaining multiple events:** NR **Mortality:** **IG (PC)**: 14/136 (17%) OR (95% CI)=0.70 (0.41-1.20), p=0.192 **IG (SC):** 34/210 (16%) OR = 0.92 (0.62-1.36), p = 0.661 **CG:** 29/159 (18%) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** All are high risk
Tinetti 1994[131] Buchner 1993[106] Tinetti 1993[162] Yale FICSIT Fair	**Falls Efficacy Scale:** Modified version taken at BL, repeated at a median of 4.5 months after BL **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Risk factor reassessment **Length of followup:** Median 4.5 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG: 4 CG: 7 **# people sustaining multiple events:** NR **Mortality:** IG: 7 CG: 5 p=NS **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

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Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Spice 2009[75] Winchester Falls Project Fair	**ADLs:** *Barthel index - difference from CG in mean score (95% CI)* IG (PC): 0.07 (-0.54-0.67), p=0.824 IG (SC): 0.63 (0.10-1.16), p=0.020 **IADLs:** NR **Among high risk:** All are high risk	**# falls/# in group:** NR **# (%) fallers:** IG (PC): 118/136 (87%) OR (95% CI)=1.17 (0.57-2.37), p=0.0673 IG (SC): 158/210 (75%) CG: 133/159 (84%) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk
Tinetti 1994[131] Buchner 1993[106] Tinetti 1993[162] Yale FICSIT Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** All are high risk	**Falls per person week:** IG: 0.012 CG: 0.018 Adj RR 0.69 (0.52, 0.90) **# falls/# in group:** IG: 94/147 CG: 164/144 **# (%) fallers:** IG: 52 (35) CG: 68 (47) P=0.04 Adj RR 0.76 (0.58, 0.98) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

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Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Spice 2009[75] Winchester Falls Project Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Fell 2+ times in the last year
Tinetti 1994[131] Buchner 1993[106] Tinetti 1993[162] Yale FICSIT Fair	**Falls Efficacy Scale:** *Adjusted mean score change (SD)* IG: 0.2 (3.9) CG: -1.2 (4.9) p=0.02 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** IG CG Death 7 (5%) 5 (3%) Hospitalization 32 (21%) 36 (24%) Musculoskeletal symptoms ("probably related to exercise program") 10 -- p=NS **External validity:** Participants had specific risk factors

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Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Van Haastregt 2000[71] Fair	**Location:** Hoensbroek, Netherlands **Target population:** Community dwelling people aged 70 or over **Recruitment strategy:** Participants were recruited from six general practices by means of a screening questionnaire from September 1997 to June 1999	**Inclusion:** Aged 70 years or over, be living in the community, and have reported two or more falls in the previous six months or have scored three or more on the mobility control scale of the short version of the sickness impact profile. **Exclusion:** Bedridden, fully dependent on a wheelchair, terminally ill, on the waiting list for admission to a nursing home, or receiving home care from a community nurse on a regular basis.	**Assessed for eligibility:** 896 **Excluded:** 580 **Not meeting inclusion criteria:** 504 **For other reasons:** 76 **Randomized:** 316 **IG:** 159 **CG:** 157 **Age: mean (SD)** IG: 77.2 (5.1) CG: 77.2 (5.0) **Female:** 65% **Ethnicity:** NR **SES:** IG CG *Elementary school education or less:* 73 (46) 88 (56) *Below average income:* 99 (62) 104 (66) **Fall History:** IG: 38% CG: 36%	**Risk category:** Other - History of falls, mobility limitation (A599) **Definition:** Two or more falls in previous 6 months or score 3+ on mobility control scale **Proportion:** 100% had at least one risk factor **Instrument:** Short version of Sickness Impact Profile
Wagner 1994[78] Fair	**Location:** Washington **Target population:** Aged 65 years or older **Recruitment strategy:** Random sample from Group Health Cooperative of Puget Sound HMO enrollees at 3 clinics with PCP's approval were mailed an indtroductory letter, followed by a mailed program description and baseline questionnaire. A second questionnaire was mailed to those who didn't respond	**Inclusion:** Aged 65 years or older, ambulatory, and independent in activities of daily living **Exclusion:** NR	**Assessed for eligibility:** 5,240 **Excluded:** 3,681 **Not meeting inclusion criteria:** 411 **For other reasons:** 3,270 **Randomized:** 1,559 (including 317 in a visit only group) **IG:** 635 **CG:** 607 **Age: mean** IG: 72.5 CG: 72.5 **Female:** IG: 60% CG: 59% **Non-white:** IG: 6% CG: 7% **SES:** IG CG Income <$15,000 35% 33% College education 26% 26% **Fall History:** IG: 35% CG: 33%	**Risk category:** Visual impairment (A503), Prescription Drug Use (A600), Other inadequate exercise, high-risk alcohol use, hearing impairment, increased fall risk (A599) **Definition:** Inadequate exercise: < 3 times per week for 15 minutes to the point of sweating or getting out of breath High-risk alcohol use: One or more of the following: subject drank alcoholic beverages ≥ 3 times per week in past month; ≥3 drinks per occasion; ≥5 drinks on one occasion in past month; ≥3 drinks and then drove a car on at least one occasion in past 12 months Increased fall risk: fell in past year or ≥ 75 years old High-risk prescription drug use: cardiovascular, psychotropic, or narcotic medications Impaired vision: With glasses, subject unable to read newsprint or recognize a friend across the street; or vision problems were not correctable, and subject had difficulty doing such things as reading, seeing the numbers on the telephone, or telling whether the stove was on or off Impaired hearing: With or without a hearing aid, subject could not usually hear and understand what a person was saying without seeing the person's face if th **Proportion:** Reported for each definition by treatment group **Instrument:** Questionnaires

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Van Haastregt 2000[71] Fair	**Category:** Clinical Assessment **Description** **IG:** Participants were screened during home visits for several medical, environmental, and behavioural factors potentially influencing falls and mobility. The screening was followed by advice, referrals, and other actions aimed at dealing with the hazards observed. The nurses followed a structured protocol for the home visits, which focused on falls, fear of falling, mobility, physical health, drugs, activities of daily living, social functioning, cognitive functioning, and psycho-social functioning. The protocol also included a check-list for home safety **CG:** Participants in the usual care group did not receive any special attention or intervention on prevention of falls and impairments in mobility **Format (single or combo, individual or group, where)** **IG:** Combination, individual, home-based **CG:** NA **Intensity (frequency and duration)** **IG:** Five home visits over a period of one year **CG:** NA **Delivery** **IG:** A community nurse conducted home visits **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** Self-reported in a weekly diary any injurious fall and any fall resulting in medical care, collected in self-administered questionnaire at 12 and 18 months **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 18 months	**Definition of fall:** NR **Rate or risk of falls/fallers:** The number of individuals sustaining any fall, more than one fall self-reported in a weekly diary, collected in self-administered questionnaires at 12 and 18 months **Length of followup:** 18 months
Wagner 1994[78] Fair	**Category:** Multi-factor risk assessment and clinical management **Description** **IG:** Visit to review disability and fall risk factors and develop tailored intervention plan. Intervention options were exercise, alcohol treatment program, home safety inspections, medication review and written recommendation to primary care team, support and encouragement for hearing and vision. Also, followup phone calls. **CG:** Usual care (not defined) **Format (single or combo, individual or group, where)** **IG:** Combo, individual and group, locations NR **CG:** N/A **Intensity (frequency and duration)** **IG:** Visit once for 60-90 minutes, exercise 1 2-hour class, alcohol program NR, med review did not include ppt, hearing and vision impairment support various **CG:** NA **Delivery** **IG:** Nurse/educator at visit, exercise NR, alcohol program NR, med review by pharmacist, hearing and vision impairment NR **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** Self-report of "injurious" fall by mailed questionnaire at baseline, 1 year and 2 years and from computerized hospital discharge files **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** Medical Outcomes Study physical limitations scale at baseline, 1 year and 2 years **IADLs:** NR **Length of followup:** 2 years	**Definition of fall:** Falling to the ground in the past year **Rate or risk of falls/fallers:** Self-report by mailed questionnaire at baseline, 1 year and 2 years and from computerized hospital discharge files **Length of followup:** 2 years

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Van Haastregt 2000[71] Fair	**Falls Efficacy Scale:** Self-administered questionnaire at 12 and 18 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Perceived health (first item RAND-36), Frenchay activities index (daily activity), mental health of RAND-36, adjusted social activities battery (social functioning), loneliness (6-point Likert scale) **Length of followup:** 18 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA
Wagner 1994[78] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: IG: 2.6% IG (visit only): 4.1% CG: 3.7% p=NS **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Van Haastregt 2000[71] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers:** IG CG 12 months 63 (50) 53 (44) 18 months 68 (57) 58 (52) **# (%) frequent fallers (2+ falls):** IG CG 12 months 34 (27) 29 (24) 18 months 43 (36) 35 (31) **Among high risk:** All are high risk
Wagner 1994[78] Fair	**ADLs:** *Medical Outcomes Study physical function score (%)* IG CG *Change from BL to Year 1* Sustained High Function 27 24 Sustained Ltd Function 48 45 Improved 10 11 Worsened 15 20* *Change from BL to Year 2* Sustained High Function 25 24 Sustained Ltd Function 47 44 Improved 11 11 Worsened 17 21 **p≤0.01 for difference with IG* **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** NR **# (%) fallers (calc):** IG CG Year 1 175 (27.5) 223 (36.8)* Year 2 199 (31.4) 177 (29.2) **p<0.01 for difference with IG* **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR

Appendix C Table 1. Effectiveness of Multifactorial Assessment and Management Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Van Haastregt 2000[71] Fair	**Falls Efficacy Scale:** *Mean (SD)* IG / CG / Adjusted difference (95% CI) Baseline 18.5 (7.7) 17.5 (7.0) NR 12 months 16.5 (6.1) 17.9 (7.9) -2.5 (-4.0- -1.0) 18 months 16.1 (5.7) 17.6 (7.3) -1.9 (-3.3- -0.5) **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** Netherlands, either fall history or mobility limitations
Wagner 1994[78] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Well-educated health maintenance organization enrollees

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Birks 2004[85] Fair	**Location:** UK **Target population:** women aged ≥70 with 1+ risk factors for hip fracture **Recruitment strategy:** All women registered on general practitioner registers were mailed study details and a hip fracture risk questionnaire; also recruited through the media - these contacted local trial coordinators. Recruited 9/99-11/00	**Inclusion:** Aged ≥70 with 1+ risk factors for hip fracture (low body weight, smoker, prior fracture, family history of hip fracture). Ambulant, majority community dwelling **Exclusion:** Bilateral hip replacements	**Assessed for eligibility:** Mailed via GPS - 70,109; volunteers 592; assesed 18,947 for eligibility **Excluded:** 14,778 **Not meeting inclusion criteria:** 1724 **For other reasons:** refused to participate 13,645 **Randomized:** 4169 **IG:** 1388 **CG:** 2781 **Age: mean (SD)** IG: 77.9 (5.7) CG: 77.8 (5.5) **Female:** 100% **Ethnicity: NR** **SES: NR** **Fall History:** IG: 43% CG: 43%	**Risk category:** Other - risk of hip fracture (A599) **Definition:** 1+ risk factors for hip fracture (low body weight, smoker, prior fracture, family history of hip fracture) **Proportion:**100% **Instrument:** Self report questionnaire

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Birks 2004[85] Fair	**Category:** Clinical Management - hip protectors **Description** **IG:** 3 pairs hip protectors (shell type) with instructions mailed to participants plus leaflet on fracture risk reduction methods **CG:** Leaflet only **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Mailed protectors and leaflet once; Instructions on usage NR **CG:** Mailed leaflet once **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** Every 6 months mailed questionnaire to all subjects asking about fractures in last 6 months; self-reported fractures were confirmed with clinicians; for those not returning questionnaires, general practitioners contacted to determine hip fracture events **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** Minimum 24 months (max 42, median 28)	**Definition of fall:** NR **Rate or risk of falls/fallers:** every 6 months mailed questionnaire to all subjects asking about falls **Length of followup:** Minimum 24 months (max 42, median 28)

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Birks 2004[85] Fair	**Falls Efficacy Scale:** fear of falling assessed in a 6 point scale **Tinetti Gait & Balance (modified POMA)**: NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** Minimum 24 months (max 42, median 28)	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** *Hip fracture* IG: 39/1388 (2.8%) CG: 66/2781 (2.4%) OR (95%CI): 1.19 (0.80-1.78) p=0.40 *Total fractures (calc)* IG: 135/1388 (9.7%) CG: 310/2781 (11.1%) **# people sustaining multiple events:** *Hip fracture (calc) :* IG: 0/1388 (0%) CG: 3/2781 (0.1%) **Mortality:** IG - 117/1388 (8%) CG - 247/2781 (9%) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk: among those who had falled in year prior to randomization:** *Hip fractures* IG 15/599 (2.5%) CG 33/1196 (2.8%) OR 0.85 (0.63-2.17) p=0.85

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Birks 2004[85] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers:** IG: 12 months 261 (27.7%); 24 months 111 (24.1%) CG: 12 months 726 (37.5%); 24 months 304 (30.5%) p: 12 months <0.001; 24 months <0.01 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Birks 2004[85] Fair	**Falls Efficacy Scale:** IG / CG / p 12 months 1.68 (1.43) / 1.85 (1.46) / 0.003 18 months 1.75 (1.45) / 1.85 (1.42) / 0.07 24 months 1.80 (1.44) / 1.93 (1.47) / 0.04 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** OK - only a small % of those recuited were assessed, randomized; all women with a risk factor. "Mainly community-dwelling" Low adherence could have contributed to apparent lack of effectiveness of hip protectors *Pelvic fractures* IG: 5/1388 (0.4%) CG: 15/2781 (0.5%) p=0.58 *Vertebral fractures* IG: 12/1388 (0.9%) CG: 23/2781 (0.8%) p=0.96 *Other non-hip fractures* IG: 84/1388 (6.1%) CG: 221/2781 (7.9%) OR (95% CI): 0.75 (0.57-0.97) p=0.03

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] Fair	**Location:** Boston **Target population:** ambulatory men and women 65 years or older and living in the community **Recruitment strategy:** Direct mailings and presentations in the community. Prescreened by questionnaire and those who passed were invited for a screening	**Inclusion:** Ambulatory men and women 65 years or older and living in the community **Exclusion:** Receiving therapy consisting of bisphosphonate, calcitonin, estrogen, tamoxifen citrate, or testosterone in the past 6 months or fluoride in the past 2 years; history of renal disease or renal stone in the past 5 years; current cancer, hyperparathyroidism, dietary calcium intake exceeding 1500 mg/d, or laboratory evidence of kidney or liver disease, bilateral hip surgery, femoral-neck bone ineral density more than 2 SD below the mean for subjects of the same age and sex	**Assessed for eligibility:** 848 prescreened; of whom 545 were invited for screening **Excluded:** 100 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 445 **IG:** 219 **CG:** 226 **Age: mean (SD)** IG: women 71 (5), men 70 (4) CG: women 71 (5), men 71 (5) **Female (calc):** IG: 55.3% CG: 55.3% **Ethnicity:** White: 96.6% Black: 2.5% Asian: 0.09% **SES:** NR **Fall History:** NR	**Risk category:** Other - female sex, less physically active and lower 25-hydroxyvitamin D levels (A599) **Definition:** Female sex Less physically active (activity below median) Low 25-hydroxyvitamin D levels = those below 32 ng/mL (80 nmol/L). **Proportion (calc):** Female: 55.3% Women less physically active: 107/246 (43.5%) Men less physically active: 80/199 (40.2%) 25-OHD <32 ng/mL: NR **Instrument:** Physical Activity Scale for the Elderly, blood plasma measurement of 25-OHD levels by a competitive protein binding assay

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] Fair	**Category:** Clinical management: vitamin D **Description** **IG:** 700 IU of vit D plus 500 mg of calcium citrate malate **CG:** Placebo **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Tablets taken once daily for 3 years **CG:** Tablets taken once daily for 3 years **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 3 years	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level. Low-trauma falls defined as occurring from a standing or sitting position; while standing, sitting, walking; and while walking / turning on ground level. **Rate or risk of falls/fallers:** Participants were asked to send a postcard after every fall, which was followed up by a phone call from research staff for details. Falls also ascertained at followup visits every 6 months for 3 years **Length of followup:** 3 years

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** 4/445 died **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** Total # of falls similar between groups for women (IG 164 falls/ 121 women; CG 142 falls / 125 women) for men (IG 110 falls /98 men; CG 110 falls / 101 men). **# (%) fallers:** 134/246 (55%) of women, 97/199 (45%) of men reported at least 1 fall. 231/445: at least 1 fall. IG: 107/219 (49% (c)) CG: 124/226 (55% (c)) **# (%) frequent fallers (2+ falls):** Most women who had > 4 falls were in IG. fell frequently: equally distributed in the active women (2 women in IG, 2 in CG), whereas of the 6 inactive women who had > 4 falls, 5 were in IG **Among high risk:** Reduced the odds of falling in ambulatory older women by 46%, and especially in less active women by 65%. Among women, 69 (50%) of the less active and 65 (61%) of the more active individuals fell. Among men, 36 (46%) of the less active and 60 (50%) of the more active individuals fell. Vit D / calcium reduced the odds of falling in women (OR, 0.54; 0.30-0.97), but not in men (OR, 0.93; 0.50-1.72). Fall reduction due to vitamin D was most pronounced in less active women (OR, 0.35; 0.15-0.81).

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Bischoff-Ferrari 2006[111] Dawson-Hughes 1997[163] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** nR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Hard to determine: why were 1/5 excluded

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Cameron 2003[66] Fair	**Location:** New South Wales, Australia **Target population:** ≥ 74; 2+ falls, or 1 fall requiring hospital admission in previous year; lived at home; female **Recruitment strategy:** May 1996 - February 1999; recruited from home or hospital - 17% from hospital Final follow up interviews completed in 2/01	**Inclusion:** Aged ≥74 years; 2+ falls, or 1 fall requiring hospital admission in previous year; lived at home; female; in contact with aged care health services; at least 1 hip without prior surgery; ability to speak English; sufficient cognitive function to give informed consent; likely to continue to live at home for three months, and to survive for at least 1 year **Exclusion:** NR	**Assessed for eligibility:** 1807 **Excluded:** 1207 **Not meeting inclusion criteria:** 592 **For other reasons:** refused = 615 **Randomized:** 600 **IG:** 302 **CG:** 298 **Age: mean (SD) = 83** IG: 83.2 (5.1) CG: 83.0 (4.9) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** IG CG 1 96 (32%) 98 (33) 2 84 (28) 106 (36) >2 122 (40) 94 (32)	**Risk category:** A599 (other): recent falls **Definition:** 2+ falls, or 1 fall requiring hospital admission in previous year **Proportion:** 100% **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Cameron 2003[66] Fair	**Category:** Clinical management: hip protectors **Description** **IG:** Use of hip protectors and contact with the "adherence" nurse; allocated to wear hip protectors, encouraged to wear them for 2 years (or until a hip fracture occurred); asked to wear the hip protectors at all times when out of bed during the day, and at night if needing to go to the toilet more than once. 2 adherence nurses supplied and fit the protectors, encouraged adherence. IG provided with 4 pairs of hip protectors (semirigid shields sewn into modified underwear), and replacement protectors provided **CG:** NR **Format (single or combo, individual or group, where)** **IG:** Single, individual, at home **CG:** NR **Intensity (frequency and duration)** **IG:** 3 nurse visits, followed by 2 telephone contacts, for routine contact with participants. If not adhering, additional telephone contacts or visits arranged **CG:** NA **Delivery** **IG:** Nurse **CG:** NA	**Fall-related fracture:** Incidence of hip fracture: ascertainment based initially on self report with follow up of radiography reports, hospital records. Timing NR **List of additional injury measures:** incidence of other injuries **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 24 months	**Definition of fall:** NR **Rate or risk of falls/fallers:** Based on self report at four monthly telephone interviews **Length of followup:** 24 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Cameron 2003[66] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Adherence with use of hip protectors Adverse effects of hip protectors **Length of followup:** 24 months	**Fall-related injury** Risk of hip fracture when falling while wearing hip protectors, compared with a fall with no hip protectors, significantly reduced: RR = 0.23 (0.08 - 0.67) No significant diffs in falls causing injury requiring hospital care. **Fracture rate per person year:** NR **# fractures:** Fracture site IG CG 302 298 *Lower limb* Hip 21 22 adjusted RR 0.92 (0.51 -1.68) Pelvis 8 6 Other 3 6 *Upper limb* Wrist 12 6 Hmrs/shoulder 5 5 Other 3 4 **# people sustaining fractures:** IG: 31 peripheral, non-hip fractures in 25 people; hip fractures 21 CG: 27 peripheral non-hip fractures in 25 people; hip fractures 22 **# people sustaining multiple events:** NR **Mortality** 13% died (33/302 in IG, 46/298 in CG, p=0.10) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Cameron 2003[66] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** N/A	**# falls/# in group:** IG: 798/302 (mean 2.70 per person) CG: 639/298 (mean 2.20) **# (%) fallers:** NR **# (%) frequent fallers (2+ falls) (calc):** no difference between groups: IG: 139 (46) CG: 131 (44) **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Cameron 2003[66] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** 3 users of hip protectors sustained a hip fracture while wearing properly applied protectors. 16 hip protector users (5%) developed minor local complications (minor skin irritation or infection, judged by the nurses as being caused by the hip protectors) 5 falls that occurred while wearing hip protectors were reported as causing significant bruising to the upper thigh. **External validity:** Limited to women with previous falls No significant differences in the total # falls, multiple falls

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 5*	**Location:** Dunedin, New Zealand **Target population:** Aged 65 years and older and currently taking psychotropic medication **Recruitment strategy:** Identified through computerized registers of 17 general practice groups and invited by their general practitioner	**Inclusion:** Aged 65 years and older, currently taking psychotropic medication, and able to move around their own home; not receiving physiotherapy **Exclusion:** Low score on mental status questionnaire	**Assessed for eligibility:** 547 **Excluded:** 454 **Not meeting inclusion criteria:** 54 **For other reasons:** 400 **Randomized:** 93 **Medication Withdrawal + Exercise Program** (**MW + EP**)**:** 24 **Medication Withdrawal** (**MW**)**:** 24 **Original Medication + Exercise Program (OM + EP):** 21 **CG:** 24 **Age: mean (SD)** MW + EP: 75.6 (7.3) MW: 74.6 (5.5) OM + EP: 73.1 (6.3) CG: 75.2 (5.6) **Female:** MW + EP: 79% MW: 75% OM + EP: 71% CG: 79% **Ethnicity:** NR **SES:** NR **Fall History:** MW + EP: 54% MW: 46% OM + EP: 10% CG: 33%	**Risk category:** Medication specific - psychotropics (A600) **Definition:** Currently taking psychotropic medication **Proportion:** 100% **Instrument:** Computerized registers of general practices

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 5*	**Category:** Clinical Management - Pharmacological Intervention **Description** **MW + EP:** Ingredients in medication reformulated into study capsules and the active ingredient was reduced; muscle strengthening and balance training and with a walking plan **MW:** Ingredients in medication reformulated into study capsules and the active ingredient was reduced **OM + EP:** Ingredients in medication were reformulated into study capsules; muscle strengthening and balance training and a walking plan **CG:** Ingredients in medication were reformulated into study capsules **Format (single or combo, individual or group, where)** **MW + EP:** Combination, individual, in-home **MW:** Single, individual, in-home **OM + EP:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **MW + EP:** Active ingredient in medication reduced over 14 weeks as follows: 80% of original dose after 2 weeks, 60% after 5 weeks, 40% after 8 weeks, and 20% after 11 weeks. Exercise program had 4 home visits over the first 2 months and phone calls. Exercises 3 times and 2 times per week **MW:** Active ingredient in medication reduced over 14 weeks as above **OM + EP:** 4 home visits over the first 2 months and then phone calls **CG:** NR **Delivery** **MW + EP:** NR for meds, physiotherapist for exercise program **MW:** NR for meds **OM + EP:** NR for meds, physiotherapist for exercise program **CG:** NR for meds	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Monthly self-report calendars by mail, follow-up call to record circumstances of the falls **Length of followup:** 44 weeks

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 5*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 5*	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**Fall rate per person year:** Medication Withdrawal MW+EP & MW: 0.52 OM+EP & CG: 1.16 Difference: 0.64 (-0.07, 1.35) Exercise Program MW+EP & OM+EP: 0.71 MW & CG: 0.97 Difference 0.26 (-0.45, 0.97) CG: NR **# falls/# in group:** Medication Withdrawal WM+EP & MW: 17/48 OM+EP & CG: 40/45 Exercise Program MW+EP & OM+EP: 22/45 MW & CG: 35/48 CG: 29/22 **# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 5*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Very small N, huge loss to followup

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Cumming 2007[90] Fair	**Location:** Sydney, Australia **Target population:** ≥70; frail [frail not defined] **Recruitment strategy:** recruited mainly from people attending outpatient aged care services of the Central Sydney Area Health Service; 8/02-7/04. Ads asking for study volunteers were also placed at appropriate local sites	**Inclusion:** Aged ≥70, living independently in the community, no cataract surgery or new eyeglass prescription in previous 3 months. Subjects with cognitive impairment not excluded, but had to have a caregiver who could complete the monthly falls calendar **Exclusion:** Not explicity listed but see inclusion	**Assessed for eligibility:** NR **Excluded:** NR **Randomized:** 616 **IG:** 309 **CG:** 307 **Age: mean (SD)** IG: 80.9 (6.3) CG: 80.3 (5.7) **Female:** IG: 67% CG: 68% **Ethnicity: NR** **SES:** *post HS degree* IG: 26% CG: 32% **Fall History:** *Falls in previous year* IG CG 0 143 (46.3%) 139 (45.3%) 1 72 (23.3) 84 (27.4) 2 41 (13.3) 28 (9.1) 3 53 (17.2) 56 (18.2)	**Risk category:** Other - frail **Definition:** NR **Proportion:** 100% **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Cumming 2007[90] Fair	**Category:** Clinical management (vision correction) **Description** **IG:** Comprehensive vision / eye examinations by a study optometrists, with subsequent treatment of vision problems 135 (44% of 309 IG) received some form of vision-related intervention New glasses 92 (29.8) Referred to ophthalmologist for: Glaucoma 17 (5.5) Cataract surgery 15 (4.9) Age-related maculopathy 5 (1.6) Other 3 (1.0) Referred to occupational therapist 24 (7.7) Refused glasses or referral 11 (3.6) **CG:** usual care (not described) **Format (single or combo, individual or group, where)** **IG:** Single; subjects encouraged to come to the study clinic at Concord Hospital or to the optometrist's own practice, but had the option of a home visit from the study optometrist. **CG:** NA **Intensity (frequency and duration)** **IG:** One examination; took approximately 30 minutes **CG:** NA **Delivery** **IG:** Optometrist; 90% of subjects were examined w/in 34 days of randomization **CG:** NA	**Fall-related injury:** If a fall was self-reported on monthly postcard, the subject completed an additional postcard about fall-related injuries (including fractures). If a postcard was not returned within 2 weeks of the end of the month, it was completed via a telephone interview. **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol :**NR **Mortality:** IG 16/309 died (5%) CG 19/307 died (6%) **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** An event that resulted in a person coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Falls during 12 months of follow-up were ascertained according to self-report using a monthly postcard system. Ascertainment of falls involved a self-report falls calendar; the calendar consisted of a preaddressed, stamped tear-off postcard for each month. Subjects asked to record each day an ''N'' if they did not fall, an ''F'' if they had a fall. If a postcard was not returned within 2 weeks of the end of the month, it was completed via a telephone interview **Length of followup:** 1 year

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Cumming 2007[90] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go**: NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Visual acuity (logMAR chart) **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# (%) fractures:** NR **# people sustaining fractures:** IG: 31 (10.0%) CG:18 (5.7%) OR (95%CI): 1.74 (0.97–3.11) **# people sustaining multiple events:** NR **Mortality:** **IG:** 16 **CG:** 19 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Cumming 2007[90] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 758/309 CG: 516/307 **# (%) fallers** IG: 201 (65.0%) CG: 153 (49.8%) **frequent fallers (2+ falls):** IG: 117 (37.9%) CG: 153 (30.6%) **Among high risk:** Subgroup analysis of those with history of falls in past year: effect similar in those without history previous falls (rate ratio from negative binomial model 2.11, (1.44–3.08) and in those with history falls (rate ratio 1.52 (1.09–2.10))

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Cumming 2007[90] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** Increased fall and fracture risk in the IG **External validity:**

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Day 2002[61] Fair *Study also located in Appendix C Tables 4 & 5*	**Location:** Melbourne, Australia **Target population:** Aged 70 years and older **Recruitment strategy:** Mailed invitation letters and made followup calls to people aged 70 years and older registered on the Autralian electoral role for the area, local publicity, and recruitment by general practitioners	**Inclusion:** Living in their own home or leasing similar accomodation and allowed to make modifications **Exclusion:** Not expecting to live in area for 2 years; regular to moderate physical activity with a balance improvement component in the previous 2 months; could not walk 10-20 meters without rest, help, or having angina; severe respiratory or cardiac disease; psychiatric illness prohibiting participation; dysphasia; recent major home modifications; education and language adjusted score >4 on the short portable mental status questionnaire; no physician approval	**Mailed invitations:** 11,120 **Assessed for eligibility:** 1,967 **Excluded:** 860 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 1,107 **Continued:** 1,090 **IG (exercise(ex)):** 135 **IG (home hazard(hh)):** 136 **IG (vision(v)):** 139 **IG (ex+hh):** 135 **IG (ex+v):** 136 **IG (v+hh):** 137 **IG (all):** 135 **CG:** 137 **Age: mean (SD)** All: 76.1 (5.0) Range across Gs: 75.4-76.5 (4.7-5.5) **Female:** All: 59.8% Range across Groups: 55.4-68.4% **Ethnicity:** NR **SES:** NR **Fall History:** NR for past year, reported for last month	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Day 2002[61] Fair *Study also located in Appendix C Tables 4 & 5*	**Category:** Multiple interventions - exercise, home hazard modification, vision, and combinations of those **Description** **IG (ex):** Exercise class and home exercises designed to improve flexibility, leg strength, and balance **IG (hh):** Home hazards were removed or modified **IG (v):** If vision tested below predetermined criteria, referred to usual eye care provider to whom vision assessment results were given; those who did not receive the intervention got the Australian Optometrist Association's brochure on eye care for those aged over 40 **CG:** Waitlist control **Format (single or combo, individual or group, where)** **IG (ex):** Single or combo with hh and/or v, group class supplemented by home exercises, class location NR **IG (hh):** Single or combo with ex and/or v, individual, in-home **IG (v):** Single or combo with ex and/or hh, individual, at usual provider's location **CG:** NA **Intensity (frequency and duration)** **IG (ex):** 1 hr a week, 15 weeks **IG (hh):** 1 visit by city home maintenance worker **IG (v):** 1 assessment and referral if tested below criteria **CG:** NA **Delivery** **IG (ex):** Instructor NR **IG (hh):** City maintenance staff **IG (v):** Trained assessor **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** At baseline only **Length of followup:** NA	**Definition of fall:** NR **Rate or risk of falls/fallers:** Self-report montly postcard, phoned if not returned by 5 days after the end of the month, phoned if reported a fall **Length of followup:** 18 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Day 2002[61] Fair *Study also located in Appendix C Tables 4 & 5*	**Falls Efficacy Scale:** At baseline only **Tinetti Gait & Balance (modified POMA): NR** **Timed Up & Go:** At baseline and 18 months, only measured random sample of 442 at 18 months for cost purposes **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Spring gauge to measure quadricep strength, postural sway, maximal balance range, coordinated stability, visual acuity, random dot stereo butterfly test, crossed disparity circles, field of view **Length of followup:** 18 months	**Fall-related injury** **Fracture rate per person year:** NR # **fractures:** NR # **people sustaining fractures:** NR # **people sustaining multiple events:** NR **Mortality**: 15 (NR which groups) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Day 2002[61] Fair *Study also located in Appendix C Tables 4 & 5*	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** NR **# (%) fallers:** **Rate ratio** IG (ex): 76/135 (56.3%) 0.82 (0.70, 0.97) IG (v): 84/139 (60.4%) 0.89 (0.75, 1.04) IG (hh): 78/136 (57.4%) 0.92 (0.78, 1.08) IG (ex+v): 66/136 (48.5%) 0.73 (0.58, 0.91) IG (ex+hh): 72/135 (53.3%) 0.76 (0.60, 0.95) IG (v+hh): 78/137 (56.9%) 0.81 (0.65, 1.02) IG (all): 65/135 (48.1%) 0.67 (0.51, 0.88) CG: 87/137 (63.5%) Ref 1.00 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Day 2002[61] Fair *Study also located in Appendix C Tables 4 & 5*	**Falls Efficacy Scale:** NR beyond baseline **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Australians

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Dhesi 2004[102] Fair	**Location:** UK **Target population:** Aged ≥65 falls clinic population **Recruitment strategy:** All patients at a falls clinic between 5/99-5/01 were screened	**Inclusion:** ambulatory subjects aged ≥65 with a history of falls and 25-hydroxyvitamin D (25OHD) ≤12µg/l. (vit D insufficiency). live in their own homes, ≥1 fall in preceding 8 weeks. **Exclusion:** Over the counter or prescribed vitamin D or calcium supplements; history of chronic renal failure, alcohol abuse, or conditions likely to impair postural stability (cerebellar disease, vestibular disease); on meds likely to interfere with postural stability or vitamin D metabolism; abbreviated mental test score of ≤7/10	**Assessed for eligibility:** 543 **Excluded:** 404 **Not meeting inclusion criteria:** 400 **For other reasons:** 4 **Randomized:** 139 **IG:** 70 **CG:** 69 **Age: mean (SD)** IG: 77.0 (6.3) CG: 76.6 (6.1) **Female (calc):** IG: 53/70 (76%) CG: 55/69 (80%) **Ethnicity (calc):** CG IG Caucasian 77% 87% Afro-Caribbean 13% 9% Middle Eastern 10% 3% **SES:** NR **Fall History:** 100%	**Risk category:** Other - at least one fall in the preceding 8 weeks (A599) **Definition:** at least one fall in the preceding 8 weeks: inadvertently coming to rest on the ground or other lower level other than as a consequence of onset of paralysis, epileptic seizure, excess alcohol or overwhelming external force **Proportion:** 100% **Instrument:** Screened at a falls clinic

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Dhesi 2004[102] Fair	**Category:** Clinical management; vitamin D supplementation **Description** **IG:** Intramuscular injection of ergocalciferol **CG:** Placebo injection **Format (single or combo, individual or group, where)** **IG:** Single, individual, at falls clinic **CG:** Single, individual, at falls clinic **Intensity (frequency and duration)** **IG:** 1 time shot of 600,000 i.u. **CG:** 1 time shot of 2 ml (equivalent volume to IG) **Delivery** **IG:** Senior nurse **CG:** Senior nurse	**Fall-related fracture: NR** **QOL** **SF-12:** NR **SF-36:** Taken at baseline and 6 months **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 6 months post-intervention	**Definition of fall:** Inadvertently coming to rest on the ground or other lowe level with or without loss of conciousness and other than as a consequence of sudden onset of paralysis, epileptic seizure, excess alcohol intake, or overwhelming external force **Rate or risk of falls/fallers:** number of falls or fallers; pts given a falls diary to record any falls over the trial period (6 months). The diary was reviewed with the patient by the first author at the follow-up assessment. **Length of followup:** 6 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Dhesi 2004[102] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** timed 50 ft walk, timed rise from a chair and walking 50 ft, timed ascent and descent of 13 steps, four-choice reaction time (CRT), postural stability, quadricep strength, and lab analysis **Length of followup:** 6 months	**Fall-related fracture** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** NR **QOL** **SF-12:** NR **SF-36 mean scores (SD):** Baseline / 6 months / P *Physical functioning* CG: 49.6 (28.7) 51.0 (27.8) 0.47 IG: 56.7 (31.0) 54.7 (29.3) 0.36 *Role – physical* CG: 44.2 (40.2) 56.2 (42.4) 0.05 IG: 56.2 (42.2) 61.6 (41.8) 0.31 *Bodily pain* CG: 62.3 (26.8) 67.4 (25.7) 0.15 IG: 61.7 (28.0) 62.8 (23.9) 0.74 *General health* CG: 61.0 (10.9) 60.2 (11.0) 0.68 IG: 60.0 (13.3) 60.7 (10.6) 0.63 *Vitality* CG: 48.6 (21.9) 47.0 (19.4) 0.41 IG: 46.5 (23.5) 47.5 (19.3) 0.67 *Social functioning* CG: 66.3 (28.3) 76.8 (27.6) 0.03 IG: 68.8 (26.8) 75.0 (26.3) 0.10 *Role – emotional* CG: 78.6 (36.8) 89.3 (25.5) 0.04 IG: 86.6 (28.9) 89.9 (33.0) 0.59 *Mental health* CG: 69.3 (24.4) 71.1 (19.9) 0.24 IG: 71.1 (21.4) 73.6 (14.5) 0.28 **EuroQol:** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Dhesi 2004[102] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 15/70 CG: 24/69 **# (%) fallers (calc):** IG: 11 (15.7%) CG: 14 (20.3%) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Dhesi 2004[102] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** limited to recent fallers with vitamin D insufficiency; study not powered to detect differences in falls No significant difference of mean number of falls and fallers between groups

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Dukas 2004[92] Fair	**Location:** Basel, Switzerland **Target population:** Basel Study participants aged ≥70 years **Recruitment strategy:** participants of this study came mainly from the Basel Study, a cohort study running since 1959. During summer 2000, all Basel Study participants aged ≥70 received a written description of the study by mail and were invited to participate; to attain adequate n, recruited by means of a newspaper advertisement and follow-up telephone interview	**Inclusion:** Basel Study participants aged ≥70 years; mobile, and have an independent life style **Exclusion:** hyperparathyroidism, polyarthritis or inability to walk, calcium intake by supplement >500 mg/d, vitamin D intake >200 IU/d, active kidney stone disease, history of hypercalcuria or cancer or other incurable diseases, dementia, elective surgery in the next 3 months, severe renal insufficiency, fracture or stroke within last 3 months	**Assessed for eligibility:** 410 invited from Basel study; 192 men, 82 women agreed; then an additional 123 women and 7 men recruited through ads: total recruited = 380 **Excluded:** 13 women, 11 men **Not meeting inclusion criteria:** 24 **For other reasons:** 0 **Randomized:** 191 women, 187 men, total = 378 **IG:** 193 **CG:** 187 **Age: mean (SD)** IG: 75.0 (4.4) CG: 75.0 (4.1) **Female:** 51% (calc) **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** Other - low calcium intake (A599) **Definition:** <512 mg/d dietary calcium intake **Proportion:** IG: 96/192 (50.0%); CG: 90/186 (48.4%) **Instrument:** Nurses' Health Study Dietary Questionnaire

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Dukas 2004[92] Fair	**Category:** clinical management - alfacalcidol **Description** **IG:** Alfacalcidol **CG:** Placebo **Format (single or combo, individual or group, where)** **IG:** Single, individual, home **CG:** Single, individual, home **Intensity (frequency and duration)** **IG:** 1 mg daily for 36 weeks **CG:** Daily for 36 weeks **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Numbers of fallers and falls were assessed using a questionnaire during each study site visit at 4 and 12 weeks after randomization and every 12 weeks thereafter asked to keep a diary of fall incidence and to inform the study center by phone within 48 hours of a fall. If available, all case reports of fall incidents were collected from the house physician or hospitals **Length of followup:** 36 weeks

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Dukas 2004[92] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** calcium intake, intact parathyroid hormone serum levels; muscle strength, balance, blood pressure, and bone quality **Length of followup:** 36 weeks	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** 1 death in each group total n = 2 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Dukas 2004[92] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group (calc):** IG: 46/192 CG: 51/186 **# (%) fallers (calc):** IG: 40 (20.8) CG: 46 (24.7) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** # falls/# in group: *≥512 mg/d daily calcium intake* CG: 22/90 (24% (calc)) IG 28/96 (29% (calc)) *<512 mg/d daily calcium intake* CG: 29/96 (30% (calc)) IG 18/96 (19% (calc)) # (%) fallers: *≥12 mg/d daily calcium intake* CG: 20/90 (22% (calc)) IG 24/96 (25% (calc)) *<512 mg/d daily calcium intake* CG: 26/96 (27% (calc)) IG: 16/96 (17% (calc))

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Dukas 2004[92] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** 6 (1 in CG, 5 in IG) of slight transient hypercalcemia. 2 in IG developed elevated calcium levels w/o clinical symptoms; 1 had taken supplementary calcium (1,000 mg/d). incidence of hypercalcemia between groups not significant. No diff in cases of serious adverse events attributable to treatment. Frequency of reported side effects equally distributed between groups. Most common side effects: itching, skin eruption. **External validity:** limited to Basel Study participants, some community; Swiss IG associated with fewer fallers (OR=0.69, 0.41–1.16)

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Foss 2006[91] Fair	**Location:** Nottingham UK - not stated here explicitly but known from Harwood **Target population:** >70, following one successful cataract operation, who had a second operable cataract, referred to a hospital ophthalmology department **Recruitment strategy:** About half were recruited from another eye trial; between 2000-2004	**Inclusion:** >70, one previous successful catarac operation, one unoperated cataract **Exclusion:** women who had complex cataracts (Fuchs corneal dystrophy, active intraocular inflammation, lens zonule dehiscence or lens instability); those with visual field defects, severe co-morbid eye disease affecting visual acuity and those with memory problems preventing the completion of the lengthy questionnaires or reliable recall of falls	**Assessed for eligibility:** 1000 referred to consultants of which 313 invited to participate **Excluded:** 74 **Not meeting inclusion criteria:** 11 **For other reasons:** 63 declined **Randomized:** 239 **IG:** 120 **CG:** 119 **Age: mean (SD)** IG: 79.2 (70-90) CG: 79.9 (70-92) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** about half of all had fallen in last 12 months IG: 57 (48%) CG: 52 (45%)	**Risk category:** Eye disease, visual impairment (A503) **Definition:** one unoperated cataract **Proportion:** 100% **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Foss 2006[91] Fair	**Category:** Medical management - expedited cataract surgery **Description** **IG:** Expedited (approximately 4 weeks) cataract surgery: small-incision cataract surgery and implantation of a folding silicone intraocular lens under local anaesthetic **CG:** Routine wait (12 months) until cataract surgery **Format (single or combo, individual or group, where)** **IG:** Single, individual, clinic **CG:** Single, individual, clinic **Intensity (frequency and duration)** **IG:** One time **CG:** One time **Delivery** **IG:** NR, but presumably surgeons **CG:** NR, but presumably surgeons	**Fall-related fracture:** Self-report in daily diary, ppts were phoned at 3 and 9 months and interviewed at 6 and 12 months to record dates of fractures **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** Interviewed at baseline and 6 months **Mortality** NR **Disability** **ADLs:** Barthel index taken at baseline and 6 months via interview **IADLs:** NR **Length of followup:** 6 months for QOL and ADL, 12 months for fall-related fracture	**Definition of fall:** unintentionally coming to rest on the ground or at a lower level, with or without loss of consciousness **Rate or risk of falls/fallers:** Falls determined by diary: asked to record falls in a daily diary, and were telephoned at 3 and 9 months, and interviewed at 6 and 12 months, to record the dates of falls **Length of followup:** 1 year

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Foss 2006[91] Fair	**Falls Efficacy Scale:** Interviewed at baseline and 6 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** visual function (VF-14), and Hospital Anxiety and Depression Scale **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** IG: 5 fractures (two hip, one pelvis, one wrist and one other arm) CG: 3 fractures (one non-hip leg, one neck of humerus and one other arm). **# people sustaining fractures:** IG: 5/120 (4%) CG: 2/119 (2%) **# people sustaining multiple events:** IG:0 CG: 1 **Mortality** IG: 1/120 died CG:2/119 died **QOL** **SF-12:** **SF-36:** **EuroQOL:** means BL 6 mo difference (95% CI) IG 0.74 0.73 CG 0.72 0.69 0.02 (−0.03, 0.08) p=0.36 **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Foss 2006[91] Fair	**ADLs: Barthel Index** means BL 6 mo difference (95% CI) IG 18.7 18.7 CG 18.9 18.8 −0.1 (−0.2, 0.3) p= 0.61 **IADLs:** NR **Among high risk:** All are high risk	**Falls per 1000 patient days:** IG: 2.9 CG: 4.3 **# falls/# in group:** NR **# (%) fallers:** 89/239 reported 252 falls IG: 48 (40) CG: 41 (34) **# (%) frequent fallers (2+ falls):** IG: 22 (18%) CG: 22 (18%) **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Foss 2006[91] Fair	**Falls Efficacy Scale:** *Mean scores* IG CG Baseline 85.5 84.4 6 months 86.1 81.7 Difference (95% CI): 3.6 (0.9-6.2) *p=0.008* **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** iris damage, posterior capsular rupture, posterior capsular opacification noted at six months **External validity:** limited to women with one previously successful cataract operation Rate of falling reduced by 32% in IG, RR 0.68, 0.39-1.19 http://www.ageing.oxfordjournals.org

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Gallagher 2001[86] Fair	**Location:** Omaha **Target population:** Women aged 65-77 **Recruitment strategy:** Surveys were mailed to mailing lists of women in the geographical area	**Inclusion:** Women aged 65-77 years, femoral neck density within normal range for age **Exclusion:** Severe chronic illness, primary hyperparathyroidism or active renal stone disease, were on certain medications in the last 6 months	**Assessed for eligibility:** 1,905 **Excluded:** 1,416 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 489 **IG (Calcitriol):** 123 **IG (HRT/ERT):** 121 **IG (HRT/ERT + Calcitriol):** 122 **CG:** 123 **Mean age (SD):** 71 (4) IG (Calcitrol): 72 (3) IG (HRT/ERT): 72 (4) IG (HRT/ERT + Calcitrol): 71 (4) CG: 71 (4) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Gallagher 2001[86] Fair	**Category:** Clinical Management-Pharmacological Intervention (Vitamin D) **Description** **IG (Calcitriol):** Rocatrol plus dietary advice to keep calcium intake between 500-1000 mg/day **IG (HRT/ERT):** Conjugated estrogens (Premarin) and medroxyprgesterone acetate (Provera) plus dietary advice to keep calcium intake between 500-1000 mg/day **IG (HRT/ERT + Calcitriol):** Rocatrol, Premarin and Provera plus dietary advice to keep calcium intake between 500-1000 mg/day **CG:** Matching placebos plus dietary advice to keep calcium intake between 500-1000 mg/day *Note: hysterectomized women were not given the progestin (ERT)* **Format (single or combo, individual or group, where)** **IG:** Single, individual, at home **CG:** Single, individual, at home **Intensity (frequency and duration)** **IG (Calcitriol):** 0.25 µg Calcitrol twice daily for 3 years **IG (HRT/ERT):** 0.625 mg Premarin and 2.5 mg Provera once daily for 3 years **IG (HRT/ERT + Calcitriol):** 0.25 µg Calcitriol twice daily; 0.625 mg Premarin and 2.5 mg Provera once daily for 3 years **CG:** Matching placebos for 3 years **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related injury:** Interview-administered questionnaire on the incidence of fractures at each visit, 6-week, 3-, 6-, 12-, 18-, 24-, 30-, and 36-month visits **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 3 years	**Definition of fall:** NR **Rate or risk of falls/fallers:** Interview-administered questionnaire on the incidence of falls at each visit, 6-week, 3-, 6-, 12-, 18-, 24-, 30-, and 36-month visits **Length of followup:** 3 years

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Gallagher 2001[86] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG (Calcitriol): 4.9% IG (HRT/ERT): 11.9% IG (HRT/ERT + Calcitriol): 7.8% CG: 10.7% Relative Risk of each IG vs. CG was not different from 1.0 **# people sustaining multiple events:** NR **Mortality** 5 deaths unrelated to study medication - 4 from congestive heart failure (1 from each group) and 1 due to myocardial infarct **QOL** **SF-12:** NR **SF-36:** NR **EuroQOL:** NR **Among high risk:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Gallagher 2001[86] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**Fall rate per person year:** IG (Calcitriol): 0.27 IG (HRT/ERT): 0.39 IG (HRT/ERT + Calcitriol): 0.35 CG: 0.43 P=0.025 difference between groups P=0.0015 difference between IG (Calcitriol) and CG Differences between the other IGs and CG were NS **# falls/# in group:** **# (%) fallers:** IG (Calcitriol): 48% IG (HRT/ERT): 56% IG (HRT/ERT + Calcitriol): 56% CG: 63% **# (%) frequent fallers (2+ falls):** 254 fallers fell 440 times total across groups **Among high risk:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Gallagher 2001[86] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** Hypercalciuria (transient) IG (Calcitriol): 26% CG: 8% Hypercalcemia (transient) IG (Calcitriol): 12% CG: 6% Major adverse events (including incident gallbladder disease, cancers, CVA, cardiovascular events, gastrointestinal events, psychiatric events, kidney stones, deep vein thromboses, death) **External validity:** Women

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Gray-Donald 1995[88] Fair	**Location:** Quebec, Canada **Target population:** Frail elderly **Recruitment strategy:** Recruited from people receiving long-term home help services from 7 local community service centers	**Inclusion:** Age >60 years at nutritional risk defined as involuntary weight loss of > 5% body weight in last month, > 7.5% in 3 mo, or >10% in 6 mo, and body BMI < 27 or BMI < 24 **Exclusion:** Receiving palliative care, alcoholic, active cancer or illness requiring a therapeutic diet incompatible with supplementation	**Assessed for eligibility:** NR **Identified as potentially eligible:** 227 **Excluded:** 177 **Not meeting inclusion criteria:** 109 **For other reasons:** 68 **Randomized:** 50 **IG:** 25 **CG:** 25 **Age: mean (SD)** IG: 76 (7) CG: 79 (8) **Female:** IG: 74% CG: 67% **Ethnicity:** NR **SES:** > 50% have less than high school education **Fall History:** NR	**Risk category:** Other - nutritional risk (A599) **Definition:** Involuntary weight loss >5% of body weight in last month, >7.5% in the last 3 months or >10% in the last 6 months and BMI of <27; or BMI <24 **Proportion:** 100% **Instrument:** Medical records, height and weight at home visit using portable scale and measuring tape, self-report of weight changes

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Gray-Donald 1995[88] Fair	**Category:** Clinical Management - Pharmacological/Nutritional Intervention (liquid protein-energy supplement) **Description** **IG:** Choice of Ensure, Ensure Plus or Enrich liquid supplement plus home visits for data collection **CG:** Home visits providing encouragement and dietary suggestions **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** 235mL cans liquid supplement 2 times per day and home visits 1 time per week for 12 weeks **CG:** 1 time per week for 12 weeks **Delivery** **IG:** Liquid supplement self-administered, home visits by research dietician **CG:** NR	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** Fall and land on floor or ground **Rate or risk of falls/fallers:** Self-report while interviewed by research dietician at baseline, 6 weeks and 12 weeks **Length of followup:** 12 weeks

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Gray-Donald 1995[88] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Hand grip strength via adjustable-handle Jamar dynamometer, General Well-Being Schedule, self-perceived health using 1 question from the Quebec Health Survey, Harpenden skinfold caliper, and dietary intake **Length of followup:** 12 weeks	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: IG: 3 CG: 1 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Gray-Donald 1995[88] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers (calc):** IG: Baseline 6 (25), 12 weeks 0 (0) IG (≥7 cans/week): Baseline 5 (33), 12 weeks 0 (0) CG: Baseline 1 (4), 12 weeks 5 (21) *p=0.05* **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Gray-Donald 1995[88] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Underweight or recent involuntary weight loss Falls not measured as a primary outcome

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Harwood 2005[87] Good	**Location:** Nottingham, United Kingdom **Target population:** Women aged > 70 years with cataract referred to one of three consultant ophthalmologists (or to an optometrist led cataract clinic when this was established in 2001) **Recruitment strategy:** Recruited during a routine clinic visit	**Inclusion:** Age >70 years, suitable for surgery, no previous ocular surgery **Exclusion:** Cataract not suitable for surgery by phacoemulsification, severe refractive error in the second eye, visual field defects, severe co-morbid eye disease affecting visual acuity, registrable partially sighted as a result of cataract, memory problems preventing completion of questionnaires or recall of falls	**Assessed for eligibility:** 482 **Excluded:** 176 **Refused:** 111 **Did not meet inclusion criteria:** 65 **Randomized:** 306 **IG:** 154 **CG:** 152 **Median age (range)** IG: 78.8 (70-95) CG: 78.1 (70-90) **Female:** 100% **Ethnicity:** NR **SES:** NR **History of falls** IG CG Previous 12 months 51% 47% Previous 1 month 11% 11%	**Risk category:** Eye diseases, visual impairments (A503), Other (A599) history of falls **Definition:** Poor vision due to cataract; history of falls **Proportion:** 100% **Instrument:** NR

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Harwood 2005[87] Good	**Category:** Clinical management (vision correction) **Description** **IG:** Expedited surgery **CG:** Routine surgery, offered spectacles Both groups received small incision cataract surgery and implantation of a folding silicone intraocular lens under local anaesthetic (one patient had a general anaesthietic). All had refraction and assessment of their vision at four weeks **Format (single or combo, individual or group, where)** **IG:** Single intervention, individual **CG:** Single intervention (delayed), individual **Intensity (frequency and duration)** **IG:** Surgery within one month **CG:** Surgery within 13 months or the routine waiting time when this became less than 13 months **Delivery** Three surgical teams	**Fall-related fracture:** NR **List of additional injury measures: :** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** Baseline and six months **Mortality:** NR **Disability** **ADLs:** Barthal Index at baseline and six months **IADLs:** NR **Length of followup:** 6 months	**Definition of fall:** Unintentionally coming to rest on the ground or at a lower level, with or without loss of consciousness **Rate or risk of falls/fallers:** Self-report of falls using diary collected by phone at three and nine months and by interview at six and 12 months **Length of followup:** 12 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Harwood 2005[87] Good	**Falls Efficacy Scale:** Baseline and six months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Hospital Anxiety and Depression Scale (HADS), VF-14 (visual disability), London Handicap Scale (LHS, handicap) **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** IG: 4 CG: 12 **# people sustaining fractures:** IG: 4 CG: 12 RR (95%CI): 0.33 (0.1-1.0) *p=0.04* **# people sustaining multiple events:** NR **Mortality** IG: 3 CG: 1 Causes NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** *Euroqol (mean)* IG CG Baseline 0.70 0.70 6 months 0.73 0.67 Mean difference (95% CI): 0.06 (0.01-0.11) *p=0.02* **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Harwood 2005[87] Good	**ADLs:** *Barthal index (mean)* IG CG Baseline 6.7 7.1 6 months 7.2 6.5 Mean difference (95% CI): 0.1 (-0.2-0.3) *p=0.05* **IADLs:** NR **Among high risk:** All are high risk	**Falls per person days:** IG: 1.00/1000 CG: 1.52/1000 RR (95% CI): 0.66 (0.45-0.96) *p=0.03* **# falls/# in group:** NR **# (%) fallers:** IG: 76 (49) CG: 69 (45) HR (95% CI): 0.95 (0.69-1.35) *p=0.77* **# (%) frequent fallers (2+ falls):** IG: 28 (18) CG: 38 (25) HR (95% CI): 0.60 (0.36-0.98) *p=0.04* **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Harwood 2005[87] Good	**Falls Efficacy Scale:** *Mean scores* IG CG Baseline 82.3 85.0 6 months 83.2 80.3 Mean difference (95% CI): 5.4 (2.7-8.0) *p<0.0005* **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** Iris damage, posterior capsular rupture, posterior capsular opacification noted at six months **External validity:** Women only; 36% participants invited declined

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Pfeifer 2000[98] Fair	**Location:** Bad Pyrmont and Hameln, Germany **Target population:** women aged ≥ 70 years **Recruitment strategy:** through newspaper ads in the community; study ran March-May 1997	**Inclusion:** women aged ≥ 70 with 25-hydroxycholecalciferol < 50 nmol/liter **Exclusion:**hypercalcemia, primary HPT, fractures caused by osteoporosis; therapy with a bisphosph-onate, calcitonin, vitamin D and and vit D metabolites, estrogen, tamoxifen in last 6 months, flouride in last 2 years; known intolerance to study meds; chronic remnal failure; history of drug or alcohol abuse, >20 cigarettes per day, >7 cups daily coffee; scheduled holiday along the geographic latitude during the study; DM and other diseases; meds possibly interfering with balance; anticonvulsants	**Assessed for eligibility:** 208 prescreened; 165 (79%) invited to screen **Excluded:** 23 (calc) **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 148 **IG:** 74 **CG:** 74 **Age: mean (SD)** IG: 74.8 (0.5) CG: 74.7 (0.5) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** Other - Vitamin D deficient (A599) **Definition:** 25-hydroxycholecalciferol < 50 nmol/liter **Proportion:** 100% **Instrument:** Blood test - radioimmunoassay

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Pfeifer 2000[98] Fair	**Category:** Clinical management - vitamin D **Description** **IG:** Vitamin D and calcium supplement **CG:** Calcium supplement **Format (single or combo, individual or group, where)** **IG:** Single, individual, home **CG:** Single, individual, home **Intensity (frequency and duration)** **IG:** 1 tablet containing 400 IU vitamin D and 500 mg calcium twice daily, 8 weeks **CG:** 1 tablet containing 600 mg calciumdaily, 8 weeks **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** Collected via questionnaire (frequency NR) verified by X-ray, medical reports **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** falling onto floor or ground, or hitting an object like a chair or stair **Rate or risk of falls/fallers:** reported by questionnaire (frequency NR) **Length of followup:** 1 year

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Pfeifer 2000[98] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Intact parathyroid hormone, markers of bone turnover, body sway **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** IG 3 (4%) CG 6 (9%) *p=0.1367* **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Pfeifer 2000[98] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 17/70 CG: 30/67 *P=0.0346* **# (%) fallers:** IG: 11 (16%) CG: 19 (28%) *P=0.0373* **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Pfeifer 2000[98] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** limited to women with 25-hydroxycholecalciferol < 50 nmol/liter mean # falls per subject: CG: .45; IG: .24

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Pfeifer 2009[99] Fair	**Location:** Austria & Germany **Target population:** Community-dwelling seniors aged ≥70 years **Recruitment strategy:** Newspaper advertisements and mailing lists	**Inclusion:** Aged ≥70 years and 25-(OH)D serum level <78 nmol/l **Exclusion:**Hypercalcemia, primary hyperparathyroid-ism, fractures of the extremities due to osteoporosis, therapy with a thiazide, biphosphonate, calcitonin, vitamin D and vitamin D metabolites, estrogen, anti-estrogen in the past 6 months or fluoride treatment in the past 2 years. Known intolerance to study medication, chronic renal failure (serum creatinine above 20% of the upper limit of the reference range, history of drug or alcohol abuse, nicotine abuse (>20 cigarettes per day), >7 cups of coffee daily, scheduled holidays along the geographic longitude during the study period, diabetes mellitus, and severe cardiovascular disease	**Assessed for eligibility:** 315 **Excluded:** 73 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 242 **IG:** 121 **CG:** 121 **Age: mean (SD)** IG: 76 (4) CG: 77 (4) **Female (calc):** IG: 74% CG: 75% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** Vitamin D Deficient (A599-Other) **Definition:** 25-(OH)D serum level <78 nmol/l **Proportion:** 100% **Instrument:** Blood draw following 8-hour fast, measured by radioimmunoassay

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Pfeifer 2009[99] Fair	**Category:** Clinical Management - Vitamin D and calcium Supplementation **Description** **IG:** Calcium and cholecIciferol tablets **CG:** Calcium tablets **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** 1 tablet containing 500 mg calcium and 400 IU cholecalciferol twice daily for 12 months **CG:** 1 tablet containing 500 mg calcium twice daily for 12 months **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** Interviewed by phone every 2 months for 20 months. Fractures verified by x-rays and medical reports **List of additional injury measures:** Injurious falls **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 20 months	**Definition of fall:** Falling onto the floor or ground or hitting an object like a chair or stair **Rate or risk of falls/fallers:** Fall diaries turned in at 20 months, phone interviews every 2 months **Length of followup:** 20 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Pfeifer 2009[99] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline, 12 and 20 months **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Physical activities, body sway, maximum isometric leg extensor strength **Length of followup:** 20 months	**Fall-related injury**: **Fracture rate per person year:** NR **# fractures:** IG: 12 CG: 19 p=0.12 **# people sustaining fractures:** IG: 7/121 CG: 13/121 p=0.08 **# people sustaining multiple events:** NR **Mortality:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Pfeifer 2009[99] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Fall rate per person-years:** NR **# falls/# in group:** IG: 106/122 CG: 169/120 p<0.001 **# (%) fallers:** IG: 49 (40) CG: 75 (63) p<0.001 **# (%) frequent fallers (2+ falls) (calc):** IG: 29 (24) CG: 34 (28) **Among high risk:** All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Pfeifer 2009[99] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** *Mean (SD)* IG / CG / p Baseline 9.0 (5.9) 8.5 (3.9) 12 months 7.5 (3.4) 8.3 (5.1) <0.001 20 months 7.3 (3.4) 8.2 (4.8) <0.001 **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** Healthy, ambulatory adults aged 70+ years with vitamin D deficiency

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Porthouse 2005[67] Fair	**Location:** England **Target population:** Community-dwelling women aged 70 and over at risk for hip fracture **Recruitment strategy:** General practices across England mailed information about the study, a consent form, and a questionnaire on risk factors for fracture to all women aged 70 and over between September 2001 and November 2002	**Inclusion:** Women aged 70 and older who had at least one self-reported risk factor for hip fracture: low bodyweight (<58 kg), any previous fracture, maternal history of hip fracture, smoker and poor or fair health **Exclusion:** Receiving any calcium supplementation of more than 500 mg a day, history of kidney or bladder stones, renal failure, hypercalcaemia, cognitive impairment or life expectancy <6 months	**Assessed for eligibility:** 11,022 **Excluded:** Not eligible: 3,078 Refused: 4,490 **Randomized:** 3454 **Excluded post-randomization:** 140 **IG:** 1321 **CG:** 1993 **Mean age (SD):** IG: 77.0 (5.10) CG: 76.7 (5.02) **Female:** 100% **Ethnicity:** NR **SES:** NR **1+ fall in the previous 12 months** IG: 33.7% CG: 44.2%	**Risk category:** NA **Definition:** NA **Proportion:** NA **Instrument:** NA

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Porthouse 2005[67] Fair	**Category:** Clinical management (pharmacological/nutritional intervention - Vitamin D) **Description** **IG:** Visit with a nurse who gave them general lifestyle advice on how to reduce their risk of fracture and six months supply of calcium and vitamin D3. They also received a leaflet with general advice on prevention of falls and how to consume adequate calcium and vitamin D from dietary sources **CG:** Sent the leaflet **Format (single or combo, individual or group, where)** **IG:** Single intervention, individual, self-administered **CG:** NA **Intensity (frequency and duration)** **IG:** Two tablets of 1000 mg of calcium and 800 IU of vitamin D3 daily for six months, at which time they were offered a further supply if desired for up to 18 months **CG:** NA **Delivery** **IG:** Practice nurse gave advice, leaflet and supplements. Medication is self-administered **CG:** Leaflet sent	**Fall-related fracture:** Primary outcome was fracture, excluding digits, rib, face and skull. Hip fracture was secondary outcome. Outcome data collected from mailed questionnaires every 6 months, doctors asked to confirm fractures **List of additional injury measures:** NR **QOL** **SF-12:** Collected at 6 and 12 months via mail **SF-36:** NR **EuroQol:** Collected at 6 and 12 months via mail **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** median 25 mo	**Definition of fall:** NR **Rate or risk of falls/fallers:** Falls self-reported every 6 months **Length of followup:** Median 25 months

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Porthouse 2005[67] Fair	**Falls Efficacy Scale:** Fear of falling measured on a 6-point Likert scale in questionnaires mailed every 6 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** Median 25 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG: unequally allocated 34/714 (4.8%); equally allocated 24/607 (4.0%) CG: unequally allocated 69/1391 (5.0%); equally allocated 22/602 (3.7%) **# people sustaining multiple events:** NR **Mortality:** *Deaths* Odds Ratio IG CG (95% CI) P value Unequally allocated 3.8% 3.7% 1.26 (0.87-1.83) 0.22 Equally allocated 4.9% 2.8% **QOL** **SF-12:** Change between baseline and followup NR **SF-36:** NR **EuroQol:** Only reported at baseline **Among high risk:** NA

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Porthouse 2005[67] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NA

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Porthouse 2005[67] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Women at risk for hip fracture

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ 4 results: High risk for falls
Prince 2008[89] Fair	**Location:** Perth, Australia **Target population:** community-dwelling ambulant women aged 70 to 90 years with a serum 25-hydroxy-vitamin D concentration of less than 24.0 ng/mL and a history of falling in the previous year **Recruitment strategy:** 4/03-10/04; by invitation letter sent to patients derived from 3 sources: patients attending EDs of teaching hospitals, pts receiving services from the local community home nursing service for mgmt of falls, and the electoral roll (lists >98% of women of this age range)	**Inclusion:** women aged 70 to 90 years with a serum 25-hydroxyvitamin D concentration of less than 24.0 ng/mL and a history of falling in the previous year **Exclusion:** current vitamin D consumption; current consumption of bone or mineral active agents apart from calcium; a bone mineral density z score at the total hip site of < −2.0; medical conditions that influence bone mineral metabolism (laboratory evidence of renal insufficiency); a fracture in the past 6 months; a Mini-Mental State Examination score of less than 24; presence of neurological conditions likely to substantially impair balance or physical activity	**Assessed for eligibility:** 3968 phone screened, 827 screened at clinic **Excluded:** 3666 (c) **Not meeting inclusion criteria:** 2857 (c) **For other reasons:** 482 not interested, 256 other (c) + 71 refused **Randomized:** 302 **IG:** 151 **CG:** 151 **Age: mean (SD)** IG: 77.0 (4.2) CG: 77.4 (5.0) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** *No. of falls in the past 12 mo* IG CG 1 59.6% 57.6% 2 27.2 26.5 3 9.9 13.2 >3 3.3 2.6	**Risk category:** A599 (other): recent falls and vitamin D deficient **Definition:** fell in last year, serum 25-hydroxyvitamin D concentration <24.0 ng/mL **Proportion:** 100% **Instrument:** self report (I think), blood draw and radioimmunoassay

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Prince 2008[89] Fair	**Category:** Clinical management - vitamin D2 **Description** **IG:** Ergocalciferol (D2), calcium citrate supplementation **CG:** Calcium alone **Format (single or combo, individual or group, where)** **IG:** Single, individual, home **CG:** Single, individual, home **Intensity (frequency and duration)** **IG:** 1000 IU/d of vitamin D2 tablet once daily and 2 x 250 IU calcium citrate tablets twice daily for 1 year **CG:** Placebo tablet once daily and 2 x 250 IU calcium citrate tablets twice daily for 1 year **Delivery** **IG:** Self-administered **CG:** Self-administered	**Fall-related fracture:** Participants asked to fill out adverse event diary, including fractures, which was photocopied and returned at 3 monthly intervals **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Subjects interviewed by staff every 6 weeks for 12 months via telephone or during clinic visits. The # of falls in the previous 6 weeks and the associated features of the falls were recorded on a falls questionnaire **Length of followup:** 1 year

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Prince 2008[89] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures (calc):** IG: 1 (0.7%) CG: 1 (0.7%) **# people sustaining multiple events:** NR **Mortality** CG: 1 died IG: 0 died **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Prince 2008[89] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers:** **IG:** 80 (53.0%) **CG:** 95 (62.9%) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** 100%

Appendix C Table 2. Effectiveness of Single Clinical Treatment Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Prince 2008[89] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** no differences between groups in rate of incident cancer, ischemic heart disease, stroke, constipation, or fracture. 1IG had mild asymptomatic hypercalcemia on 1 occasion. **External validity:** limited to older women (70-90) with recent falls and specific VitD levels; LOCATION of study important here because of extent of light exposure VitD reduced risk of having at least 1 fall over 1 year after adjustment for baseline height, which was significantly different between the 2 groups VitD reduced the risk of having 1 fall (IG, 21.2%; CG 33.8%; OR, 0.50 (0.28-0.88) but not multiple falls. 82 patients (47%) had 1st fall in summer/autumn; 93 (53%) in winter/spring. % with 1st fall in summer / autumn: IG 27.8%, CG 27.2% (OR, 0.81; 0.46-1.42) % with 1st fall in winter / spring: IG 25.2%, CG 35.8% (OR, 0.55; 0.32-0.96), = RR of 0.77 (0.56-0.98) OR = 0.66 (0.41-1.06); adjusted for differences in height: IG had a lower risk of falling vs CG (OR, 0.61; 0.37-0.99) = 19% RR reduction

UK-United Kingdom; IG-intervention group; CG-control group; NR-not reported; NA-not applicable; CI-confidence interval; USPSTF-United States Preventive Services Task Force; ED-emergency department; POMA-Performance Oriented Balance and Mobility Assessment; ADL-activities of daily living; IADL-instrumental activities of daily living; BMI-body mass indexSES-socioeconomic status; SD-standard deviation; QOL-quality of life; HR-hazard ratio

Appendix C Table 3. Effectiveness of Clinical Education and Behavioral Counseling Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Clemson 2004[103] Good	**Location:** Sydney and Newcastle, Australia **Target population:** aged ≥ 70 who had a fall in the previous year, or were concerned about falling **Recruitment strategy:** distribution of promotional materials; health professional referrals; media ads and editorials in local papers; database mailouts by general medical practices, the VA, and a football club; and presentations to community orgs. People who were interested were invited to contact the authors by mail or telephone. An RA then telephoned to screen for eligibility. conducted over a 26-month period, closing in October 2001	**Inclusion:** community residents aged ≥ 70 who had a fall in the previous year or were concerned about falling, conversational English **Exclusion:** cognitive problems associated with dementia (measured using 3+ errors on the Short Portable Mental Status Questionnaire); being homebound and unable to independently leave home	**Assessed for eligibility:** 732 **Excluded:** 422 **Not meeting inclusion criteria:** 75 **Declined:** 347 **Randomized:** 310 **IG:** 157 **CG:** 153 **Age: mean (SD)** IG: 78.31 (5.26) CG: 78.47 (5.66) **Female:** IG: 74% CG: 74% **Ethnicity:** NR **SES:** NR **Fall History:** CG IG 1 25 (16%) 27 (17%) ≥2 75 (49%) 76 (48%) Mean 2.53 (3.84) 2.19 (2.94)	**Risk category:** Other - A599: had a fall in the previous yr, or were concerned about falling **Definition:** had a fall in the previous year or were concerned about falling **Proportion:** 100% **Instrument:** Self-report

Appendix C Table 3. Effectiveness of Clinical Education and Behavioral Counseling Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Clemson 2004[103] Good	**Category:** Clinical Education/Behavioral Counseling **Description** **IG:** Stepping On, multifaceted community-based learning program to improve fall self-efficacy and a home visit **CG:** Social visits **Format (single or combo, individual or group, where)** **IG:** Combo, group and individual, group at community venue and individual in home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** 2-hr sessions weekly for 7 weeks, with follow-up OT home visit within 6 weeks of the final session. A booster session, 3 months after session seven, lasting 1.5 hours, at the program venue. **CG:** Up to 2 visits during same time as program **Delivery** **IG:** Occupational therapist **CG:** Occupational therapy student	**Fall-related fracture:** NR **QOL** **SF-12:** NR **SF-36:** At baseline and 14 months **EuroQol:** NR **Mortality** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 14 months	**Definition of fall:** an event that results in a person unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Self-report on monthly tear-off postcard calendars. If a fall was reported, the RA telephoned to ascertain whether the fall met the study definition. If the calendar was not returned within 2 weeks of the end of the month, the RA telephoned the subject to complete the schedule **Length of followup:** 14 months. Median length of follow-up for all subjects was 429 days (range 2–529)

Appendix C Table 3. Effectiveness of Clinical Education and Behavioral Counseling Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life	KQ1 results: Disability
Clemson 2004[103] Good	**Falls Efficacy Scale:** Modified Falls-Efficacy ScaleMeasured at baseline and 14 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Physical Activity Scale for the Elderly (PASE), the Worry scale, Falls Behavioral Scale, Mobility Efficacy Scale **Length of followup:** 14 months. Median length of follow-up for all subjects was 429 days (range 2–529)	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** 7 / 310 **QOL** **SF-12:** NR **SF-36:** n (mean chg+/-SD) Mean diff CG IG 95% CI *Mental health component* 125 (-0.52±10.00) 133 (0.01±9.65) 0.53 (-2.95-1.88) *Physical component* 125 (0.68±9.04) 133 (-0.02±8.34) 0.70 (-2.94-1.88) **EuroQol:** NR **Among high risk:** All are high risk	**ADLs:** NR **IADLs:** NR **Among high risk:** NA

Appendix C Table 3. Effectiveness of Clinical Education and Behavioral Counseling Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2 & KQ2a results: Rate or risk of falls and fallers	KQ2b results: Other positive outcomes	Comments
Clemson 2004[103] Good	**# falls/# in group:** IG: 179/157 CG: 255/153 **# (%) fallers:** IG: 82 (52%) CG: 89 (58%) **# (%) frequent fallers (2+ falls):** IG: 40 (26%) CG: 53 (35%) **Among high risk:** All are high risk (RR only reported for subgroup analysis)	**Falls Efficacy Scale:** *Modified Falls Efficacy Scale* n (mean chg+/-SD) mean diff CG IG 95% CI P 125 (-1.10±19.60) 133 (0.63±16.40) 1.74, (-6.1-2.7) 0.042 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** OK - some limits in exclusion criteria - some concern about past fallers and those concerned being grouped together

VA-Veterans Administration; IG-intervention group; CG-control group; NR-not reported; NA-not applicable; CI-confidence interval; USPSTF-United States Preventive Services Task Force;POMA-Performance Oriented Balance and Mobility Assessment; ADL-activities of daily living; IADL-instrumental activities of daily living; SES-socioeconomic status; SD-standard deviation; QOL-quality of life

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 5*	**Location:** Dunedin and Auckland, New Zealand **Target population:** Royal New Zealand Foundation of the Blind register and low vision clinic patients aged 75 and older **Recruitment strategy:** Foundation or clinic staff invited people who met criteria to participate	**Inclusion:** Aged 75 and older, distance visual acuity of 6/24 meters or worse in the better eye after the best possible correction **Exclusion:** Could not walk around their own residence, receiving physiotherapy at time of recruitment, or could not understand trial requirements	**Assessed for eligibility:** NR **Invited to participate:** 708 **Excluded:** 317 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 391 **IG (HS):** 100 **IG (Otago):** 97 **IG (HS + Otago):** 98 **CG:** 96 **Age: mean (SD):** IG (HS): 83.1 (4.5) IG (Otago): 83.4 (4.9) IG (HS + Otago): 83.8 (4.7) CG: 84.0 (4.9) **Female:** IG (HS): 66% IG (Otago): 74% IG (HS + Otago): 63% CG: 70% **Ethnicity:** NR **SES:** NR **Fall History:** IG (HS): 45% IG (Otago): 42% IG (HS + Otago): 43% CG: 50%	**Risk category:** A503 Eye diseases, visual impairment **Definition:** Distance visual acuity of 6/24 meters or worse in the better eye after the best possible correction **Proportion:** 100% **Instrument:** logMAR letter charts adapted from the Snellen criteria and designed to be used from 1-4 meters

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 5*	**Category:** Clinical Management - assistive device prescription; Home Hazard Modification; Exercise/Physical Therapy **Description** **IG (HS):** Home safety assessment and modification guided by Canadian Model of Occupational Performance and using Westmead home safety assessment checklist **IG (Otago):** Individually-prescribed Otago Exercise Program for strength and balance with walking **IG (HS + Otago):** Combination of above two interventions **CG:** Social visits **Format (single or combo, individual or group, where)** **IG (HS):** Single, individual, in-home **IG (Otago):** Single, individual, in-home **IG (HS + Otago):** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG (HS):** One home visit and any required follow-up for installation of equipment, etc. Mailed confirmation of plan agreement following home visit **IG (Otago):** Five home visits to prescribe exercises. Prescribed three, 30-minute sessions per week of Otago and walking outside at least twice per week for one year **IG (HS + Otago):** Combination of the above **CG:** Two home visits lasting and hour each during the first six months of the trial **Delivery** **IG (HS):** Occupational Therapist with two-day training course for study **IG (Otago):** Physiotherapist **IG (HS + Otago):** Both of the above **CG:** Research staff	**Fall-related injury:** NR **QOL:** NR **Mortality:** NR **Disability:** NR	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Self-report monthly calendars returned via mail, assessors called to record the circumstances of the falls **Length of followup:** 1 year

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life	KQ1 results: Disability
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 5*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Peripheral fracture rate per person year:** NR **# peripheral fractures:** NR **# people sustaining peripheral fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG (HS): 3/100 IG (Otago): 2/97 IG (HS + Otago): 4/98 CG: 7/96 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk	**ADLs:** NR **IADLs:** NR **Among high risk:** NA

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2 & KQ2a results: Rate or risk of falls and fallers	KQ2b results: Other positive outcomes	Comments
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 5*	**Falls per person year:** IG (HS): 0.65 IG (Otago): 1.30 IG (HS + Otago): 1.17 CG: 1.65 **# falls/# in group:** IG (HS): 64/100 IG (Otago): 120/97 IG (HS + Otago): 108/98 CG: 151/96 **# (%) fallers:** IG (HS): 36 (36%) IG (Otago): 47 (48%) IG (HS + Otago): 47 (48%) CG: 59 (61%) **# (%) frequent fallers (2+ falls):** IG (HS): 16 (16%) IG (Otago): 27 (28%) IG (HS + Otago): 24 (24%) CG: 29 (30%) **Among high risk:** All are high risk	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Don't know how many were assessed and excluded

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 5*	**Location:** Melbourne, Australia **Target population:** Aged 70 years and older **Recruitment strategy:** Mailed invitation letters and made followup calls to people aged 70 years and older registered on the Autralian electoral role for the area, local publicity, and recruitment by general practitioners	**Inclusion:** Living in their own home or leasing similar accomodation and allowed to make modifications **Exclusion:** Not expecting to live in area for 2 years; regular to moderate physical activity with a balance improvement component in the previous 2 months; could not walk 10-20 meters without rest, help, or having angina; severe respiratory or cardiac disease; psychiatric illness prohibiting participation; dysphasia; recent major home modifications; education and language adjusted score >4 on the short portable mental status questionnaire; no physician approval	**Mailed invitations:** 11,120 **Assessed for eligibility:** 1,967 **Excluded:** 860 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 1,107 **Continued:** 1,090 **IG (exercise(ex)):** 135 **IG (home hazard(hh)):** 136 **IG (vision(v)):** 139 **IG (ex+hh):** 135 **IG (ex+v):** 136 **IG (v+hh):** 137 **IG (all):** 135 **CG:** 137 **Age: mean (SD)** All: 76.1 (5.0) Range across Groupss: 75.4-76.5 (4.7-5.5) **Female:** All: 59.8% Range across Groupss: 55.4-68.4% **Ethnicity:** NR **SES:** NR **Fall History:** NR for past year, reported for last month	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 5*	**Category:** Multiple interventions - exercise, home hazard modification, vision, and combinations of those **Description** **IG (ex):** Exercise class and home exercises designed to improve flexibility, leg strength, and balance **IG (hh):** Home hazards were removed or modified **IG (v):** If vision tested below predetermined criteria, referred to usual eye care provider to whom vision assessment results were given; those who did not receive the intervention got the Australian Optometrist Association's brochure on eye care for those aged over 40 **CG:** Waitlist control **Format (single or combo, individual or group, where)** **IG (ex):** Single or combo with hh and/or v, group class supplemented by home exercises, class location NR **IG (hh):** Single or combo with ex and/or v, individual, in-home **IG (v):** Single or combo with ex and/or hh, individual, at usual provider's location **CG:** NA **Intensity (frequency and duration)** **IG (ex):** 1 hr a week, 15 weeks **IG (hh):** 1 visit by city home maintenance worker **IG (v):** 1 assessment and referral if tested below criteria **CG:** NA **Delivery** **IG (ex):** Instructor NR **IG (hh):** City maintenance staff **IG (v):** Trained assessor **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** At baseline only **Length of followup:** At baseline only	**Definition of fall:** NR **Rate or risk of falls/fallers:** Self-report montly postcard, phoned if not returned by 5 days after the end of the month, phoned if reported a fall **Length of followup:** 18 months

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life	KQ1 results: Disability
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 5*	**Falls Efficacy Scale:** At baseline only **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline and 18 months, only measured random sample of 442 at 18 months for cost purposes **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Spring gauge to measure quadricep strength, postural sway, maximal balance range, coordinated stability, visual acuity, random dot stereo butterfly test, crossed disparity circles, field of view **Length of followup:** 18 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: 15 (NR which groups) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA	**ADLs:** NR **IADLs:** NR **Among high risk:** NA

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2 & KQ2a results: Rate or risk of falls and fallers	KQ2b results: Other positive outcomes	Comments
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 5*	**# falls/# in group:** NR **# (%) fallers:** **Rate ratio** IG (ex): 76/135 (56.3%) 0.82 (0.70, 0.97) IG (v): 84/139 (60.4%) 0.89 (0.75, 1.04) IG (hh): 78/136 (57.4%) 0.92 (0.78, 1.08) IG (ex+v): 66/136 (48.5%) 0.73 (0.58, 0.91) IG (ex+hh): 72/135 (53.3%) 0.76 (0.60, 0.95) IG (v+hh): 78/137 (56.9%) 0.81 (0.65, 1.02) IG (all): 65/135 (48.1%) 0.67 (0.51, 0.88) CG: 87/137 (63.5%) Ref 1.00 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Australians

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Stevens 2001[70] Fair	**Location:** Perth, Australia **Target population:** Aged 70 and older **Recruitment strategy:** Primary: letters followed by phone calls to people on State Electoral Roll and White Pages directory Secondary: up to one cohabitant of index recruit, separate phone call to assess eligibility	**Inclusion:** Aged 70 and older; living independently; cognitively able to follow protocol; able to participate for next 10-12 mo; able to make changes to home; not modified home with ramps or rails. **Exclusion:** Modified home by the fitting of ramps or grab rails	**Assessed for eligibility:** Primary: 2,956 Secondary: NR **Excluded:** Primary: 1,395 Secondary: NR **Not meeting inclusion criteria:** Primary: 1,395 Secondary: NR **For other reasons:** NR **Randomized:** 1879 **IG:** 635 **CG:** 1,244 **Mean age:** IG: 76 CG: 76 **Female:** IG: 54% CG: 52% **Ethnicity:** NR **SES:** NR **Fall History:** IG: 26% CG: 27%	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Stevens 2001[70] Fair	**Category:** Home hazard modification **Description** **IG:** Home hazard assessment, installation of free safety devices, and an educational strategy to empower seniors to remove or modify home hazards **CG:** Home visit to educate ppts how to recognize a fall and complete the diary **Format (single or combo, individual or group, where)** **IG:** Single, individual (by household), in-home **CG:** Single, individual (by household), in-home **Intensity (frequency and duration)** **IG:** Once within the first week after recruitment **CG:** Once within the first week after recruitment **Delivery** **IG:** Research nurse **CG:** Research nurse	**Fall-related fracture:** NR **List of additional injury measures:** Fall-related injuries, and fall-related injuries serious enough to seek medical care. No further detail provided **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** An event that results in a person unintentionally coming to rest on the ground, floor or other lower level **Rate or risk of falls/fallers:** Self-report daily calendar mailed at the end of each month. All reported falls confirmed by phone interview **Length of followup:** 1 year

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life	KQ1 results: Disability
Stevens 2001[70] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA	**ADLs:** NR **IADLs:** NR **Among high risk:** NA

Appendix C Table 4. Effectiveness of Home Hazard Modification Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2 & KQ2a results: Rate or risk of falls and fallers	KQ2b results: Other positive outcomes	Comments
Stevens 2001[70] Fair	**Fall rate per 100 person years:** IG: 68.87/100PY CG: 72.28/100PY No significant difference **# falls/# in group:** NR Adj OR: 1.02 (0.83, 1.27) **# (%) fallers:** NR Adj OR: 0.97 (0.74, 1.28) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NA Odds ratios were reported, and no significant difference between groups	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Good Secondary recruitment method compromise random selection? Intervention may not have been effective in home hazards significantly being modified 15.8% of CG reported also reducing fall risk in home

UK-United Kingdom; IG-intervention group; CG-control group; NR-not reported; NA-not applicable; CI-confidence interval; USPSTF-United States Preventive Services Task Force; mo-month; POMA-Performance Oriented Balance and Mobility Assessment; ADL-activities of daily living; IADL-instrumental activities of daily living; SES-socioeconomic status; SD-standard deviation; QOL-quality of life

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Ashburn 2007[96] Fair	**Location:** Dorset, UK **Target population:** People with Parkinson's Disease (PD) **Recruitment strategy:** Identified from clinical registers of 3 Parkinson's Disease specialists in 2 National Health Service trusts. After approved by Parkinson's Disease nurse, mailed invitation letter	**Inclusion:** Confirmed diagnosis of idiopathic Parkinson's Disease, independently mobile, >1 fall in the past year, passed screening test for gross cognitive impairment **Exclusion:** Unable to participate in assessments due to pain, acute medical condition and in receipt of, or soon to receive, treatment	**Assessed for eligibility:** 1,107 **Excluded:** 965 **Not meeting inclusion criteria:** 598 **For other reasons:** 367 **Randomized:** 142 **IG:** 70 **CG:** 72 **Age: mean (SD)** IG: 72.7 (9.6) CG: 71.6 (8.8) **Female:** IG: 46% CG: 33% **Ethnicity:** NR **SES:** NR **Fall History:** 100%	**Risk category:** Parkinson's Disease/Syndrome (A501) **Definition:** Confirmed diagnosis of Parkinson's Disease **Proportion:** 100% **Instrument:** Clinical registers

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Ashburn 2007[96] Fair	**Category:** Exercise **Description** **IG:** Progressive muscle strengthening, range of movement, balance training and walking exercises chosen from an exercise menu. Also taught strategies for fall prevention and movement initiation and compensation. After the initial treatment period, received montly phone calls for encouragement and problem solving **CG:** Usual care which was usually contact with a local PD nurse. Also offered advice about exercises at the end of followup to increase adherence **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** NR **Intensity (frequency and duration)** **IG:** 1 hour session 1 time per week for 6 weeks, then monthly phone calls for 6 months. Exercises were encouraged daily **CG:** NR **Delivery** **IG:** Physiotherapist **CG:** Usually a PD nurse	**Fall-related fracture:** Self-report falls diary mailed in each month **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** At baseline, 8 weeks and 6 months **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 6 months	**Definition of fall:** An event that resulted in a person coming to rest unintentionally on the ground or other lower level, not as a result of a major intrinsic event or overwhelming hazard **Rate or risk of falls/fallers:** Self-report falls diary mailed in each month **Length of followup:** 6 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Ashburn 2007[96] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline, 8 weeks and 6 months **6-meter timed walk:** NR **Functional reach:** At baseline, 8 weeks and 6 months **Berg Balance Scale:** At baseline, 8 weeks and 6 months **List of additional measures:** Self-assesment Parkinson's Disease Disability Scale (SAS), chair stand test **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** IG: 2/67 (3%) CG: 6/67 (9%) p=0.141 **# people sustaining multiple events:** NR **Mortality**: IG: 1 CG: 2 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol Mean (SD):** Adjusted* Diff IG CG (95% CI) P Baseline 63.1 (17.1) 64.6 (14.5) 8 weeks 61.3 (19.8) 61.7 (14.5) -0.7 (-5.6, 4.3) 0.793 6 months 63.0 (18.7) 56.6 (16.9) 5.7 (0.47, 11.0) 0.033 *Adjusted for SAS, Berg Balance/Functional Reach/EuroQol at baseline, and centre **Among high risk**: All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Ashburn 2007[96] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** All are high risk	**# falls/# in group:** NR **# (%) fallers:** IG CG 8 weeks 37 (57%) 42 (66%) 6 months 46 (73%) 49 (78%) p=NS **# (%) frequent fallers (2+ falls):** IG CG 8 weeks 21 (32%) 28 (44%) 6 months 35 (56%) 42 (68%) p=NS **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Ashburn 2007[96] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** "No significant differences between groups" (data NR) **6-meter timed walk:** NR **Functional reach mean score (SD):** IG: Baseline 23.2 (6.7); 8 weeks 23.6 (6.4); 6 months 23.8 (6.8) CG: Baseline 25.0 (7.0); 8 weeks 24.0 (7.0); 6 months 22.5 (6.8) Adjusted* Diff (95%CI): 8 weeks 1.2 (-0.3-2.6); 6 months 2.0 (0.5-3.5) P: 8 weeks 0.108; 6 months 0.009 *****Adjusted for Disease Disability Scale, Berg Balance/Functional Reach/EuroQoL at baseline and centre **Berg Balance Scale mean score (SD):** IG: Baseline 44.3 (9.8); 8 weeks 45.8 (9.2); 6 months 45.3 (10.0) CG: Baseline 43.6 (10.5); 8 weeks 45.2 (9.9); 6 months 44.6 (11.0) Adjusted* Diff (95%CI): 8 weeks 0.1 (-0.26-2.25); 6 months 0.1 (-1.8-2.0) P: 8 weeks 0.120; 6 months 0.913 *Adjusted for Disease Disability Scale, Berg Balance/Functional Reach/EuroQol at baseline and centre **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** Applicable to people with PD who are frequent fallers

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Barnett 2003[104] Fair	**Location:** South Western Sydney, Australia **Target population:** > 65, identified as at risk of falling using a standardised assessment screen by their general practitioner or hospital-based physiotherapist, residing in South Western Sydney, Australia **Recruitment strategy:** drawn from people aged ≥65 who attended one of 24 general practice clinics or two acute hospital physiotherapy departments in South Western Sydney, Australia	**Inclusion:** Had 1+ physical performance impairments found to be important risk factors for falls that could be addressed by exercise participation; lower limb weakness (inability to stand from a 45 cm high chair in less than 2 seconds),poor balance (a need to step to maintain balance when performing a near-tandem balance test), and slow reaction time (inability to catch a rod dropped from above the hand within 300 milliseconds). **Exclusion:** cognitive impairments, degenerative conditions such as Parkinson's or a medical condition involving the neuromuscular, skeletal or cardiovascular system, that precluded taking part in an exercise program	**Assessed for eligibility:** 601 **Excluded:** 438 **Not meeting inclusion criteria:** 348 **Declined: 90** **Randomized:** 163 **IG:** 83 **CG:** 80 **Age: mean (SD)** IG: 74.4 (4.9) CG: 75.4 (6.0) **Female:** IG 69.9%, CG 63.8% **Ethnicity: English main language** IG 90.4%, CG 88.8% **SES:** NR **Fall History:** Fell in last year: IG 43.4%, CG 41.3% Afraid of falling: IG 17%, CG 11%	**Risk category:** Gait and/or balance impairment (A507) **Definition:** 1+ physical performance impairments found to be important risk factors for falls that could be addressed by exercise participation; lower limb weakness, poor balance and slow reaction time **Proportion:** 100% **Instrument:** Short Physical Performance Battery (Guralnik et al, 1994), Lateral stablility (Lord et al., 1999)

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Barnett 2003[104] Fair	**Category:** exercise / physical therapy **Description** **IG:** Group exercise program with ancillary home exercises: class content designed by a PT to address falls risk factors. 5–10 minutes warm up, exercises to improve balance, coordination, aerobic capacity and muscle strength; functional exercises, balance and co-ordination exercises, strength work, aerobic activity. 10-minute cool down with relaxation and controlled breathing. The complexity and speed of the exercise and the resistance of the bands were all steadily increased over the year. The number of exercise subjects in each group ranged from 6 to 18 (mean=9). A home exercise programme based on the class content was also given to participants, with diaries to record participation. Also received written information on practical strategies for avoiding falls such as hand and foot placement if loss of balance occurred. **CG:** Given the same written information about falls prevention, but no alternative 'non-exercise' activity.Median # classes attended by the IG was 23 (0–36); 28 (33.7%) attended 30 or more classes. 91% of IG who were still attending exercise classes at the end of the trial were performing the home exercise program at least once a week, 13% daily **Format (single or combo, individual or group, where)** **IG:** Combo - classes in community setting, home exercise at home **CG:** Individual **Intensity (frequency and duration)** **IG:** Weekly for a year; 1 hour classes: 37 classes total **CG:** Once **Delivery** **IG:** In a community setting; accredited exercise instructor trained to provide the same programme led each class; 3 instructors participated in the study **CG:** NR	**Fall-related fracture:** NR **QOL:** **SF-12:** NR **SF-36:** At baseline and 6 months **EuroQol:** NR **Mortality**:NR **Disability:** NR Other fall-related injury: Fall-related injuries reported. Injurious falls defined as falls that resulted in bruises, strains, cuts and abraisions, back pain and fractures. **Follow-up period**: 6 months	**Rate or risk of falls/fallers:** Falls measured over a 12-month follow-up period using monthly postal surveys. Falls frequency and severity were monitored for in both groups with postal surveys sent to the subjects at the end of each calendar month. If not returned within 2 weeks, further contact was made by telephone interview. Falls were defined as "events which lead to the conscious subject coming to rest inadvertently on the ground". **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Barnett 2003[104] Fair	**Falls Efficacy Scale:** % afraid of falling was recorded **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** walking speed in ms-1 over 6-m distance assessed at baseline and after 6-mo **Functional reach:** NR **Berg Balance Scale:** Step-up ability was measured using the Berg alternate step-up test at baseline and 6-mo **List of additional measures:** Strength Sway Coordinated stability score Reaction time Sit to stand time **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures**:NR **# people sustaining multiple events:**NR **Mortality:** NR **QOL** **SF-12:** NR **SF-36:** Groups did not differ by change in SF 36 after 6-mo. Domains of SF-36 assessed: general health, physical functioning, vitality, mental health, Physical Activity Scale, and sit to stand time **EuroQol**: NR **Among high risk:** 100%

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Barnett 2003[104] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Fall rate per person year:** IG: 0.605 CG: 0.946 IRR = 0.60 (0.36-0.99) **Time to first fall:** NR **# falls:** NR **# (%) fallers/non-fallers:** IG: 27 (35.5%) CG: 37 (50.0%) IRR = 0.71 (0.49-1.04) **# (%) frequent fallers (2+ falls):** IG: 8 (10.8%) CG: 18 (24.3%) IRR = 0.44 (0.21-0.96) **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Barnett 2003[104] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** BL 6 mo retest IG CG IG CG 6.3 (1.9) 6.2 (2.2) 6.1 (1.8) 6.1 (2.3) **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** Limited to people with some frailty / disability; >half initially assessed excluded and another 1/6th refused

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Buchner 1997[105] Buchner 1993[106] Seattle FICSIT/MoveIT Fair	**Location:** Seattle **Target population:** Aged between 68-85 years **Recruitment strategy:** Random sample from the Group Health Cooperative of Puget Sound HMO. Invitation letters mailed followed up by phone calls	**Inclusion:** Aged 68-85 years, unable to perform an 8-step tandem gait without errors, and below the 50th percentile in knee extensor strength **Exclusion:** Active cardiovascular, pulmonary, vestibular, and bone diseases; history of coronary artery disease or a positive cardiac stress test; body weight >180% of ideal, major psychiatric illness, active metabolic disease; chronic anemia; amputation; chronic neurological or muscle disease; inability to walk; dependency in eating, dressing, transfer or bathing; terminal illness; inability to speak English or fill out forms	**Assessed for eligibility:** 13,866 **Excluded at first screening:** 12,898 **Not meeting inclusion criteria:** 10,453 **For other reasons:** 2,445 refused **Excluded at second screening:** 787 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 105 to FICSIT, rest to MoveIT (not reported in this paper) **IG(Endurance Training (ET)):** 25 **IG(Strength Training (ST):** 25 **IG (ET+ST):** 25 **CG:** 30 **Age: mean** IG(ET) IG(ST) IG(ET+ST) CG 75 74 75 75 **Female:** IG(ET) IG(ST) IG(ET+ST) CG 52% 52% 52% 50% **Ethnicity:** *Caucasian* IG(ET) IG(ST) IG(ET+ST) CG 88% 100% 88% 97% **SES:** *Years of formal education* IG(ET) IG(ST) IG(ET+ST) CG 15 14 14 13 **Fall History:** IG(ET) IG(ST) IG(ET+ST) CG 20% 16% 28% 23%	**Risk category:** Balance and/or gait impairment (A507) **Definition:** Unable to perform an 8-step tandem gait without errors; <50th percentile in knee extensor strength for age, sex, height and weight **Proportion:** 100% had one or both risks **Instrument:** Clinic screening (instruments NR)

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Buchner 1997[105] Buchner 1993[106] Seattle FICSIT/MoveIT Fair	**Category:** Exercise **Description** **IG(ET):** Stationary bicycles plus discharge planning to continue exercise **IG(ST):** Two sets of 10 reps of resistence training with weight machines plus discharge planning to continue exercies **IG(ST+ET):** One set of 10 reps resistence training with weight machines and stationary bicycles plus discharge planning to continue exercise **CG:** Usual activity level **Format (single or combo, individual or group, where)** **IG(ET):** Single, group, location NR **IG(ST):** Single, group, location NR **IG(ET+ST):** Combo, group, location NR **CG:** NA **Intensity (frequency and duration)** **IG(ET):** 1 hour 3 days per week for 24-26 weeks **IG(ST):** 1 hour 3 days per week for 24-26 weeks **IG(ET+ST):** 1 hour 3 days per week for 24-26 weeks **CG:** NA **Delivery** **IG(ET):** NR **IG(ST):** NR **IG(ET+ST):** NR **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** Role limitation-physical, bodily pain, and general health scales at baseline and 6 months **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** At baseline and 6 months **Length of followup:** 6 months for CG, 9 months for IGs	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level, whether or not you were injured **Rate or risk of falls/fallers:** Immediate self-report by mail, also monthly self-report postcards. Participants who did not return postcards were telephoned **Length of followup:** End of study funding - median time 18 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Buchner 1997[105] Buchner 1993[106] Seattle FICSIT/MoveIT Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Strength (using isokinetic dynamometer), aerobic capacity (using treadmill and expired gases), balance (balance beam walks, standing on tilt boards), gait (40m walking course), Sickness Impact Profile; stair climbing speed **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36 Scores - Mean (SD):** CG IG(ET) IG(ST) IG(ET+ST) *General health* Baseline 77 (14) 78 (18) 78 (10) 71 (15) 6-month change -2 (14) 1 (10) 1 (9) 1 (11) *Bodily pain* Baseline 76 (21) 78 (24) 74 (21) 73 (22) 6-month change 1 (20) -2 (19) 2 (22) -1 (19) *Role physical* Baseline 71 (28) 73 (31) 65 (39) 72 (32) 6-month change 3 (38) 10 (38) 4 (47) -1 (29) **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Buchner 1997[105] Buchner 1993[106] Seattle FICSIT/MoveIT Fair	**ADLs:** NR **IADLs:** *# Independent IADLs (out of 5) - Mean (SD)* CG / IG(ET) / IG(ST) / IG(ET+ST) Baseline: 4.6 (0.7) / 4.7 (0.6) / 4.8 (0.7) / 4.6 (1.0) 6-month change: 0.2 (0.7) / 0.2 (0.5) / 0.1 (0.7) / 0.1 (0.4) **Among high risk:** All are high risk	**Fall rate per year:** IGs: 0.49 CG: 0.81 RR: 0.61, 95% CI (0.39, 0.93) **# falls/# in group:** NR **# (%) fallers at 1 yr (calc):** *Year 1* IGs: 32 (42) CG: 18 (60) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Buchner 1997[105] Buchner 1993[106] Seattle FICSIT/MoveIT Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Highly selected population-only 7% passed the first phase of screening. Sample is possibly on verge of decline

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Campbell 1997[97] Dunedin A - Year 1 Fair	**Location:** Dunedin, New Zealand **Target population:** Women aged 80 years and older **Recruitment strategy:** Identified by computerized registers of 17 general practices and invited by their general practitioner	**Inclusion:** Women aged 80 and older, able to move around within their own home; mentally competent to comply with study **Exclusion:** Receiving physiotherapy	**Assessed for eligibility:** 622 invited **Excluded:** 389 **Not meeting inclusion criteria:** 30 **For other reasons:** 359 **Randomized:** 233 **IG:** 116 **CG:** 117 **Age: mean (SD)** IG: 84.1 (3.1) CG: 84.1 (3.4) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** IG: 41% CG: 47%	**Risk category:** Other - female (A599) **Definition:** Female sex **Proportion:** 100% **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Campbell 1997[97] Dunedin A - Year 1 Fair	**Category:** Exercise **Description** **IG:** Strength and balance exercises, a walking plan, visits and phone calls **CG:** .Social visits and phone calls **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Exercise program 30 minutes 3 times per week, walking plan 3 times per week, visits 1 hour 4 times during the first 2 months and regular phone calls during the year of follow-up **CG:** Visits 1 hour 4 times during the first 2 months and regular phone calls during the year of follow-up **Delivery** **IG:** Physiotherapist **CG:** Research nurse	**Fall-related fracture:** Fractures not reported separately **List of additional injury measures:** Serious and moderate fall injury reported montly by mailed calendars, follow-up call to record circumstances **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** Completed at baseline and 1 year **Length of followup:** 1 year	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Monthly self-report calendars by mail, follow-up call to record circumstances of the falls **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Campbell 1997[97] Dunedin A - Year 1 Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** Baseline and 6 months **Berg Balance Scale:** NR **List of additional measures:** 4-test balance scale, strength of knee extensor muscle, chair stand test, time to walk 8 feet and 20 meters, time to climb up and down a set of stairs, distance walked in six minutes **Length of followup:** 6 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: IG: 2/116 CG: 4/117 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Campbell 1997[97] Dunedin A - Year 1 Fair	**ADLs:** NR **IADLs:** No differences between the group scores: median 8.0; range 0-8 (no further data) **Among high risk:** All are high risk	**Mean (SD) fall rate per year:** IG: 0.87 (1.29) (had 108.8 person-years) CG: 1.34 (1.93) (had 113.4 person-years) Difference: 0.47 95% CI: 0.04-0.90 **# falls/# in group:** IG: 88/116 CG: 152/117 **# (%) fallers (calc):** IG: 53 (46%) CG: 62 (53%) **# (%) frequent fallers (2+ falls) (calc):** IG: 22 (19%) CG: 34 (29%) **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Campbell 1997[97] Dunedin A - Year 1 Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** "No differences between groups" **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** New Zealand women 80+ years old

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 2*	**Location:** Dunedin, New Zealand **Target population:** Aged 65 years and older and currently taking psychotropic medication **Recruitment strategy:** Identified through computerized registers of 17 general practice groups and invited by their general practitioner	**Inclusion:** Aged 65 years and older, currently taking psychotropic medication, and able to move around their own home; not receiving physiotherapy **Exclusion:** Low score on mental status questionnaire	**Assessed for eligibility:** 547 invited **Excluded:** 454 **Not meeting inclusion criteria:** 54 **For other reasons:** 400 **Randomized:** 93 **Medication Withdrawal + Exercise Program (MW + EP):** 24 **Medication Withdrawal (MW):** 24 **Original Medication + Exercise Program (OM + EP):** 21 **CG:** 24 **Age: mean (SD)** MW + EP: 75.6 (7.3) MW: 74.6 (5.5) OM + EP: 73.1 (6.3) CG: 75.2 (5.6) **Female:** MW + EP: 79% MW: 75% OM + EP: 71% CG: 79% **Ethnicity:** NR **SES:** NR **Fall History:** MW + EP: 54% MW: 46% OM + EP: 10% CG: 33%	**Risk category:** Medication specific - psychotropics (A600) **Definition:** Currently taking psychotropic medication **Proportion:** 100% **Instrument:** Computerized registers of general practices

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 2*	**Category:** Exercise and Clinical Management - Pharmacological Intervention **Description** **MW + EP:** Ingredients in medication were reformulated into study capsules and the amount of active ingredient was gradually reduced over 14 weeks; exercise program was muscle strengthening and balance training along with a walking plan **MW:** Ingredients in medication were reformulated into study capsules and the amount of active ingredient was gradually reduced over 14 weeks **OM + EP:** Ingredients in medication were reformulated into study capsules; muscle strengthening and balance training along with a walking plan **CG:** Ingredients in medication were reformulated into study capsules **Format (single or combo, individual or group, where)** **MW + EP:** Combination, individual, in-home **MW:** Single, individual, in-home **OM + EP:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **MW + EP:** Active ingredient in medication reduced over 14 weeks as follows: 80% of original dose after 2 weeks, 60 % after 5 weeks, 40% after 8 weeks, and 20% after 11 weeks. The exercise program had 4 home visits over the first 2 months and then phone calls for advice and to maintain motivation. Prescribed e **MW:** Active ingredient in medication reduced over 14 weeks as follows: 80% of original dose after 2 weeks, **OM + EP:** 4 home visits over the first 2 months and then phone calls for advice and to maintain motivation **CG:** NR **Delivery** **MW + EP:** NR for meds, physiotherapist for exercise program **MW:** NR for meds **OM + EP:** NR for meds, physiotherapist for exercise program **CG:** NR for meds	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Monthly self-report calendars by mail, follow-up call to record circumstances of the falls **Length of followup:** 44 weeks

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 2*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 2*	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Fall rate per person year:** <u>Medication Withdrawal</u> MW+EP & MW: 0.52 OM+EP & CG: 1.16 Difference: 0.64 (-0.07, 1.35) <u>Exercise Program</u> MW+EP & OM+EP: 0.71 MW & CG: 0.97 Difference 0.26 (-0.45, 0.97) CG: NR **# falls/# in group:** <u>Medication Withdrawal</u> WM+EP & MW: 17/48 OM+EP & CG: 40/45 <u>Exercise Program</u> MW+EP & OM+EP: 22/45 MW & CG: 35/48 CG: 29/22 **# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Campbell 1999[112] Dunedin B Fair *Study also located in Appendix C Table 2*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Very small N, huge loss to followup

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 4*	**Location:** Dunedin and Auckland, New Zealand **Target population:** Royal New Zealand Foundation of the Blind register and low vision clinic patients aged 75 and older **Recruitment strategy:** Foundation or clinic staff invited people who met criteria to participate	**Inclusion:** Aged 75 and older, distance visual acuity of 6/24 meters or worse in the better eye after the best possible correction **Exclusion:** Could not walk around their own residence, receiving physiotherapy at time of recruitment, or could not understand trial requirements	**Assessed for eligibility:** NR **Invited to participate:** 708 **Excluded:** 317 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 391 **IG (HS):** 100 **IG (Otago):** 97 **IG (HS + Otago):** 98 **CG:** 96 **Age: mean (SD):** IG (HS): 83.1 (4.5) IG (Otago): 83.4 (4.9) IG (HS + Otago): 83.8 (4.7) CG: 84.0 (4.9) **Female:** IG (HS): 66% IG (Otago): 74% IG (HS + Otago): 63% CG: 70% **Ethnicity:** NR **SES:** NR **Fall History:** *Fall in previous year* IG (HS): 45% IG (Otago): 42% IG (HS + Otago): 43% CG: 50%	**Risk category:** A503 Eye diseases, visual impairment **Definition:** Distance visual acuity of 6/24 meters or worse in the better eye after the best possible correction **Proportion:** 100% **Instrument:** logMAR letter charts adapted from the Snellen criteria and designed to be used from 1-4 meters

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 4*	**Category:** Clinical Management - assistive device prescription; Home Hazard Modification; Exercise/Physical Therapy **Description** **IG (HS):** Home safety assessment and modification guided by Canadian Model of Occupational Performance and using Westmead home safety assessment checklist **IG (Otago):** Individually-prescribed Otago Exercise Program for strength and balance with walking **IG (HS + Otago):** Combination of above two interventions **CG:** Social visits **Format (single or combo, individual or group, where)** **IG (HS):** Single, individual, in-home **IG (Otago):** Single, individual, in-home **IG (HS + Otago):** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG (HS):** One home visit and any required follow-up for installation of equipment, etc. Mailed confirmation of plan agreement following home visit **IG (Otago):** Five home visits to prescribe exercises. Prescribed three, 30-minute sessions per week of Otago and walking outside at least twice per week for one year **IG (HS + Otago):** Combination of the above **CG:** Two home visits lasting and hour each during the first six months of the trial **Delivery** **IG (HS):** Occupational Therapist with two-day training course for study **IG (Otago):** Physiotherapist **IG (HS + Otago):** Both of the above **CG:** Research staff	**Fall-related injury:** NR **QOL:** NR **Mortality:** NR **Disability:** NR	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Self-report monthly calendars returned via mail, assessors called to record the circumstances of the falls **Length of followup:** 12 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 4*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA)**: NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Peripheral fracture rate per person year:** NR **# peripheral fractures:** NR **# people sustaining peripheral fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG (HS): 3/100 IG (Otago): 2/97 IG (HS + Otago): 4/98 CG: 7/96 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 4*	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Falls per person year:** IG (HS): 0.65 IG (Otago): 1.30 IG (HS + Otago): 1.17 CG: 1.65 **# falls/# in group:** IG (HS): 64/100 IG (Otago): 120/97 IG (HS + Otago): 108/98 CG: 151/96 **# (%) fallers:** IG (HS): 36 (36%) IG (Otago): 47 (48%) IG (HS + Otago): 47 (48%) CG: 59 (61%) **# (%) frequent fallers (2+ falls):** IG (HS): 16 (16%) IG (Otago): 27 (28%) IG (HS + Otago): 24 (24%) CG: 29 (30%) **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Campbell 2005[63] VIP Trial Fair *Study also located in Appendix C Table 4*	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Don't know how many were assessed and excluded

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 4*	**Location:** Melbourne, Australia **Target population:** Aged 70 years and older **Recruitment strategy:** Mailed invitation letters and made followup calls to people aged 70 years and older registered on the Autralian electoral role for the area, local publicity, and recruitment by general practitioners	**Inclusion:** Living in their own home or leasing similar accomodation and allowed to make modifications **Exclusion:** Not expecting to live in area for 2 years; regular to moderate physical activity with a balance improvement component in the previous 2 months; could not walk 10-20 meters without rest, help, or having angina; severe respiratory or cardiac disease; psychiatric illness prohibiting participation; dysphasia; recent major home modifications; education and language adjusted score >4 on the short portable mental status questionnaire; no physician approval	**Mailed invitations:** 11,120 **Assessed for eligibility:** 1,967 **Excluded:** 860 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 1,107 **Continued:** 1,090 **IG (exercise(ex)):** 135 **IG (home hazard(hh)):** 136 **IG (vision(v)):** 139 **IG (ex+hh):** 135 **IG (ex+v):** 136 **IG (v+hh):** 137 **IG (all):** 135 **CG:** 137 **Age: mean (SD)** All: 76.1 (5.0) Range across Gs: 75.4-76.5 (4.7-5.5) **Female:** All: 59.8% Range across Groups: 55.4-68.4% **Ethnicity:** NR **SES:** NR **Fall History:** NR for past year, reported for last month	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 4*	**Category:** Multiple interventions - exercise, home hazard modification, vision, and combinations of those **Description** **IG (ex):** Exercise class and home exercises designed to improve flexibility, leg strength, and balance **IG (hh):** Home hazards were removed or modified **IG (v):** If vision tested below predetermined criteria, referred to usual eye care provider to whom vision assessment results were given; those who did not receive the intervention got the Australian Optometrist Association's brochure on eye care for those aged over 40 **CG:** Waitlist control **Format (single or combo, individual or group, where)** **IG (ex):** Single or combo with hh and/or v, group class supplemented by home exercises, class location NR **IG (hh):** Single or combo with ex and/or v, individual, in-home **IG (v):** Single or combo with ex and/or hh, individual, at usual provider's location **CG:** NA **Intensity (frequency and duration)** **IG (ex):** 1 hour a week, 15 weeks **IG (hh):** 1 visit by city home maintenance worker **IG (v):** 1 assessment and referral if tested below criteria **CG:** NA **Delivery** **IG (ex):** Instructor NR **IG (hh):** City maintenance staff **IG (v):** Trained assessor **CG:** NA	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** At baseline only **Length of followup:** At baseline only	**Definition of fall:** NR **Rate or risk of falls/fallers:** Self-report montly postcard, phoned if not returned by 5 days after the end of the month, phoned if reported a fall **Length of followup:** 18 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 4*	**Falls Efficacy Scale:** At baseline only **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** At baseline and 18 months, only measured random sample of 442 at 18 months for cost purposes **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Spring gauge to measure quadricep strength, postural sway, maximal balance range, coordinated stability, visual acuity, random dot stereo butterfly test, crossed disparity circles, field of view **Length of followup:** 18 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: 15 (NR which groups) **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 4*	**ADLs:** NR **IADLs:** NR beyond baseline **Among high risk:** NR	**# falls/# in group:** NR **# (%) fallers:** **Rate ratio** IG (ex): 76/135 (56.3%) 0.82 (0.70, 0.97) IG (v): 84/139 (60.4%) 0.89 (0.75, 1.04) IG (hh): 78/136 (57.4%) 0.92 (0.78, 1.08) IG (ex+v): 66/136 (48.5%) 0.73 (0.58, 0.91) IG (ex+hh): 72/135 (53.3%) 0.76 (0.60, 0.95) IG (v+hh): 78/137 (56.9%) 0.81 (0.65, 1.02) IG (all): 65/135 (48.1%) 0.67 (0.51, 0.88) CG: 87/137 (63.5%) Ref 1.00 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Day 2002[61] Fair *Study also located in Appendix C Tables 2 & 4*	**Falls Efficacy Scale:** NR beyond baseline **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** Australians

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Green 2002[94] Fair	**Location:** UK **Target population:** patients >50 who had mobility problems (including a recent fall) 1 year after stroke **Recruitment strategy:** identified patients from hospital and community therapy stroke registers. A research physiotherapist recruited and assessed patients at their homes. ~~no further info.~~	**Inclusion:** >50 years, had a stroke at least 1 year previously, and had associated persisting mobility problems, defined as: use of a mobility aid (other than a walking stick); a fall in the previous 3 months; unable to manage stairs, slopes, or uneven surfaces independently; or a slower gait speed over 10 m than expected for age group **Exclusion:** another cause than stroke for the mobility problem, dementia (a score of less than 7 on the abbreviated mental test), severe comorbidity, bedfast, or had PT in the previous 6 months	**Assessed for eligibility:** 359 **Excluded:** 189 **Not meeting inclusion criteria:** 177 **For other reasons:** 10 refused consent and 2 were not available for treatment **Randomized:** 170 **IG:** 85 **CG:** 85 **Age: mean (SD)** IG: 71.5 (8.7) CG: 73.5 (8.3) **Female:** IG: 42% CG: 46% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** Cerebrovascular Disorder - Stroke (A502) **Definition:** Had a stroke at least 1 year previously **Proportion:** 100% **Instrument:** Identified from hospital and community therapy stroke registers

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Green 2002[94] Fair	**Category:** Exercise / PT: PT **Description**: **IG:** Community PT done by an established community PT service (13 staff) as part of their usual work. Initially, all patients were assessed by a PT and then treated with a problem solving approach at home or in outpatient rehabilitation centres **CG:** No treatment **Format (single or combo, individual or group, where)** **IG:** Single, individual; assessed at a PT center, intervention at home or in outpatient rehabilitation centres **CG:** NA **Intensity (frequency and duration)** **IG:** Maximum contact period of 13 weeks with a minimum of three contacts per patient: median number of treatments per patient was 3 (IQR 2–7, range 0–22) and the mean duration of every treatment was 44 min (SD 21, range 10–90) **CG:** NA **Delivery** **IG:** An established community PT service (13 staff) **CG:** NA	**Fall-related fracture:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality** NR **ADLs:** daily activity (Barthel index scores): range 0–20, higher scores indicate greater independence **IADLs:** NR **Length of followup:** 9 months	**Definition of fall:** NR **Rate or risk of falls/fallers: #** of falls assessed in-home by a researcher at baseline, 3, 6, and 9 months **Length of followup:** 9 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Green 2002[94] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** Gait speed was measured up to 3 times over 10 meters, mean time of the last 2 walks used in analysis. Assessed at baseline, 3, 6, and 9 months **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Rivermead mobility index, Frenchay activities index, hospital anxiety and depression scale, depression, General Health Questionnaire 28 **Length of followup:** 9 months	**Fall-related injury** NR **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality** IG: 4/85 CG: 5/85 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Green 2002[94] Fair	**ADLs:** IG CG n outcome msr n outcome msr p Baseline 85 18 (16–19) 85 18 (16–19) 3 months 81 18 (16–19) 80 18 (16–19) 0.497 6 months 73 18 (16–19) 77 18 (16–19) 0.888 9 months 72 18 (16–19) 74 18 (16–20) 0.478 **IADLs:** NR **Among high risk:** All are high risk	**# falls/# in group:** NR **# (%) fallers (calc):** IG CG n, outcome n, outcome p Baseline–3 months 81 13 (16%) 809 (11%) NR 3–6 months 73 16 (22%) 77 15 (19%) NR 6–9 months 72 17 (24%) 74 10 (14%) NR Overall 85 30 (35%) 85 23 (27%) 0.263 **# (%) frequent fallers (2+ falls):** NR **Among high risk:** All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Green 2002[94] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk mean (SD):** Gait speed was 2·6 m/min (0·30–4·95) (p=0·027), higher in the treatment group at 3 months; not at 6-months' and 9-months' follow-up, and no overall treatment effect (p=0·135) IG / CG n m/min / n m/min / p Baseline 83 23·2 (10·1) / 85 24·4 (12·4) / NR 3 months 78 25·5 (12·6) / 77 24·9 (13·8) / 0.027 6 months 69 26·0 (13·1) / 73 25·3 (13·6) / NS 9 months 64 25·4 (14·5) / 67 25·8 (13·6) / NS **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** stroke victims only, 50 and up; in UK

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Li 2005[116] Fair	**Location:** Portland, OR **Target population:** Inactive adults aged 70 years and older **Recruitment strategy:** Patients aged 70 years and older in the Legacy Health System were mailed a letter and then telephoned. Those passing the phone screen were scheduled for an assessment	**Inclusion:** Aged 70 years and older, inactive (no regular, moderate or strenuous PA program in last 3 mos), ambulatory, free of chronic medical problems that would limit participation in low- to moderate-intensity exercise, no cognitive impairments **Exclusion:** NR	**Assessed for eligibility:** 669 were age-eligible **Excluded:** 413 **Not meeting inclusion criteria:** 67 **For other reasons:** 346 **Randomized:** 256 **IG:** 125 **CG:** 131 **Age: mean (SD)** IG: 76.94 (4.69) CG: 77.99 (5.14) **Female:** IG: 70% CG: 70% **Ethnicity:** IG: 90% White CG: 91% White **SES:** *High school education* IG: 94% CG: 90% *Household income < $35,000* IG: 64% CG: 70% **Fall History, *within previous 3 months*:** IG: 53 (42%) CG: 41 (31%) p=0.08	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Li 2005[116] Fair	**Category:** Exercise **Description** **IG:** Tai chi classes following the 24-Form Yang style and synchronized breathing **CG:** Stretching classes focused on the upper body accompanied by deep breathing and relaxation **Format (single or combo, individual or group, where)** **IG:** Single, group, location NR **CG:** Single, group, location NR **Intensity (frequency and duration)** **IG:** 1-hour class, 3 times per week for 26 weeks **CG:** 1-hour class, 3 times per week for 26 weeks **Delivery** **IG:** Tai Chi instructors **CG:** Exercise instructors	**Fall-related fracture:** NR **List of additional injury measures:** Injurious falls and falls resulting in medical care **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** When you land on the floor or the ground, or fall and hit objects like stairs or pieces of furniture, by accident **Rate or risk of falls/fallers:** Self-report on daily falls calendars collected on a monthly basis **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Li 2005[116] Fair	**Falls Efficacy Scale:** Survey of Activities and Fear of Falling in the Elderly (SAFFE) taken at baseline, 3, 6 and 12 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** Taken at baseline, 3, 6 and 12 months **6-meter timed walk:** NR **Functional reach:** Taken at baseline, 3, 6 and 12 months **Berg Balance Scale:** Taken at baseline, 3, 6 and 12 months **List of additional measures:** Dynamic gait index (DGI), 50-foot speed walk, single leg standing tests **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Li 2005[116] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**Fall** **# falls/# in group:** *During 6-month intervention** IG: 38/95 CG: 73/93 *During 6 months post-intervention* IG: 18/95 CG: 49/93 **# (%) fallers:** *During 6-month intervention** IG: 27 (28) CG: 43 (46) *During 6 months post-intervention* IG: 15/95 (16%) CG: 43/93 (46%) **# (%) frequent fallers (2+ falls) (calc):** *During 6-month intervention** IG: 7 (7) CG: 21 (22) *During 6 months post-intervention* IG: NR CG: NR **Among high risk:** NA *****Based on all available ppts who provided fall data during the 6-month intervention period

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Li 2005[116] Fair	**Falls Efficacy Scale mean score (SD):** IG / CG / P Baseline 0.62 (0.28) / 0.60 (0.32) / NR 3 months 0.37 (0.31) / 0.54 (0.35) / NR 6 months 0.28 (0.33) / 0.52 (0.37) / <0.001 12 months 0.30 (0.33) / 0.56 (0.35) / 0.05 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach mean inches (SD):** IG / CG / P Baseline 9.45 (2.41) / 8.90 (2.83) / NR 3 months 10.03 (2.29) / 8.80 (2.63) / NR 6 months 10.73 (2.48) / 8.69 (2.71) / <0.001 12 months 10.62 (2.49) / 8.38 (2.55) / 0.01 **Berg Balance Scale mean score (SD):** IG / CG / P Baseline 45.67 (3.92) / 46.18 (4.53) / NR 3 months 48.65 (4.02) / 47.09 (4.56) / NR 6 months 49.28 (4.15) / 47.15 (4.22) / <0.001 12 months 48.69 (4.23) / 45.86 (5.09) / 0.04 **Among high risk:** NR	**Adverse effects:** NR **External validity:** Pretty good for aged 70 and older inactive. 5/13 assessors not blinded, possible bias.

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Logghe 2009[114] Fair	**Location:** the Netherlands **Target population:** Aged ≥70 years living at home with a high risk of falling **Recruitment strategy:** Patient registration files of participating general practitioners were searched for keywords (e.g. fall and dizziness). Invited by mail and screened for eligibility by phone	**Inclusion:** Aged ≥70 years, living at home, and having a high fall risk as defined by 1+ fall incidents in the previous year or 2+ of the following self-reported risk factors: disturbed balance, mobility problems, dizziness, and the use of benzodiazepines or diuretics **Exclusion:** NR	**Assessed for eligibility:** 5,931 **Excluded:** 5,662 **Not meeting inclusion criteria:** 177 **For other reasons:** 5,485 **Randomized:** 269 **IG:** 138 **CG:** 131 **Age: mean (SD)** IG: 77.5 (4.7) CG: 76.8 (4.6) **Female:** IG: 69.6% CG: 72.5% **Ethnicity:** NR **SES:** < *High school education (calc)* IG: 29% CG: 34.5% **Fall History:** IG: 63.8% CG: 60.3%	**Risk category:** Other - Various (A599) **Definition:** 1+ fall incidents in the previous year or 2+ of the following self-reported risk factors: disturbed balance, mobility problems, dizziness, and the use of benzodiazepines or diuretics **Proportion:** 100% **Instrument:** Self-report on short telephone survey

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Logghe 2009[114] Fair	**Category:** Exercise - Tai Chi Chuan **Description** **IG:** Tai Chi Chuang training and falls prevention brochure **CG:** Falls prevention brochure and usual care, could use or apply for available services in the are as before **Format (single or combo, individual or group, where)** **IG:** Single, groups of 7-14 people plus asked to do positions at home, location of group NR **CG:** NR **Intensity (frequency and duration)** **IG:** Class 1 hour twice per week for 13 weeks, asked to do positions at home 15 minutes twice per week **CG:** NR **Delivery** **IG:** Professional Tai Chi Chuan instructors experienced with older people **CG:** NR	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Daily falls calendars returned monthly by mail, followed up by phone if participant did not turn in a calendar **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Logghe 2009[114] Fair	**Falls Efficacy Scale:** Taken at 3 and 12 months by a research assistant, and at 6 months by mail **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** Taken at 3 and 12 months by a research assistant **List of additional measures:** Physical Activity Scale for the Elderly, Groningen Activity Restriction Scale, blood pressure and heart rate at rest, FEV and PEF by spirometer, use of healthcare services **Length of followup:** 1 year	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: IG: 1 CG: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: All are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Logghe 2009[114] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** IG: 115/138 CG: 90/131 **# (%) fallers:** IG: 58 (42%) CG: 59 (45%) Unadjusted HR (95% CI): 1.16 (0.86-1.56) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** *# falls/# in group among those with 1+ falls in previous year* IG: 95/88 CG: 59/79 Adjusted HR (95% CI): 1.38 (0.98-1.95) *# (%) fallers among those with 1+ falls in previous year* IG: 44 (50%) CG: 40 (51%)

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Logghe 2009[114] Fair	**Falls Efficacy Scale:** *Mean score (SD)* IG / CG / P Baseline 6.0 (5.0) / 5.7 (5.0) / 0.47 3 months 4.9 (4.4) / 5.8 (5.3) / 0.38 12 months 5.2 (4.8) / 5.7 (4.7) / 1.00 **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** *Mean score (SD)* IG / CG / P Baseline 51.8 (4.3) / 51.2 (5.0) / 0.45 3 months 51.9 (4.0) / 51.4 (4.4) / 0.30 12 months 50.4 (5.1) / 50.2 (5.1) / 0.90 **Among high risk:** All are high risk	**Adverse effects:** NR **External validity:** At high risk for falling, 70+ years old

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Lord 1995[108] PPTs from Randwick Falls and Fractures Study Fair	**Location:** Sydney, Australia **Target population:** Women aged 60 years and older **Recruitment strategy:** In 1992 from the Randwick Falls and Fractures Study conducted between 1988-1991. They were recruited from 64 randomly selected Census collector's districts in the Randwick local government area	**Inclusion:** Lived in the district, aged 65 years and older **Exclusion:** Not living at the dwelling at the time of the study, no or very little English, ill and/or immobile, in the hospital, medical condition involving the neuromuscular, skeletal, or dardiovascular system that precluded taking part in an exercise program, were already attending exercise classes of equivalent intensity to the study intervention	**Assessed for eligibility:** NR **Excluded:** NR **Not meeting inclusion criteria:** NR 43 **For other reasons:** NR 69 **Randomized:** 374 **IG:** 187 **CG:** 187 **Excluded post-rand:** 112 **Not meeting inclusion criteria:** IG: 28, CG: 15 **For other reasons:** IG: 41, CG: 28 **Included:** 197 **IG:** 100 **CG:** 97 **Age: mean (SD)** IG: 71.6 (5.5) CG: 71.7 (5.3) **Female:** 100% **Ethnicity:** NR **SES:** NR **Fall History:** *During 12 months of initial study* IG: 28% CG: 28.9%	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Lord 1995[108] PPTs from Randwick Falls and Fractures Study Fair	**Category:** Exercise **Description** **IG:** Aerobic exercises, strengthening exercises, and activities for flexibility, endurance, and hand-eye and foot-eye coordination **CG:** NR **Format (single or combo, individual or group, where)** **IG:** Single, group classes, at a community hall and a public hospital **CG:** NR **Intensity (frequency and duration)** **IG:** 1 hour sessions 2 times per week for 4, 10-12 week terms **CG:** NR **Delivery** **IG:** NR **CG:** NR	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** NA	**Definition of fall:** an event that resulted in a person coming to rest unintentionally on the ground or other lower level, not as the result of a major intrinsic event or an overwhelming hazard **Rate or risk of falls/fallers:** Questionnaires were mailed every 2 months, followup phone calls to those who did not return the questionnaires **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Lord 1995[108] PPTs from Randwick Falls and Fractures Study Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Muscle strength, reaction time, neuromuscular control, body sway **Length of followup:** 1 year	**Fall-related injury** **Peripheral fracture rate per person year:** NR **# peripheral fractures:** NR **# people sustaining peripheral fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Lord 1995[108] PPTs from Randwick Falls and Fractures Study Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NA	**# falls/# in group:** NR **# (%) fallers:** IG (overall): 26 (34.7) CG: 33 (35.1) RR 0.99 (0.65, 1.50) IG (attended <75% of classes): 12 (44.4) IG (attended ≥75% of classes): 14 (29.2) RR 0.83 (0.49, 1.40) **# (%) frequent fallers (2+ falls):** IG (overall): 8 (10.7) CG: 12 (12.8) RR 0.84 (0.36, 1.94) IG (attended <75% of classes): 4 (14.8) IG (attended ≥75% of classes): 3 (6.3) RR 0.49 (0.15, 1.65) **Among high risk:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Lord 1995[108] PPTs from Randwick Falls and Fractures Study Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** NR **External validity:** Australian women

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Luukinen 2007[93] Fair	**Location:** City of Oulu, Finland **Target population:** Home-dwelling older adults **Recruitment strategy:** Recruited from the city's home care service while they were examined in their homes between October 16, 2000 - March 26, 2001	**Inclusion:** Aged 85 and older and at least one of the following risk factors measured at baseline: >2 falls during the year preceding baseline, frequent feelings of loneliness, poor self-rated health, poor visual acuity, poor hearing, depression, poor cognition, impaired balance, impaired chair rise and slow walking speed **Exclusion:** NR	**Assessed for eligibility:** 555 **Excluded:** 69 **Refused:** 0 **Did not meet inclusion criteria:** 69 **Randomized:** 486 **IG:** 243 **CG:** 243 **Mean age (SD)** IG: 88 (3) CG: 88 (3) **Female** IG: 78% CG: 80% **Ethnicity:** NR **SES:** NR **Fall History:** NR	**Risk category:** Other - Various (A599) **Definition:** >2 falls during the year preceding baseline, frequent feelings of loneliness, poor self-rated health, poor visual acuity, poor hearing, depression, poor cognition, impaired balance, impaired chair rise and slow walking speed **Proportion** IG CG ≥2 falls during previous year 27% 27% Slow walking speed 27% 20% Impaired chair stand 35% 38% Impaired balance 47% 50% Trouble with vision 21% 26% **Instrument:** Loneliness, poor self-rated health, poor visual acuity and poor hearing were assessed via questionnaire. Depression was assessed according to the short version of the Geriatric Depression Scale. Cognitive status was assessed according to the MiniMental State Examination test and poor cognitive status was defined as a score of <20. Balance was assessed by the nurse as an ability to stand with the feet in a tandem position for 10 seconds. Lower extremity function was assessed by an ability to rise up from a chair without using one's arms. Walking speed was measured during a 2.4-meter walk, and slow walking speed was defined as <0.34 m/s.

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Luukinen 2007[93] Fair	**Category:** Exercise/physical therapy **Description** **IG:** Individual intervention plans based on risk factor assessment with exercise prioritized. Exercise programs were either already existing or novel. Family physician visit to assess feasibility of written plan **CG:** Usual care **Format (single or combo, individual or group, where)** **IG: Combination of strategies for individual and group exercises.** Walking exercises. Home exercises in a standing position if possible, sitting if cannot perform standing, lying if cannot perform sitting or standing. Group exercises in small groups and rehabilitation for war veterans. Self-care exercises aimed to improve management of personal daily activities **CG:** Usual care **Intensity (frequency and duration)** **IG:** Three times daily with 5-15 repetitions for home exercises. Group and self-care exercises NR. Duration NR **CG:** Usual care **Delivery** **IG:** Physiotherapist and occupational therapist **CG:** Usual care	**Fall-related fracture:** NR **List of additional injury measures:** Self-report recorded by a research nurse via phone call every other month and validated by examining medical records for a median follow up time of 16 months. Fall-related injuries included fractures, dislocations and soft tissue injuries needing suturing and even more severe injuries **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 16 months	**Definition of fall:** unexpected event when a person fell to the ground from an upper level or the same level. Accidents with a moving car or bicycle not included **Rate or risk of falls/fallers:** Self-report recorded by a research nurse via phone call every other month for a median follow up time of 16 months **Length of followup:** 16 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Luukinen 2007[93] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Grip strength, body mass index, blood pressure, cognitive status, balance, ability to rise from a chair, walking speed and number of medications **Length of followup:** 16 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality:** IG: 48 CG: 50 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Luukinen 2007[93] Fair	**ADL:** NR **IADL:** NR **Among high risk:** NA	**Falls per person year (95% CI):** IG / CG Prior: 1.16 (1.02-1.32) / 1.02 (0.89-1.17) During: 1.15 (1.03-1.29) / 1.23 (1.10-1.37) **# falls/# in group:** NR **# (%) fallers:** IG: 126 (58) CG: 136 (62) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NA

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Luukinen 2007[93] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NA	**Adverse effects:** NR **External validity:** ~25% attrition after baseline

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Morgan 2004[113] Fair	**Location:** Miami, FL **Target population:** Aged 60 years and older who had either a hospital admission or bed rest for ≥2 days in the past month **Recruitment strategy:** Identified through inpatient records at the Miami VA Medical Center, registered nurse or physical therapist at their assisted living facility or outpatient physical therapy clinic	**Inclusion:** Aged 60 years and older and had either a hospital admission or bed rest for ≥2 days in the past month **Exclusion:** Medical conditions that made it unsafe for them to participate in the exercise program, scored < 23 on mini-mental state examination, required use of oxygen therapy at home, had planned future inpatient evaluations or treatments within the next 2 months, required human assistance, a wheelchair or artificial limbs to ambulate	**Assessed for eligibility:** 433 **Excluded:** 139 **Not meeting inclusion criteria:** 113 **For other reasons:** 26 did not consent **Randomized:** 294 **Lost before BL:** 49 (which G NR) **Incomplete data:** 16 (IG: 8, CG: 8) **IG:** 119 **CG:** 110 **Age: mean (SD)** IG: 81.0 (7.6) CG: 80.1 (7.4) **Female (calc):** IG: 72.3% CG: 69.1% **Ethnicity:** NR **SES:** NR **Fall History:** IG: 38.7% CG: 32.7%	**Risk category:** Other: Recent Hospitalization/Bed Rest (A599) **Definition:** Had either a hospital admission or bed rest for ≥2 days in the past month **Proportion:** 100% **Instrument:** Inpatient records, or referral from registered nurse or physical therapist

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Morgan 2004[113] Fair	**Category:** Exercise **Description** **IG:** SAFE-GRIP program. Exercise sessions designed to directly affect neuromuscular functioning (i.e., muscle strength, joint flexibility), balance, and gait **CG:** Instructed to continue their usual activities **Format (single or combo, individual or group, where)** **IG:** Single, groups of 5, location NR **CG:** N/A **Intensity (frequency and duration)** **IG:** 45-minute sessions 3 times per week for 8 weeks **CG:** N/A **Delivery** **IG:** A physical therapist assisted by a physical therapy assistant **CG:** N/A	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** Physical Function (PF) subscale taken only at baseline **EuroQOL:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** none	**Definition of fall:** NR **Rate or risk of falls/fallers:** Self-report on postcard diaries returned by mail every 2 weeks **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Morgan 2004[113] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** Only at baseline **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NA	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** Only taken at baseline **EuroQol:** NR **Among high risk**: NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Morgan 2004[113] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** NR **# (%) fallers (calc):** IG: 34 (28.6) CG: 34 (30.9) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** *Univariate Association with Fall Risk* *High (≥55) vs Low (<55) SF-36 PF subscale score** ß (SE): -1.07 (0.27) HR: 0.34 P≤0.0001 *PPTs not assigned to high and low PF until after randomization

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Morgan 2004[113] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** Only taken at baseline **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** NR **External validity:** Applicable to people with recent hospitalization or bed rest PPT's baseline level of activity unknown

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Robertson 2001[141] West Auckland Trial Fair	**Location:** West Auckland, New Zealand **Target population:** Aged 75 years and older **Recruitment strategy:** Mailed letter to people from computerised registers at 17 general practices	**Inclusion:** Aged 75 years and older **Exclusion:** Inability to walk around own residence or receiving physiotherapy at time of recruitment; unable to understand requirements of the trial	**Assessed for eligibility:** 530 (590 less the 60 unable to be reached) **Excluded:** 290* **Not meeting inclusion criteria:** 6 **For other reasons:** 120 refused, 69 health problem, 22 already active, 13 moving home; unable to contact **Doesn't add up* **Randomized:** 240 **IG:** 121 **CG:** 119 **Age: mean (SD)** IG: 80.8 (3.8) CG: 81.1 (4.5) **Female (calc):** IG: 68% CG: 67% **Ethnicity:** NR **SES:** NR **Fall History:** IG: 36% CG: 38%	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Robertson 2001[141] West Auckland Trial Fair	**Category:** Exercise **Description** **IG:** Muscle strengthening and balance retraining that progressed in difficulty, and a walking plan **CG:** Usual care (specifics NR) **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** NR **Intensity (frequency and duration)** **IG:** Prescribed three, 30-minute sessions per week for strength and balance exercises, walk twice per week for a year. Nurse visited weeks 1, 2, 4 and 8 with a booster visit at 6 months **CG:** NR **Delivery** **IG:** District nurses with one week training by physiotherapist **CG:** NR	**Fall-related fracture:** Fractures not reported separately **List of additional injury measures:** Serious and moderate fall injury reported montly by mailed calendars, follow-up call to record circumstances **QOL** **SF-12:** at baseline only **SF-36:** NR **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** 1 year	**Definition of fall:** Unintentionally coming to rest on the ground, floor, or other lower level **Rate or risk of falls/fallers:** Monthly self-report calendars by mail, follow-up call to record circumstances of the falls **Length of followup:** 1 year

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Robertson 2001[141] West Auckland Trial Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** NR **Length of followup:** NR	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: **IG:** 1/121 **CG:** 6/119 **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Robertson 2001[141] West Auckland Trial Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**Falls per 100 person years:** IG: 68.5 CG: 100.6 p=NR **# falls/# in group:** IG: 80/121 CG: 109/119 p=0.019 **# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Robertson 2001[141] West Auckland Trial Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** One participant fell while exercising as instructed. **External validity:** High attrition from assessment Subgroup analysis showed exercise program effective in those aged ≥80 years but not in those aged 75-79

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Rubenstein 2000[100] Fair	**Location:** California **Target population:** Ambulatory men aged 70 years or older with at least one of the following risk factors: lower extremity weakness, impaired gait or balance, or >1 falls in the last 6 months **Recruitment strategy:** Informational flyers mailed, respondants screened by phone	**Inclusion:** NR **Exclusion:** Exercised regularly, severe cardiac or pulmonary disease, terminally ill, severe joint pain, dementia, medically unresponsive depression, progressive neurologic disease	**Assessed for eligibility:** 695 **Excluded:** 636 **Not meeting inclusion criteria:** 535 **For other reasons:** 101 (refused) **Randomized:** 59 **IG:** 31 **CG:** 28 **Age: mean (SD)** IG: 76.4 (4.9) CG: 74.4 (43.4)* *SD appears to be a typo **Female:** 0% **Caucasian:** IG: 97% CG: 93% **<12 years education:** IG: 58.1% CG: 67.9% **Fall History:** IG: 48.4% CG: 64.3%	**Risk category:** Gait and/or balance impairment (A507) **Definition:** Lower extremity weakness, impaired gait or balance, or 1+ falls in the last 6 months **Proportion:** 100% **Instrument:** Lower extremity weakness: Manual muscle score of ≤ 4/5 in ≥ 1 leg flexor or extensor muscle Impaired gait: Performance Oriented Mobility Index (POMI) gait subscale score <10/12 Impaired balance: POMI balance subscale score <14/16

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Rubenstein 2000[100] Fair	**Category:** Exercise **Description** **IG:** Exercise classes focused on strength training, endurance training and balance training **CG:** No treatment **Format (single or combo, individual or group, where)** **IG:** Single, group, Sepulveda VA Ambulatory Care Center **CG:** N/A **Intensity (frequency and duration)** **IG:** 3, 90-minute sessions per week for 12 weeks **CG:** NA **Delivery** **IG:** Exercise physiology graduate students **CG:** NA	**Fall-related fracture:** Question ppts every 2 weeks by phone (CG) or at the exercise classes (IG) **List of additional injury measures:** Collected information on "injuries" in general **QOL** **SF-12:** NR **SF-36:** At BL and at 1 week post-intervention **EuroQol:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** At baseline **Length of followup:** 12 weeks	**Definition of fall:** NR **Rate or risk of falls/fallers:** Question ppts every 2 weeks by phone (CG) or at the exercise classes (IG) **Length of followup:** 12 weeks

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Rubenstein 2000[100] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Sit-to-stand repititions, 6-min walk, POMI gait and balance, one-leg balance, Yale activity survey **Length of followup:** 12 weeks	**Fall-related injury** **Peripheral fracture rate per person year:** 0 (both groups) **# peripheral fractures:** 0 (both groups) **# people sustaining peripheral fractures:** 0 (both groups) **# people sustaining multiple events:** 0 (both groups) **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** *Physical Functioning* IG CG Baseline 59.6±24.8 62.2±21.0 Post-test 65.0±17.4 60.6±20.3 ANOVA (group x time) *F* (1,53) = 3.2 p=0.08 *Role limits-physical* IG CG Baseline 66.9±36.7 53.7±38.4 Post-test 75.0±34.0 57.4±35.2 ANOVA (group x time) *F* (1,53) = 0.36 p=0.55 *Health perceptions* IG CG Baseline 60.0±19.1 58.9±19.5 Post-test 64.3±18.2 61.1±19.9 ANOVA (group x time) *F* (1,53) = 0.26 p=0.61 *Health question* IG CG Baseline 51.8±26.3 50.9±20.2 Post-test 67.9±21.4 46.3±22.7 ANOVA (group x time) F(1,53) = 8.5 p=0.005 **EuroQol:** NR **Among high risk**: all are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Rubenstein 2000[100] Fair	**ADLs:** NR **IADLs:** NR **Among high risk:** NR	**# falls/# in group:** IG: 13/31 CG: 14/28 **# (%) fallers (calc):** IG: 12/31(38.7) CG: 9/28(32.1) **# (%) frequent fallers (2+ falls):** NR **Among high risk:** all are high risk

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Rubenstein 2000[100] Fair	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** NR **External validity:** Small sample size. Are they all vets? Short follow-up period

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Voukelatos 2007[115] Good	**Location:** Sydney, Australia **Target population:** Community-dwelling adults aged 60 and over **Recruitment strategy:** Advertisements were placed in local community newspapers in central and southeastern Sydney between June 2001 - March 2003	**Inclusion:** Aged 60 and older, living in the community, had not practiced tai chi in the previous 12 months **Exclusion:** Degenerative neurological condition such as Parkinson's disease, dementia, a severely debilitating stroke, severe arthritis, or marked vision impairment or unable to walk across a room unaided	**Assessed for eligibility:** 977 **Excluded** Not eligible: 275 Refused: NR **Randomized:** 702 **IG:** 353 **CG:** 349 **Mean age (SD):** 69 (6.5) IG: 69 CG: 69 **Female:** 84% **IG:** 85% **CG:** 83% **Ethnicity:** NR **Level of education:** IG CG <Intermediate 16% 12% Intermediate 43% 41% Secondary 13% 14% Technical college 14% 16% University 14% 17% **1+ Falls in the previous 12 months:** IG: 31% CG: 36%	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR **Risk category:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Voukelatos 2007[115] Good	**Category:** Exercise/Physical Therapy (3 D - tai chi) **Description** **IG:** Tai chi class, generally Sun style, ppts paid AU$44 to increase the likelihood of attendance **CG:** Waitlist control, ppts were asked not to do tai chi for 24 weeks and at the end were offered the same tai chi class **Format (single or combo, individual or group, where)** **IG:** Single intervention, groups of 8-15 ppts, 24 community venues, format not modified for the study **CG:** N/A **Intensity (frequency and duration)** **IG:** One one-hour class per week for 16 weeks **CG:** N/A **Delivery** **IG:** tai chi instructors either had ≥5 years experience or completed an accredited tai chi trainers' course, and taught tai chi or other gentle exercise programs to older people. Instructors were recuited from the community venues and allocated to classes based on availability **CG:** N/A	**Fall-related fracture:** NR **List of additional injury measures:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Mortality:** NR **Disability** **ADLs:** NR **IADLs:** NR **Length of followup:** N/A	**Definition of fall:** unintentionally coming to rest on ground, floor, or other lower level **Rate or risk of falls/fallers:** Daily self-report of falls over 24 weeks recorded on a monthly calendar mailed in at the end of each month **Length of followup:** 6 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Voukelatos 2007[115] Good	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Swaymeter, lateral stability, choice stepping **Length of followup:** 4 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality:** NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk:** N/A

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Voukelatos 2007[115] Good	**ADLs:** NR **IADLs:** NR **Among high risk:** N/A	**# falls/# in group:** NR **# (%) fallers (calc):** IG CG 16 weeks 61 (17.6) 70 (20.8) 24 weeks 71 (20.5) 81 (24.0) **# (%) frequent fallers (2+ falls) (calc):** IG CG 16 weeks 8 (2.3) 13 (3.9) 24 weeks 15 (4.3) 27 (8.0) **Among high risk:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Voukelatos 2007[115] Good	**Falls Efficacy Scale:** NR **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** N/A	**Adverse effects:** NR **External validity:** Mostly women **Fall rate:** *Incident Rate Ratios, Relative Risks, and Hazard Ratios* Unadjusted / Adjusted 16 weeks # falls, IRR (95% CI) p-value 0.72 (0.48-1.10) 0.10 / 0.73 (0.50-1.07) 0.11 ≥1 falls, RR (95%CI) p-value 0.85 (0.62-1.16) 0.30 / NR ≥2 falls, RR (95% CI) p-value 0.54 (0.23-1.26) 0.10 / NR ≥1 falls, HR (95% CI) p-value 0.72 (0.51-1.01) 0.06 / 0.72 (0.50-1.03) 0.07 ≥2 falls, HR (95% CI) p-value 0.33 (0.14-0.78) 0.01 / 0.25 (0.08-0.83) 0.02 24 weeks # falls, IRR (95% CI) p-value 0.67 (0.46-0.96) 0.03 / 0.67 (0.47-0.94) 0.02 ≥1 falls, RR (95%CI) p-value 0.86 (0.65-1.14) 0.28 / NR ≥2 falls, RR (95% CI) p-value 0.54 (0.28-0.96) 0.05 / NR ≥1 falls, HR (95% CI) p-value 0.67 (0.49-0.93) 0.02 / 0.66 (0.47-0.92) 0.02 ≥2 falls, HR (95% CI) p-value 0.33 (0.14-0.78) 0.01 / 0.27 (0.12-0.59) 0.001

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics	KQ4 results: High risk for falls
Wolf 1996[107] Fair	**Location:** Atlanta **Target population:** Aged 70 and older **Recruitment strategy:** Local advertisements and direct contact with residents in an independent living facility	**Inclusion:** Aged 70 years and older; live in unsupervised environments; ambulatory **Exclusion:** Debilitating condition or profound visual deficits that could compromise balance or ambulation	**Assessed for eligibility:** 977 **Excluded:** 777 **Not meeting inclusion criteria:** NR **For other reasons:** NR **Randomized:** 200 **IG(tai chi (TC):** 72 **IG(Balance training (BT):** 64 **CG:** 64 **Age: mean (SD)** IG(TC): 76.9 (4.8) IG(BT): 76.3 (5.1) CG: 75.4 (4.1) **Female:** IG(TC): 81% IG(BT): 77% CG: 84% **Ethnicity:** NR **SES:** *Education* IG(TC) IG(BT) CG High School 20.8% 28.1% 20.3% College 56.9% 45.3% 51.6% Grad School 22.2% 26.6% 28.1% **Fall History:** IG(TC): 42% IG(BT): 31% CG: 34% p=0.43	**Risk category:** NR **Definition:** NR **Proportion:** NR **Instrument:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	Intervention(s) evaluated	KQ1 and KQ1a outcome measures: Fall-related injury, mortality, quality of life, and disability	KQ2 & KQ2a outcome measures: Rate or risk of falls and fallers
Wolf 1996[107] Fair	**Category:** Exercise **Description** **IG(TC):** Tai chi classes **IG(BT):** Ppts stood on platforms and moved cursor on a screen into targets by moving center of mass without foot displacement **CG:** Educational classes with topics of interest to older people **Format (single or combo, individual or group, where)** **IG(TC):** Single, groups of 12, location NR **IG(BT):** Single, individual, location NR **CG:** Single, groups of 10-12, location NR **Intensity (frequency and duration)** **IG(TC):** 2 times per week (45 mins individual time) for 15 weeks, practiced encouraged in between **IG(BT):** 1 time per week (45 mins individual time) for 15 weeks **CG:** 1 time per week (45 mins individual time) for 15 weeks **Delivery** **IG(TC):** Instructor **IG(BT):** NR **CG:** Gerontological nurse/researcher	**Fall-related fracture:** Self-report on monthly calendar with monthly phone calls from project staff, verified by nurse coordinator **List of additional injury measures:** Injurious fall **QOL** **SF-12:** NR **SF-36:** NR **EuroQOL:** NR **Mortality**: NR **Disability** **ADLs:** NR **IADLs:** Lawton and Brody IADL scale at baseline, post-intervention and 4 months **Length of followup:** 4 months	**Definition of fall:** FICSIT: Unintentionally coming to rest on the ground, floor, or other lower level Atlanta site specific: Same as above minus minor events such as stumbles **Rate or risk of falls/fallers:** Self-report monthly calendar with monthly phone calls from project staff **Length of followup:** 4 months

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b outcome measures: Other positive outcomes	KQ1 and KQ1a results: Fall-related injury, mortality, and quality of life
Wolf 1996[107] Fair	**Falls Efficacy Scale:** Taken at baseline, post-intervention and 4 months **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **List of additional measures:** Grip strength, systolic BP-post walk, walking distance over 12 minutes **Length of followup:** 4 months	**Fall-related injury** **Fracture rate per person year:** NR **# fractures:** NR **# people sustaining fractures:** NR **# people sustaining multiple events:** NR **Mortality**: NR **QOL** **SF-12:** NR **SF-36:** NR **EuroQol:** NR **Among high risk**: NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ1 results: Disability	KQ2 & KQ2a results: Rate or risk of falls and fallers
Wolf 1996[107] Fair	**ADLs:** NR **IADLs:** No significant changes observed across groups **Among high risk:** NR	**# falls/# in group:** *FICSIT definition* IG(TC): 56/72 IG(BT): 76/64 CG: 77/64 *Atlanta site definition* IG(TC): 29/72 IG(BT): 44/64 CG: 37/64 **# (%) fallers:** NR **# (%) frequent fallers (2+ falls):** NR **Among high risk:** NR

Appendix C Table 5. Effectiveness of Exercise and Physical Therapy Interventions to Prevent Falls in Older Adults

Study reference USPSTF quality rating	KQ2b results: Other positive outcomes	Comments
Wolf 1996[107] Fair	**Falls Efficacy Scale:** *Fear of Falling* IG(TC) n Pre Post 4-mo; IG(BT) n Pre Post 4-mo; CG n Pre Post 4-mo Not at all afraid 60 43% 53% 47% 51 29% 27% 33% 54 44% 35% 41% Somewhat afraid 33% 39% 37% 51% 47% 43% 37% 44% 35% Fairly afraid 13% 2% 8% 14% 14% 12% 11% 13% 15% Very afraid 10% 7% 8% 6% 12% 12% 7% 7% 10% *P = 0.046* *Change in pre- to postintervention scores on the fear of falling measure was significantly different for TC compared with the CG (P=0.046)* **Tinetti Gait & Balance (modified POMA):** NR **Timed Up & Go:** NR **6-meter timed walk:** NR **Functional reach:** NR **Berg Balance Scale:** NR **Among high risk:** NR	**Adverse effects:** NR **External validity:** 80% attrition from assessment

UK-United Kingdom; IG-intervention group; CG-control group; NR-not reported; NA-not applicable; CI-confidence interval; PD-Parkinson's Disease; USPSTF-United States Preventive Services Task Force; mo-month; POMA-Performance Oriented Balance and Mobility Assessment; ADL-activities of daily living; IADL-instrumental activities of daily living;SES-socioeconomic status; SD-standard deviation; QOL-quality of life

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Study finds little evidence of benefit from NHS falls clinics. *Guidelines in Practice.* 2008;11:10.	Provides no data not otherwise covered in other articles for this study
Alp A, Kanat E, Yurtkuran M. Efficacy of a self-management program for osteoporotic subjects. *Am J Phys Med Rehabil.* 2007;86:633-640.	Not conducted in primary care or other setting with a primary care-comparable population
Anstey KJ, Burns R, von Sanden C, Luszcz MA. Psychological well-being is an independent predictor of falling in an 8-year follow-up of older adults. *J Gerontol B Psychol Sci Soc Sci.* 2008;63B:249-257.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Armstrong AL, Oborne J, Coupland CA, Macpherson MB, Bassey EJ, Wallace WA. Effects of hormone replacement therapy on muscle performance and balance in post-menopausal women. *Clin Sci (Lond).* 1996;91:685-690.	Population does not have an average age of 65 and older
Armstrong AL. Hormone replacement therapy - effects on strength, balance, and bone density [MD Thesis]. Nottingham: University of Nottingham, 1996.	Provides no data not otherwise covered in other articles for this study
Baker MK, Atlantis E, Fiatarone Singh MA. Multi-modal exercise programs for older adults. *Age Ageing.* 2007;36:375-381.	Used only as a source document
Barr RJ, Stewart A, Torgerson DJ, Seymour DG, Reid DM. Screening elderly women for risk of future fractures--participation rates and impact on incidence of falls and fractures. *Calcif Tissue Int.* 2005;76:243-248.	Poor reporting
Batchelor F, Hill K, Mackintosh S, Said C, Whitehead C. The FLASSH study: protocol for a randomised controlled trial evaluating falls prevention after stroke and two sub-studies. *BMC Neurology*. 2009;9:14.	No relevant outcomes
Becker C, Walter-Jung B, Nikolaus T. The other side of hip protectors. *Age Ageing.* 2000;29:186.	Not conducted in primary care or other setting with a primary care-comparable population
Becker C, Lindemann U, Nikolaus T. Multifactorial intervention on falls and fractures in nursing homes. *Age Ageing.* 2000;29(Suppl 2):18.	Provides no data not otherwise covered in other articles for this study
Ben IR, Giladi N, Gruendlinger L. Methylphenidate may reduce risk of falling in the elderly. *Brown University Geriatr Psychopharmacol Update.* 2008;12:3.	Does not focus on reducing risk or rate of falls or fallers
Berggren M, Stenvall M, Olofsson B, Gustafson Y. Evaluation of a fall-prevention program in older people after femoral neck fracture: a one-year follow-up. *Osteoporos Int.* 2008;19:801-809.	Not conducted in primary care or other setting with a primary care-comparable population
Bernabei R, Landi F, Gambassi G, et al. Randomised trial of impact of model of integrated care and case management for older people living in the community. *BMJ.* 1998;316:1348-1351.	Does not focus on reducing risk or rate of falls or fallers
Beswick AD, Rees K, Dieppe P, et al. Complex interventions to improve physical function and maintain independent living in elderly people: a systematic review and meta-analysis. *Lancet.* 2008;371:725-735.	Used only as a source document
Birks YF, Hildreth R, Campbell P, Sharpe C, Torgerson DJ, Watt I. Randomised controlled trial of hip protectors for the prevention of second hip fractures. *Age Ageing.* 2003;32:442-444.	Poor reporting
Bischoff HA, Stahelin HB, Dick W, et al. Effects of vitamin D and calcium supplementation on falls: a randomized controlled trial. *J Bone Mineral Res.* 2003;18:343-351.	Population not comparable to primary care
Bischoff-Ferrari HA, Orav JE, Dawson HB. Effect of vitamin D3 plus calcium on fall risk in older men and women: a 3-year randomized controlled trial [abstract]. *J Bone Mineral Res.* 2004;19:S57.	Provides no data not otherwise covered in other articles for this study
Bischoff-Ferrari HA, Willett WC, Wong JB, Giovannucci E, Dietrich T, Dawson-Hughes B. Fracture prevention with vitamin D supplementation: a meta-analysis of randomized controlled trials. *JAMA.* 2005;293:2257-2264.	Used only as a source document
Bleijlevens MH, Hendriks MR, van-Haastregt JC, et al. Process factors explaining the ineffectiveness of a multidisciplinary fall prevention programme: a process evaluation. *BMC Pub Health.* 2008;8:332.	Provides no data not otherwise covered in other articles for this study
Boonen S, Bischoff-Ferrari HA, Cooper C, et al. Addressing the musculoskeletal components of fracture risk with calcium and vitamin D: a review of the evidence. *Calc Tissue Int.* 2006;78:257-270.	Does not focus on reducing risk or rate of falls or fallers
Bourke N, Persson UM. Effects of an exercise and education based falls prevention programme for community dwelling older people with and without computerised visual feedback training -- a randomised controlled pilot study. *Phys Ther Rev.* 2008;13:200-201.	No relevant outcomes
Bowling A, Formby J, Grant K. Accidents in elderly care: a randomised controlled trial (Part 2). *Nurs Stand.* 1992;6:28-31.	Not conducted in primary care or other setting with a primary care-comparable population
Brouwer BJ, Walker C, Rydahl SJ, Culham EG. Reducing fear of falling in seniors through education and activity programs: a randomized trial. *J Am Geriatr Soc.* 2003;51:829-834.	Does not focus on reducing risk or rate of falls or fallers
Brownsell S, Hawley MS. Automatic fall detectors and the fear of falling. *J Telemed Telecare.* 2004;10:262-266.	Does not focus on reducing risk or rate of falls or fallers

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Buchner DM, Cress ME, de Lateur BJ, et al. A comparison of the effects of three types of endurance training on balance and other fall risk factors in older adults. *Aging (Milano).* 1997;9:112-119.	Does not focus on reducing risk or rate of falls or fallers
Buchner DM, Cress ME, Wagner EH, deLateur BJ. The role of exercise in fall prevention: developing targeting criteria for exercise programs. In: Vesllas B, Toupet M, Rubenstein L, et al (eds). Falls, Balance, and Gait Disorders in the Elderly. Amsterdam: Elsevier; 1992:55-68.	Not a randomized controlled trial
Buettner LL. Focus on caregiving. Falls prevention in dementia populations: following a trial program of recreation therapy, falls were reduced by 164 percent. *Provider.* 2002;28:41-43.	Population not comparable to primary care
van Schoor NM, Smit JH, Twisk JW, et al. Prevention of hip fractures by external hip protectors: a randomized controlled trial. *JAMA*. 2003;289:1957-1962.	Population not comparable to primary care
Burton LC, Paglia MJ, German PS, Shapiro S, Damiano AM. The effect among older persons of a general preventive visit on three health behaviors: smoking, excessive alcohol drinking, and sedentary lifestyle. *Prev Med.* 1995;24:492-497.	Does not focus on reducing risk or rate of falls or fallers
Byles JE, Tavener M, O'Connell RL, et al. Randomised controlled trial of health assessments for older Australian veterans and war widows. *Med J Aust.* 2004;181:186-190.	Does not focus on reducing risk or rate of falls or fallers
Cameron ID, Venman J, Kurrle SE et al. Hip protectors in aged-care facilities: a randomized trial of use by individual higher-risk residents. *Age Ageing.* 2001;30:477-481.	Population not comparable to primary care
Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Falls prevention over 2 years: a randomized controlled trial in women 80 years and older. *Age Ageing.* 1999;28:513-518.	High or differential attrition
Caplan GA, Ward JA, Brennan NJ, Coconis J, Board N, Brown A. Hospital in the home: a randomised controlled trial. *Med J Aust.* 1999;170:156-160.	Not conducted in primary care or other setting with a primary care-comparable population
Carpenter GI, Demopoulos GR. Screening the elderly in the community: controlled trial of dependency surveillance using a questionnaire administered by volunteers. *BMJ.* 1990;300:1253-1256.	Does not focus on reducing risk or rate of falls or fallers
Carter S, Campbell E, Sanson FR, Corkrey R, Gillespie W. A trial of two strategies aimed at reducing falls through home hazard modification and medication review. *Unpublished information (permission to quote granted).* 2002.	No relevant outcomes
Carter SE, Campbell EM, Sanson-Fisher RW, Redman S, Gillespie WJ. Environmental hazards in the homes of eldery people. *Age Ageing.* 1997;26:195-202.	No relevant outcomes
Cauley JA, Robbins J, Chen Z, et al. Effects of estrogen plus progestin on risk of fracture and bone mineral density: the Women's Health Initiative randomized trial. *JAMA.* 2003;290:1729-1738.	Does not focus on reducing risk or rate of falls or fallers
Chandler JM, Duncan PW, Kochersberger G, Studenski S. Is lower extremity strength gain associated with improvement in physical performance and disability in frail, community-dwelling elders? *Arch Phys Med Rehabil.* 1998;79:24-30.	Does not focus on reducing risk or rate of falls or fallers
Chapuy MC, Arlot ME, Duboeuf F, et al. Vitamin D3 and calcium to prevent hip fractures in the elderly women. *N Engl J Med.* 1992;327:1637-1642.	Does not focus on reducing risk or rate of falls or fallers
Cheng PT, Wu SH, Liaw MY, Wong AM, Tang FT. Symmetrical body-weight distribution training in stroke patients and its effect on fall prevention. *Arch Phys Med Rehabil.* 2001;82:1650-1654.	Not conducted in primary care or other setting with a primary care-comparable population
Chin a Paw MJ, de Jong N, Schouten EG, Hiddink GJ, Kok FJ. Physical exercise and/or enriched foods for functional improvement in frail, independently living elderly: a randomized controlled trial. *Arch Phys Med Rehabil.* 2001;82:811-817.	Does not focus on reducing risk or rate of falls or fallers
Clarke M, Clarke SJ, Jagger C. Social intervention and the elderly: a randomized controlled trial. *Am J Epidemiol.* 1992;136:1517-1523.	Does not focus on reducing risk or rate of falls or fallers
Close JC, Patel A, Hooper R, Glucksman E, Jackson SH, Swift CG. PROFET : improved clinical outcomes at no additional cost [abstract]. *J Am Geriatr Soc*. 2000;29(Suppl 1):48.	Provides no data not otherwise covered in other articles for this study
Close J. Can the incidence of falls in the elderly be reduced by a secondary prevention protocol? Oxford: National Research Register; 2003.	Not a randomized controlled trial
Close J, Hooper R, Glucksman E, Jackson S, Swift C. Predictors of falls in a high risk population: results from the Prevention of Falls in the Elderly Trial (PROFET). *J Am Geriatr Soc.* 2000;48:S79.	Not a randomized controlled trial
Coleman EA, Wagner EH, Grothaus LC, Hecht J, Savarino J, Buchner DM. Predicting hospitalization and functional decline in older health plan enrollees: are administrative data as accurate as self-report? *J Am Geriatr Soc.* 1998;46:419-425.	Does not focus on reducing risk or rate of falls or fallers
Coogler CE, Wolf SL. Balance training in elderly fallers and nonfallers. *Rehabil Rd Prog Rep.* 1994;96-97.	No relevant outcomes
Counsell SR, Callahan CM, Clark DO, et al. Geriatric care management for low-income seniors: a randomized controlled trial. *JAMA.* 2007;298:2623-2633.	Population-based or community, non-referral population

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Crome P. A randomised controlled trial of a nurse-led falls prevention clinic. *J Am Geriatr Soc.* 2000;48:S78.	No relevant outcomes
Dalby DM, Sellors JW, Fraser FD, Fraser C, van IC, Howard M. Effect of preventive home visits by a nurse on the outcomes of frail elderly people in the community: a randomized controlled trial. *CMAJ.* 2000;162:497-500.	Does not focus on reducing risk or rate of falls or fallers
Dawson P, Chapman KL, Shaw FE, Kenny RA. Measuring the outcome of physiotherapy in cognitively impaired elderly patients who fall. *Physiotherapy.* 1997;83:352.	Does not focus on reducing risk or rate of falls or fallers
Dean CM, Rissel C, Sharkey M, et al. Exercise intervention to prevent falls and enhance mobility in community dwellers after stroke: a protocol for a randomised controlled trial. *BMC Neurol.* 2009;9:38.	No relevant outcomes
Devereux K, Robertson D, Briffa NK. Effects of a water-based program on women 65 years and over: a randomised controlled trial. *Aust J Physiother.* 2005;51:102-108.	Does not focus on reducing risk or rate of falls or fallers
Dhesi JK, Allain TJ, Mangoni AA, Jackson SH. The implications of a growing evidence base for drug use in elderly patients, 4: vitamin D and bisphosphonates for fractures and osteoporosis. *Br J Clin Pharmacol.* 2006;61:521-528.	Not a randomized controlled trial
Di Monaco M, Vallero F, De Toma E, De Lauso L, Tappero R, Cavanna A. A single home visit by an occupational therapist reduces the risk of falling after hip fracture in elderly women: a quasi-randomized controlled trial. *J Rehabil Med.* 2008;40:446-450.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Donald IP, Pitt K, Armstrong E, Shuttleworth H. Preventing falls on an elderly care rehabilitation ward. *Clin Rehabil.* 2000;14:178-185.	Not conducted in primary care or other setting with a primary care-comparable population
Ebrahim S, Thompson PW, Baskaran V, Evans K. Randomized placebo-controlled trial of brisk walking in the prevention of postmenopausal osteoporosis. *Age Ageing.* 1997;26:253-260.	Problems with baseline comparability between groups
Edwards N. A home based, nurse delivered exercise programme reduced falls and serious injuries in people ≥80 years of age. *Evid Based Nurs.* 2002;5:22.	Not a randomized controlled trial
Eekhof J, De Bock G, Schaapveld K, Springer M. Effects of screening for disorders among the elderly: an intervention study in general practice. *Fam Pract.* 2000;17:329-333.	Does not focus on reducing risk or rate of falls or fallers
Egan M, Jaglal S, Byrne K, Wells J, Stolee P. Factors associated with a second hip fracture: a systematic review. *Clin Rehabil.* 2008;22:272-282.	Used only as a source document
El-Faizy M, Reinsch S. Home safety intervention for the prevention of falls. *Phys Occup Ther Geriatr.* 1994;12(3):33-49.	Not a randomized controlled trial
Engelhardt JB, Toseland RW, O'Donnell JC, Richie JT, Jue D, Banks S. The effectiveness and efficiency of outpatient geriatric evaluation and management. *J Am Geriatr Soc.* 1996;44:847-856.	Does not focus on reducing risk or rate of falls or fallers
Epstein AM, Hall JA, Fretwell M, et al. Consultative geriatric assessment for ambulatory patients: a randomized trial in a health maintenance organization. *JAMA.* 1990;263:538-544.	Does not focus on reducing risk or rate of falls or fallers
Eriksson BG, Mellstrom D, Svanborg A. Medical-social intervention in a 70-year-old Swedish population: a general presentation of methodological experience. *Compr Gerontol [C].* 1987;1:49-56.	Does not focus on reducing risk or rate of falls or fallers
Fabacher D, Josephson K, Pietruszka F, Linderborn K, Morley JE, Rubenstein LZ. An in-home preventive assessment program for independent older adults: a randomized controlled trial. *J Am Geriatr Soc.* 1994;42:630-638.	Outcome assessment not blinded
Ferreri S, Roth MT, Casteel C, Demby KB, Blalock SJ. Methodology of an ongoing, randomized controlled trial to prevent falls through enhanced pharmaceutical care. *Am J Geriatr Pharmacother.* 2008;6:61-81.	No relevant outcomes
Fiatarone MA, O'Neil EF, Doyle RN, Clements K. Efficacy of home-based resistance training in frail elders. In: Andrews GR, ed. Abstracts of the 16th Congress of the International Association of Gerontology. Bedford Park, South Australia: World Congress of Gerontology; 1997:323.	Poor reporting
Fuzhong L, Harmer P, Glasgow R, et al. Translation of an effective Tai Chi intervention into a community-based falls-prevention program. *Am J Pub Health.* 2008;98:1195-1198.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Gallagher EM, Brunt H. Head over heels: impact of a health promotion program to reduce falls in the elderly. *Can J Aging.* 1996;15:84-96.	Poor reporting
Gardner M. Home-based exercises to prevent falls in elderly women. *N Z J Physiother.* 1998;26:6.	Provides no data not otherwise covered in other articles for this study
Gates S, Fisher JD, Cooke MW, Carter YH, Lamb SE. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. *BMJ.* 2008;336:130-133.	Used only as a source document
Gill TM, Baker DI, Gottschalk M, Peduzzi PN, Allore H, Byers A. A program to prevent functional decline in physically frail, elderly persons who live at home. *N Engl J Med.* 2002;347:1068-1074.	Does not focus on reducing risk or rate of falls or fallers

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Reference	Reason for exclusion
Gitlin LN, Hauck WW, Winter L, Dennis MP, Schulz R. Effect of an in-home occupational and physical therapy intervention on reducing mortality in functionally vulnerable older people: preliminary findings. *J Am Geriatr Soc.* 2006;54:950-955.	Does not focus on reducing risk or rate of falls or fallers
Gitlin LN, Winter L, Dennis MP, Corcoran M, Schinfeld S, Hauck WW. A randomized trial of a multicomponent home intervention to reduce functional difficulties in older adults. *J Am Geriatr Soc.* 2006;54:809-816.	Does not focus on reducing risk or rate of falls or fallers
Grant AM, Avenell A, Campbell MK, et al. Oral vitamin D3 and calcium for secondary prevention of low-trauma fractures in elderly people (Randomised Evaluation of Calcium or Vitamin D, RECORD): a randomised placebo-controlled trial. *Lancet.* 2005;365:1621-1628.	Poor reporting
Greenspan AI, Wolf SL, Kelley ME, O'Grady M. Tai Chi and perceived health status in older adults who are transitionally frail: a randomized controlled trial. *Phys Ther.* 2007;87:525-535.	Does not focus on reducing risk or rate of falls or fallers
Greenspan SL, Resnick NM, Parker RA. The effect of hormone replacement on physical performance in community-dwelling elderly women. *Am J Med.* 2005;118:1232-1239.	Comparative effectiveness design
Gunner-Svensson F, Ipsen J, Olsen J, Waldstrom B. Prevention of relocation of the aged in nursing homes. *Scand J Prim Health Care.* 1984;2:49-56.	Does not focus on reducing risk or rate of falls or fallers
Hakim RM, Roginski A, Walker J. Comparison of fall risk education methods for primary prevention with community-dwelling older adults in a senior center setting. *J Geriatr Phys Ther.* 2007;30:60-68.	No relevant outcomes
Hall N, De Beck P, Johnson D, Mackinnon K, Gutman G, Glick N. Randomized trial of a health promotion program for frail elders. *Can J Aging.* 1992;11:72-91.	Does not focus on reducing risk or rate of falls or fallers
Harling A, Simpson JP. A systematic review to determine the effectiveness of Tai Chi in reducing falls and fear of falling in older adults. *Phys Ther Rev.* 2008;13:237-248.	Used only as a source document
Hauer K, Rost B, Rutschle K, et al. Exercise training for rehabilitation and secondary prevention of falls in geriatric patients with a history of injurious falls. *J Am Geriatr Soc.* 2001;49:10-20.	Not conducted in primary care or other setting with a primary care-comparable population
Hebert R, Robichaud L, Roy PM, Bravo G, Voyer L. Efficacy of a nurse-led multidimensional preventive programme for older people at risk of functional decline: a randomized controlled trial. *Age Ageing.* 2001;30:147-153.	Does not focus on reducing risk or rate of falls or fallers
Hendriksen C, Lund E, Stromgard E. Consequences of assessment and intervention among elderly people: a three year randomised controlled trial. *Br Med J (Clin Res Ed).* 1984;289:1522-1524.	Does not focus on reducing risk or rate of falls or fallers
Hien le TT, Cumming RG, Cameron ID, et al. Atypical antipsychotic medications and risk of falls in residents of aged care facilities. *J Am Geriatr Soc.* 2005;53:1290-1295.	Not conducted in primary care or other setting with a primary care-comparable population
Hornbrook MC, Stevens VJ, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Preventing falls among community-dwelling older persons: results from a randomized trial. *Gerontologist.* 1994;34:16-23.	Comparative effectiveness design
Hourigan SR, Nitz JC, Brauer SG, O'Neill S, Wong J, Richardson CA. Positive effects of exercise on falls and fracture risk in osteopenic women. *Osteoporos Int.* 2008;19:1077-1086.	Population does not have an average age of 65 and older
Inokuchi S, Matsusaka N, Hayashi T, Shindo H. Feasibility and effectiveness of a nurse-led community exercise programme for prevention of falls among frail elderly people: a multi-centre controlled trial. *J Rehabil Med.* 2007;39:479-485.	Not a randomized controlled trial
Iyer S, Naganathan V, McLachlan AJ, Le Couteur DG. Medication withdrawal trials in people aged 65 years and older: a systematic review. *Drugs Aging.* 2008;25:1021-1031.	Not conducted in primary care or other setting with a primary care-comparable population
Campbell AJ, Robertson MC, La Grow SJ, et al. Randomized controlled trial of prevention of falls in people aged ≥75 with severe visual impairment: the VIP trial. *BMJ.* 2005;331:817.	Provides no data not otherwise covered in other articles for this study
Jensen J, Lundin-Olsson L, Nyberg L, Gustafson Y. Fall and injury prevention in older people living in residential care facilities: a cluster randomized trial. *Ann Intern Med.* 2002;136:733-741.	Not conducted in primary care or other setting with a primary care-comparable population
Jitapunkul S. A randomised controlled trial of regular surveillance in Thai elderly using a simple questionnaire administered by non-professional personnel. *J Med Assoc Thai.* 1998;81:352-356.	Setting: country below 0.90 on Human Development Index
Jones CJ, Robichaux J, Williams P, Rikli R. The effects of a 16-week exercise program on the dynamic balance of older adults. *J Clin Exp Gerontol.* 1992;14:165-182.	Does not focus on reducing risk or rate of falls or fallers
Karachalios T, Lyritis GP, Kaloudis J, Roidis N, Katsiri M. The effects of calcitonin on acute bone loss after pertrochanteric fractures. A prospective, randomised trial. *J Bone Joint Surg Br.* 2004;86:350-358.	Does not focus on reducing risk or rate of falls or fallers
Kenny RA, Seifer C. Brief report: SAFE PACE 2 (Syncope and Falls in the Elderly Pacing and Carotid Sinus Evaluation): a randomized control trial of cardiac pacing in older patients with falls and carotid sinus hypersensitivity. *Am J Geriatr Cardiol.* 1999;8:87.	Provides no data not otherwise covered in other articles for this study

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Kerse NM, Flicker L, Jolley D, Arroll B, Young D. Improving the health behaviours of elderly people: randomised controlled trial of a general practice education programme. *BMJ.* 1999;319:683-687.	Does not focus on reducing risk or rate of falls or fallers
King MB, Tinetti ME. A multifactorial approach to reducing injurious falls. *Clin Geriatr Med.* 1996;12:745-759.	Provides no data not otherwise covered in other articles for this study
Kingston P. Older people and falls: a randomized controlled trial of a health visitor (HV) intervention. *Rev Clin Gerontol.* 2001;11:209-214.	Poor reporting
Kingston P. Elderly people and accidents: a prospective analysis of accidental causation among elderly populations and their post discharge requirements. Oxford: National Research Register; 2000.	Poor reporting
Kingston P. RCT of health visitor (HV) intervention in falls. *Age Ageing.* 2001;30(Suppl 1):40.	Poor reporting
Kono A, Kai I, Sakato C, Harker JO, Rubenstein LZ. Effect of preventive home visits for ambulatory housebound elders in Japan: a pilot study. *Aging Clin Exp Res.* 2004;16:293-299.	Does not focus on reducing risk or rate of falls or fallers
Kriska AM, Bayles C. A randomized exercise trial in older women: increased activity over two years and the factors associated with compliance. *Med Sci Sports Exerc.* 1986;18:557-562.	Population does not have an average age of 65 and older
Larsen ER, Mosekilde L, Foldspang A. Vitamin D and calcium supplementation prevents severe falls in elderly community-dwelling women: a pragmatic population-based 3-year intervention study. *Aging Clin Exp Res.* 2005;17:125-132.	No relevant outcomes
Latham N, Anderson C, Bennett D, Stretton C. Progressive resistance strength training for physical disability in older people. *Cochrane Database Syst Rev.* 2003;CD002759.	Used only as a source document
Latham NK, Anderson CS, Lee A, Bennett DA, Moseley A, Cameron ID. A randomized, controlled trial of quadriceps resistance exercise and vitamin D in frail older people: the Frailty Interventions Trial in Elderly Subjects (FITNESS). *J Am Geriatr Soc.* 2003;51:291-299.	Population not comparable to primary care
Lawton BA, Rose SB, Elley CR, Dowell AC, Fenton A, Moyes SA. Exercise on prescription for women aged 40-74 recruited through primary care: two year randomised controlled trial. *BMJ.* 2008;337:a2509.	Population does not have an average age of 65 and older
Leathley M. Fallers attending casualty. Oxford: National Research Register; 2001.	Provides no data not otherwise covered in other articles for this study
Leveille SG, Wagner EH, Davis C, et al. Preventing disability and managing chronic illness in frail older adults: a randomized trial of a community-based partnership with primary care. *J Am Geriatr Soc.* 1998;46:1191-1198.	Does not focus on reducing risk or rate of falls or fallers
Li F, Harmer P, Fisher KJ, et al. Tai Chi and fall reductions in older adults: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci.* 2005;60:187-194.	No relevant outcomes
Li F, Harmer P, McAuley E, et al. An evaluation of the effects of Tai Chi exercise on physical function among older persons: a randomized contolled trial. *Ann Behav Med.* 2001;23:139-146.	Does not focus on reducing risk or rate of falls or fallers
Lichtenstein MJ, Shields SL, Shiavi RG, Burger C. Exercise and balance in aged women: a pilot controlled clinical trial. *Arch Phys Med Rehabil.* 1989;70:138-143.	Does not focus on reducing risk or rate of falls or fallers
Lin MR, Wolf SL, Hwang HF, Gong SY, Chen CY. A randomized, controlled trial of fall prevention programs and quality of life in older fallers. *J Am Geriatr Soc.* 2007;55:499-506.	Not a randomized controlled trial
Lips P, Graafmans WC, Ooms ME, Bezemer PD, Bouter LM. Vitamin D supplementation and fracture incidence in elderly persons: a randomized, placebo-controlled clinical trial. *Ann Intern Med.* 1996;124:400-406.	Does not focus on reducing risk or rate of falls or fallers
Liu-Ambrose T, Khan KM, Eng JJ, Janssen PA, Lord SR, McKay HA. Resistance and agility training reduce fall risk in women aged 75 to 85 with low bone mass: a 6-month randomized, controlled trial. *J Am Geriatr Soc.* 2004;52:657-665.	Does not focus on reducing risk or rate of falls or fallers
Liu-Ambrose T, Khan KM, Eng JJ, Lord SR, McKay HA. Balance confidence improves with resistance or agility training: increase is not correlated with objective changes in fall risk and physical abilities. *Gerontology.* 2004;50:373-382.	Does not focus on reducing risk or rate of falls or fallers
Liu-Ambrose T, Donaldson MG, Ahamed Y, et al. Otago home-based strength and balance retraining improves executive functioning in older fallers: a randomized controlled trial. *J Am Geriatr Soc.* 2008;56:1821-1830.	Comparative effectiveness study design
Logghe IH, Zeeuwe PE, Verhagen AP, et al. Lack of effect of Tai Chi Chuan in preventing falls in elderly people living at home: a randomized clinical trial. *J Am Geriatr Soc.* 2009;57:70-75.	No relevant outcomes
Lord SR, Lloyd DG, Nirui M, Raymond J, Williams P, Stewart RA. The effect of exercise on gait patterns in older women: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci.* 1996;51:M64-M70.	Does not focus on reducing risk or rate of falls or fallers
Lord SR, Ward JA, Williams P, Strudwick M. The effect of a 12-month exercise trial on balance, strength, and falls in older women: a randomized controlled trial. *J Am Geriatr Soc.* 1995;43:1198-1206.	Does not focus on reducing risk or rate of falls or fallers

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Lord SR, Ward JA, Williams P, Zivanovic E. The effects of a community exercise program on fracture risk factors in older women. *Osteoporos Int.* 1996;6:361-367.	No relevant outcomes
Luukinen H, Lehtola S, Jokelainen J, Vaananen-Sainio R, Lotvonen S, Koistinen P. Prevention of disability by exercise among the elderly: a population-based, randomized, controlled trial. *Scand J Prim Health Care.* 2006;24:199-205.	Does not focus on reducing risk or rate of falls or fallers
Lyons RA, John A, Brophy S, et al. Modification of the home environment for the reduction of injuries. *Cochrane Database Syst Rev.* 2006:CD003600.	Used only as a source document
MacRae PG, Feltner ME, Reinsch S. A 1-year exercise program for older women: effects on falls, injuries, and physical performance. *J Aging Phys Activ.* 1994;2:127-142.	High or differential attrition
Mansfield A, Peters AL, Liu BA, Maki BE. A perturbation-based balance training program for older adults: study protocol for a randomised controlled trial. *BMC Geriatrics.* 2007;7:12.	Does not focus on reducing risk or rate of falls or fallers
Mariano C. A 16-week Tai Chi programme prevented falls in healthy older adults. *Evid Based Nurs.* 2008;11:60.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Marston A. Can the type of walking stick issued effect mobility, confidence or fear of falling? *Int J Ther Rehabil.* 2007;14:229-234.	Does not focus on reducing risk or rate of falls or fallers
Masud T, Coupland C, Drummond A, et al. Multifactorial day hospital intervention to reduce falls in high risk older people in primary care: a multi-centre randomised controlled trial. *Trials.* 2006;7:5.	Provides no data not otherwise covered in other articles for this study
Mayo NE, Gloutney L, Levy AR. A randomized trial of identification bracelets to prevent falls among patients in a rehabilitation hospital. *Arch Phys Med Rehabil.* 1994;75:1302-1308.	Not conducted in primary care or other setting with a primary care-comparable population
McEwan RT, Davison N, Forster DP, Pearson P, Stirling E. Screening elderly people in primary care: a randomized controlled trial. *Br J Gen Pract.* 1990;40:94-97.	Does not focus on reducing risk or rate of falls or fallers
McMurdo ME, Millar AM, Daly F. A randomized controlled trial of fall prevention strategies in old peoples' homes. *Gerontology.* 2000;46:83-87.	Not conducted in primary care or other setting with a primary care-comparable population
McNeely E, Clements SD, Wolf SL. A program to reduce frailty in the elderly. In: Funk SG, Tornquist EM, Champagne MT, Wiese RA, eds. Key Aspects of Elder Care: Managing Falls, Incontinence, and Cognitive Impairment. New York: Springer; 1992:89-92.	Provides no data not otherwise covered in other articles for this study
Means KM, Rodell DE, O'Sullivan PS, Cranford LA. Rehabilitation of elderly fallers: pilot study of a low to moderate intensity exercise program. *Arch Phys Med Rehabil.* 1996;77:1030-1036.	Not a randomized controlled trial
Millar AM, McMurdo ME. A trial of falls prevention. *Age Ageing* 1999;28(Suppl 1):15.	Not conducted in primary care or other setting with a primary care-comparable population
Mulrow CD, Gerety MB, Kanten D, et al. A randomized trial of physical rehabilitation for very frail nursing home residents. *JAMA.* 1994;271:519-524.	Not conducted in primary care or other setting with a primary care-comparable population
Mulrow CD, Gerety MB, Kanten D, DeNino LA, Cornell JE. Effects of physical therapy on functional status of nursing home residents. *J Am Geriatr Soc.* 1993;41:326-328.	Not conducted in primary care or other setting with a primary care-comparable population
Nakamura T, Meguro K, Sasaki H. Relationship between falls and stride length variability in senile dementia of the Alzheimer type. *Gerontology.* 1996;42:108-113.	Not conducted in primary care or other setting with a primary care-comparable population
Newbury J, Marley J. Preventive home visits to elderly people in the community: visits are most useful for people aged ≥75. *BMJ.* 2000;321:512.	Not a randomized controlled trial
Newbury J, Marley J. Functional assessment of the elderly (letter). *BMJ.* 1999:Oct 5.	Does not focus on reducing risk or rate of falls or fallers
Newcomer R, Maravilla V, Faculjak P, Graves MT. Outcomes of preventive case management among high-risk elderly in three medical groups: a randomized clinical trial. *Eval Health Prof.* 2004;27:323-348.	Does not focus on reducing risk or rate of falls or fallers
Nichols JF, Hitzelberger LM, Sherman JG, Patterson P. Effects of resistance training on muscular strength and funcational abilities of community-dwelling older adults. *J Aging Phys Activ.* 1995;3:238-250.	Does not focus on reducing risk or rate of falls or fallers
Nieuwboer A, Kwakkel G, Rochester L, et al. Cueing training in the home improves gait-related mobility in Parkinson's disease: the RESCUE trial. *J Neurol Neurosurg Psych.* 2007;78:134-140.	Does not focus on reducing risk or rate of falls or fallers
Nowalk MP, Prendergast JM, Bayles CM, D'Amico FJ, Colvin GC. A randomized trial of exercise programs among older individuals living in two long-term care facilities: the FallsFREE program. *J Am Geriatr Soc.* 2001;49:859-865.	Not conducted in primary care or other setting with a primary care-comparable population
O'Donnell S, Moher D, Thomas K, Hanley DA, Cranney A. Systematic review of the benefits and harms of calcitriol and alfacalcidol for fractures and falls. *J Bone Mineral Metab.* 2008;26:531-542.	Used only as a source document

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Papaioannou A, Adachi JD, Winegard K, et al. Efficacy of home-based exercise for improving quality of life among elderly women with symptomatic osteoporosis-related vertebral fractures. *Osteoporos Int.* 2003;14:677-682.	Does not focus on reducing risk or rate of falls or fallers
Pardessus V, Puisieux F, Di Pompeo C, Gaudefroy C, Thevenon A, Dewailly P. Benefits of home visits for falls and autonomy in the elderly: a randomized trial study. *Am J Phys Med Rehabil.* 2002;81:247-252.	Population not comparable to primary care
Parker MJ, Gillespie LD, Gillespie WJ. Hip protectors for preventing hip fractures in the elderly. *Cochrane Database Syst Rev.* 2004;CD001255.	Used only as a source document
Parker MJ, Gillespie WJ, Gillespie LD. Effectiveness of hip protectors for preventing hip fractures in elderly people: systematic review. *BMJ.* 2006;332:571-574.	Article covered by an included systematic review
Pathy MS, Bayer A, Harding K, Dibble A. Randomised trial of case finding and surveillance of elderly people at home. *Lancet.* 1992;340:890-893.	Does not focus on reducing risk or rate of falls or fallers
Peel N, Cartwright C, Steinberg M. Monitoring slips, trips and falls in the older community: preliminary results. *Health Promot J Australia.* 1998;148-150.	Does not focus on reducing risk or rate of falls or fallers
Peel N, Steinberg M, Williams G. Home safety assessment in the prevention of falls among older people. *Aust N Z J Public Health.* 2000;24:536-539.	Not a randomized controlled trial
Peeters GM, de Vries OJ, Elders PJ, Pluijm SM, Bouter LM, Lips P. Prevention of fall incidents in patients with a high risk of falling: design of a randomised controlled trial with an economic evaluation of the effect of multidisciplinary transmural care. *BMC Geriatrics.* 2007;7:15.	Provides no data not otherwise covered in other articles for this study
Pereira MA, Kriska AM, Day RD, Cauley JA, LaPorte RE, Kuller LH. A randomized walking trial in postmenopausal women: effects on physical activity and health 10 years later. *Arch Intern Med.* 1998;158:1695-1701.	Does not focus on reducing risk or rate of falls or fallers
Pereira MA. Ten Year Follow-Up of a Randomized Exercise Trial in Post-Menopausal Women [Phd Thesis]. Pittsburgh: University of Pittsburgh; 1996.	Does not focus on reducing risk or rate of falls or fallers
Perry SD, Radtke A, McIlroy WE, Fernie GR, Maki BE. Efficacy and effectiveness of a balance-enhancing insole. *J Gerontol A Biol Sci Med Sci.* 2008;63:595-602.	Population-based or community, non-referral population
Peterson JF, Kuperman GJ, Shek C, Patel M, Avorn J, Bates DW. Guided prescription of psychotropic medications for geriatric inpatients. *Arch Intern Med.* 2005;165:802-807.	Not conducted in primary care or other setting with a primary care-comparable population
Peterson JF, Rosenbaum BP, Waitman LR et al. Physicians' response to guided geriatric dosing: initial results from a randomized trial. *Medinfo.* 2007;12:2-40.	No relevant outcomes
Pfeifer M, Begerow B, Minne HW, Suppan K, Fahrleitner-Pammer A, Dobnig H. Effects of a long-term vitamin D and calcium supplementation on falls and parameters of muscle function in community-dwelling older individuals. *Osteoporos Int.* 2009;20:315-322.	No relevant outcomes
Pit SW, Byles JE, Henry DA, Holt L, Hansen V, Bowman DA. A Quality Use of Medicines program for general practitioners and older people: a cluster randomised controlled trial. *Med J Aust.* 2007;187:23-30.	Does not focus on reducing risk or rate of falls or fallers
Pynoos J, Rose D, Rubenstein L, Choi IH, Sabata D. Evidence-based interventions in fall prevention. *Home Health Care Serv Q.* 2006;25:55-73.	Not a randomized controlled trial
Ray WA, Taylor JA, Meador KG, et al. A randomized trial of a consultation service to reduce falls in nursing homes. *JAMA.* 1997;278:557-562.	Not conducted in primary care or other setting with a primary care-comparable population
Reinsch S, MacRae P, Lachenbruch PA, Tobis JS. Attempts to prevent falls and injury: a prospective community study. *Gerontologist.* 1992;32:450-456.	Poor reporting
Resnick B. Testing the effect of the WALC intervention on exercise adherence in older adults. *J Gerontol Nurs.* 2002;28:40-49.	Not conducted in primary care or other setting with a primary care-comparable population
Reuben DB, Frank JC, Hirsch SH, McGuigan KA, Maly RC. A randomized clinical trial of outpatient comprehensive geriatric assessment coupled with an intervention to increase adherence to recommendations. *J Am Geriatr Soc.* 1999;47:269-276.	Does not focus on reducing risk or rate of falls or fallers
Ringe JD, Farahmand P, Schacht E, Rozehnal A. Superiority of a combined treatment of alendronate and alfacalcidol compared to the combination of alendronate and plain vitamin D or alfacalcidol alone in established postmenopausal or male osteoporosis (AAC-Trial). *Rheumatol Int.* 2007;27:425-434.	Not a randomized controlled trial
Rizzo JA, Baker DI, McAvay G, Tinetti ME. The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. *Med Care.* 1996;34:954-969.	Provides no data not otherwise covered in other articles for this study
Ro OC, Hjort PF. Interventional research in primary health care for the elderly. *Scand J Prim Health Care.* 1985;3:133-136.	Not a randomized controlled trial
Robertson MC, Devlin N, Scuffham P, Gardner MM, Buchner DM, Campbell AJ. Economic evaluation of a community based exercise programme to prevent falls. *J Epidemiol Community Health.* 2001;55:600-606.	Provides no data not otherwise covered in other articles for this study
Robertson MC, Gardner MM, Devlin N, McGee R, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls, 2: controlled trial in multiple centres. *BMJ.* 2001;322:701-704.	Not a randomized controlled trial

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Robertson MC. Development of a Falls Prevention Programme for Elderly People: Evaluation of Efficacy, Effectiveness, and Efficiency. Dunedin, New Zealand: University of Otago; 2001.	Provides no data not otherwise covered in other articles for this study
Rockwood K, Stadnyk K, Carver D, et al. A clinimetric evaluation of specialized geriatric care for rural dwelling, frail older people. *J Am Geriatr Soc.* 2000;48:1080-1085.	Does not focus on reducing risk or rate of falls or fallers
Rooks DS, Ransil BJ, Hayes WC. Self-paced exercise and neuromotor performance in community-dwelling older adults. *J Aging Phys Activity.* 1997;135-149.	Does not focus on reducing risk or rate of falls or fallers
Rubenstein LZ, Alessi CA, Josephson KR, Trinidad HM, Harker JO, Pietruszka FM. A randomized trial of a screening, case finding, and referral system for older veterans in primary care. *J Am Geriatr Soc.* 2007;55:166-174.	Not a randomized controlled trial
Ryan JW, Spellbring AM. Implementing strategies to decrease risk of falls in older women. *J Gerontol Nurs.* 1996;22:25-31.	Poor reporting
Sakamoto K, Nakamura T, Hagino H, et al. Effects of unipedal standing balance exercise on the prevention of falls and hip fracture among clinically defined high-risk elderly individuals: a randomized controlled trial. *J Orthop Sci.* 2006;11:467-472.	Population not comparable to primary care
Salkeld G, Cumming RG, O'Neill E, Thomas M, Szonyi G, Westbury C. The cost effectiveness of a home hazard reduction program to reduce falls among older persons. *Aust N Z J Public Health.* 2000;24:265-271.	Population not comparable to primary care
Santana-Sosa E, Barriopedro MI, Lopez-Mojares LM, Perez M, Lucia A. Exercise training is beneficial for Alzheimer's patients. *Int J Sports Med.* 2008;29:845-850.	Not conducted in primary care or other setting with a primary care-comparable population
Sato T, Ebihara S, Kudo H, Fujii M, Sasaki H, Butler JP. Toe clearance rehabilitative slipper for gait disorder in the elderly. *Geriatr Gerontol Int.* 2007;7:310-311.	Does not focus on reducing risk or rate of falls or fallers
Sato Y, Iwamoto J, Kanoko T, Satoh K. Amelioration of osteoporosis and hypovitaminosis D by sunlight exposure in hospitalized, elderly women with Alzheimer's disease: a randomized controlled trial. *J Bone Mineral Res.* 2005;20:1327-1333.	Does not focus on reducing risk or rate of falls or fallers
Sato Y, Iwamoto J, Kanoko T, Satoh K. Low-dose vitamin D prevents muscular atrophy and reduces falls and hip fractures in women after stroke: a randomized controlled trial. *Cerebrovasc Dis.* 2005;20:187-192.	Not conducted in primary care or other setting with a primary care-comparable population
Sato Y, Iwamoto J, Kanoko T, Satoh K. Risedronate sodium therapy for prevention of hip fracture in men 65 years or older after stroke. *Arch Intern Med.* 2005;165:1743-1748.	Does not focus on reducing risk or rate of falls or fallers
Sato Y, Iwamoto J, Kanoko T, Satoh K. Risedronate therapy for prevention of hip fracture after stroke in elderly women. *Neurology.* 2005;64:811-816.	Population not comparable to primary care
Sato Y, Kanoko T, Satoh K, Iwamoto J. Menatetrenone and vitamin D2 with calcium supplements prevent nonvertebral fracture in elderly women with Alzheimer's disease. *Bone.* 2005;36:61-68.	Does not focus on reducing risk or rate of falls or fallers
Sato Y, Kanoko T, Satoh K, Iwamoto J. The prevention of hip fracture with risedronate and ergocalciferol plus calcium supplementation in elderly women with Alzheimer disease: a randomized controlled trial. *Arch Intern Med.* 2005;165:1737-1742.	Does not focus on reducing risk or rate of falls or fallers
Sawka AM, Boulos P, Beattie K, et al. Do hip protectors decrease the risk of hip fracture in institutional and community-dwelling elderly? A systematic review and meta-analysis of randomized controlled trials. *Osteoporos Int.* 2005;16:1461-1474.	Used only as a source document
Schnelle JF, Alessi CA, Simmons SF, Al-Samarrai NR, Beck JC, Ouslander JG. Translating clinical research into practice: a randomized controlled trial of exercise and incontinence care with nursing home residents. *J Am Geriatr Soc.* 2002;50:1476-1483.	Not conducted in primary care or other setting with a primary care-comparable population
Schoenfelder DP. A fall prevention program for elderly individuals: exercise in long-term care settings. *J Gerontol Nurs.* 2000;26:43-51.	Population not comparable to primary care
Shapiro A, Taylor M. Effects of a community-based early intervention program on the subjective well-being, institutionalization, and mortality of low-income elders. *Gerontologist.* 2002;42:334-341.	Does not focus on reducing risk or rate of falls or fallers
Shaw FE, Bond J, Richardson DA, et al. Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomised controlled trial. *BMJ.* 2003;326:73.	Population not comparable to primary care
Shaw FE. Can multidisciplinary intervention prevent falls in patients with cognitive impairment and dementia attending a casualty department? *Age Ageing.* 2000;29(Suppl 1):47.	Population not comparable to primary care
Shaw F. Physiotherapy intervention for cognitively impaired elderly fallers attending casualty. Oxford: National Research Register; 2003.	Population not comparable to primary care
Shaw F. Risk modiication of falls in cognitively impaired elderly patients attending a casualty department: a randomised controlled explanatory study. Oxford: National Research Register; 2003.	Population not comparable to primary care
Shekelle PG, Maglione M, Chang JT, et al. Falls Prevention Interventions in the Medicare Population. Baltimore, MD: Centers for Medicare and Medicaid Services; 2004.	Used only as a source document

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Shigematsu R, Okura T, Sakai T, Rantanen T. Square-stepping exercise versus strength and balance training for fall risk factors. *Aging Clin Exp Res.* 2008;20:19-24.	Comparative effectiveness design
Shigematsu R, Okura T, Nakagaichi M, et al. Square-stepping exercise and fall risk factors in older adults: a single-blind, randomized controlled trial. *J Gerontol A Biol Sci Med Sci.* 2008;63:76-82.	Comparative effectiveness design
Silverman M, Musa D, Martin DC, Lave JR, Adams J, Ricci EM. Evaluation of outpatient geriatric assessment: a randomized multi-site trial. *J Am Geriatr Soc.* 1995;43:733-740.	Does not focus on reducing risk or rate of falls or fallers
Sjösten N, Vaapio S, Kivelä S. The effects of fall prevention trials on depressive symptoms and fear of falling among the aged: a systematic review. *Aging Ment Health.* 2008;12:30-46.	Does not focus on reducing risk or rate of falls or fallers
Skelton DA, Beyer N. Exercise and injury prevention in older people. *Scand J Med Sci Sports.* 2003;13:77-85.	Not a randomized controlled trial
Skelton DA, Stranzinger K, Dinan SM, Rutherford OM. BMD improvements following FaME (Falls Management Exercise) in frequently falling women age 65 and over: an RCT. *J Aging Phys Activ.* 2008;16:S89-S90.	No relevant outcomes
Smith H, Anderson F, Raphael H, Maslin P, Crozier S, Cooper C. Effect of annual intramuscular vitamin D on fracture risk in elderly men and women—a population-based, randomized, double-blind, placebo-controlled trial. *Rheumatology*. 2007;46:1852-1857.	Does not focus on reducing risk or rate of falls or fallers
Sohng KY, Moon JS, Song HH, Lee KS, Kim YS. Fall prevention exercise program for fall risk factor reduction of the community-dwelling elderly in Korea. *Yonsei Med J.* 2003;44:883-891.	Does not focus on reducing risk or rate of falls or fallers
Sorensen KH, Sivertsen J. Follow-up three years after intervention to relieve unmet medical and social needs of old people. *Compr Gerontol [B].* 1988;2:85-91.	Does not focus on reducing risk or rate of falls or fallers
Spink MJ, Menz HB, Lord SR. Efficacy of a multifaceted podiatry intervention to improve balance and prevent falls in older people: study protocol for a randomised trial. *BMC Geriatrics.* 2008;8:30.	No relevant outcomes
Steultjens E, Clemson L. A preventative home safety programme for community-dwelling older people with low vision reduced falls and was more cost-effective than an exercise programme: commentary. *Aust Occup Ther J.* 2006;53:243-244.	Provides no data not otherwise covered in other articles for this study
Stevens VJ, Hornbrook MC, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Design and implementation of a falls prevention intervention for community-dwelling older persons. *Behav Health Ageing.* 1991;2:57-73.	No relevant outcomes
Stevens M, Holman CD, Bennett N, de Klerk N. Preventing falls in older people: outcome evaluation of a randomized controlled trial. *J Am Geriatr Soc.* 2001;49:1448-1455.	No relevant outcomes
Stuck AE, Aronow HU, Steiner A, et al. A trial of annual in-home comprehensive geriatric assessments for elderly people living in the community. *N Engl J Med.* 1995;333:1184-1189.	Does not focus on reducing risk or rate of falls or fallers
Stuck AE, Egger M, Hammer A, Minder CE, Beck JC. Home visits to prevent nursing home aAdmission and functional decline in elderly people. *JAMA.* 2002;287:1022-1028.	Used only as a source document
Stuck AE, Minder CE, Peter-Wuest I, et al. A randomized trial of in-home visits for disability prevention in community-dwelling older people at low and high risk for nursing home admission. *Arch Intern Med.* 2000;160:977-986.	Does not focus on reducing risk or rate of falls or fallers
Suzuki T, Kim H, Yoshida H, Ishizaki T. Randomized controlled trial of exercise intervention for the prevention of falls in community-dwelling elderly Japanese women. *J Bone Mineral Metab.* 2004;22:602-611.	High or differential attrition
Swanenburg J, de Bruin ED, Stauffacher M, Mulder T, Uebelhart D. Effects of exercise and nutrition on postural balance and risk of falling in elderly people with decreased bone mineral density: randomized controlled trial pilot study. *Clin Rehabil.* 2007;21:523-534.	Comparative effectiveness design
Tennstedt S, Howland J, Lachman M, Peterson E, Kasten L, Jette A. A randomized, controlled trial of a group intervention to reduce fear of falling and associated activity restriction in older adults. *J Gerontol B Psychol Sci Soc Sci.* 1998;53:384-392.	Does not focus on reducing risk or rate of falls or fallers
Tinetti ME, Baker DI, Gottschalk M, et al. Home-based multicomponent rehabilitation program for older persons after hip fracture: a randomized trial. *Arch Phys Med Rehabil.* 1999;80:916-922.	Not conducted in primary care or other setting with a primary care-comparable population
Tinetti ME, Mendes de Leon CF, Doucette JT, Baker DI. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *J Gerontol.* 1994;49:M140-M147.	Not a randomized controlled trial
Tinetti ME. Prevention of falls and fall injuries in elderly persons: a research agenda. *Prev Med.* 1994;23:756-762.	Not a randomized controlled trial
Tobis J, Reinsch S, MacRae P, Lachenbruch T. Experimental intervention at senior centres for the prevention of falls. *J Am Geriatr Soc.* 1990;38:A28.	Provides no data not otherwise covered in other articles for this study
Tulloch AJ, Moore V. A randomized controlled trial of geriatric screening and surveillance in general practice. *J R Coll Gen Pract.* 1979;29:733-740.	Does not focus on reducing risk or rate of falls or fallers

Appendix C Table 6. Studies Excluded From the Review for Key Question 1

Reference	Reason for exclusion
Vaapio S, Salminen M, Vahlberg T, et al. Effects of risk-based multifactorial fall prevention on health-related quality of life among the community-dwelling aged: a randomized controlled trial. *Health Qual Life Outcomes.* 2007;5:20.	No relevant outcomes
Vaapio SS, Salminen MJ, Ojanlatva A, Kivela SL. Quality of life as an outcome of fall prevention interventions among the aged: a systematic review. *Eur J Pub Health.* 2009;19:7-15.	Used only as a source document
van der Velde N, Meerding WJ, Looman CW, Pols HA, van der Cammen TJ. Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients. *Drugs Aging.* 2008;25:521-529.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
van Haastregt JC, Diederiks JP, van Rossum E, de Witte LP, Voorhoeve PM, Crebolder HF. Effects of a programme of multifactorial home visits on falls and mobility impairments in elderly people at risk: randomised controlled trial. *BMJ*. 2000;321:994-998.	No relevant outcomes
van Rossum E, Frederiks CM, Philipsen H, Portengen K, Wiskerke J, Knipschild P. Effects of preventive home visits to elderly people. *BMJ.* 1993;307:27-32.	Does not focus on reducing risk or rate of falls or fallers
van Schoor NM, Smit JH, Twisk JW, Bouter LM, Lips P. Prevention of hip fractures by external hip protectors: a randomized controlled trial. *JAMA.* 2003;289:1957-1962.	Not conducted in primary care or other setting with a primary care-comparable population
Vass M, Avlund K, Kvist K, Hendriksen C, Andersen CK, Keiding N. Structured home visits to older people. Are they only of benefit for women? A randomised controlled trial. *Scand J Prim Health Care.* 2004;22:106-111.	Does not focus on reducing risk or rate of falls or fallers
Vassallo M, Vignaraja R, Sharma JC, Briggs RS, Allen SC. Can intervention prevent falls and injury in geriatric wards? Hospital Injury Prevention (HIP) study. *Age Ageing* 2001;30(Suppl 2):15.	Not conducted in primary care or other setting with a primary care-comparable population
Verfaillie DF, Nichols JF, Turkel E, Hovell MF. Effects of resistance, balance, and gait training on reduction of risk factors leading to falls in elders. *J Aging Phys Activity.* 1997;213-228.	Does not focus on reducing risk or rate of falls or fallers
Vetter NJ, Jones DA, Victor CR. Effect of health visitors working with elderly patients in general practice: a randomised controlled trial. *Br Med J (Clin Res Ed).* 1984;288:369-372.	Does not focus on reducing risk or rate of falls or fallers
Vetter NJ, Lewis PA, Ford D. Can health visitors prevent fractures in elderly people? *BMJ.* 1992;304:888-890.	High or differential attrition
Wallace JI, Buchner DM, Grothaus L, et al. Implementation and effectiveness of a community-based health promotion program for older adults. *J Gerontol A Biol Sci Med Sci.* 1998;53:M301-M306.	Does not focus on reducing risk or rate of falls or fallers
Widen HL, von Koch L, Kostulas V, et al. A randomized controlled trial of rehabilitation at home after stroke in southwest Stockholm. *Stroke.* 1998;29:591-597.	Population not comparable to primary care
Wilkins S, Jung B, Wishart L, Edwards M, Norton SG. The effectiveness of community-based occupational therapy education and functional training programs for older adults: a critical literature review. *Can J Occup Ther.* 2003;70:214-225.	Used only as a source document
Williams ME, Williams TF, Zimmer JG, Hall WJ, Podgorski CA. How does the team approach to outpatient geriatric evaluation compare with traditional care: a report of a randomized controlled trial. *J Am Geriatr Soc.* 1987;35:1071-1078.	Does not focus on reducing risk or rate of falls or fallers
Wolf B, Feys H, De Weerdt W, et al. Effect of a physical therapeutic intervention for balance problems in the elderly: a single-blind, randomized, controlled multicentre trial. *Clin Rehabil.* 2001;15:624-636.	Does not focus on reducing risk or rate of falls or fallers
Wolf SL, Barnhart HX, Ellison GL, Coogler CE. The effect of Tai Chi Quan and computerized balance training on postural stability in older subjects. *Phys Ther.* 1997;77:371-381.	No relevant outcomes
Wolf SL, Kutner NG, Green RC, McNeely E. The Atlanta FICSIT study: two exercise interventions to reduce frailty in elders. *J Am Geriatr Soc.* 1993;41:329-332.	Provides no data not otherwise covered in other articles for this study
Wolfson L, Whipple R, Derby C, et al. Balance and strength training in older adults: intervention gains and Tai Chi maintenance. *J Am Geriatr Soc.* 1996;44:498-506.	Does not focus on reducing risk or rate of falls or fallers
Yates SM, Dunnagan TA. Evaluating the effectiveness of a home-based fall risk reduction program for rural community-dwelling older adults. *J Gerontol A Biol Sci Med Sci.* 2001;56:M226-M230.	Does not focus on reducing risk or rate of falls or fallers
Zimmer JG, Groth-Juncker A, McCusker J. A randomized controlled study of a home health care team. *Am J Public Health.* 1985;75:134-141.	Does not focus on reducing risk or rate of falls or fallers

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Study finds little evidence of benefit from NHS falls clinics. *Guidelines in Practice.* 2008;11:10.	Provides no data not otherwise covered in other articles for this study
Arai T, Obuchi S, Inaba Y, et al. The effects of short-term exercise intervention on falls self-efficacy and the relationship between changes in physical function and falls self-efficacy in Japanese older people: a randomized controlled trial. *Am J Phys Med Rehabil.* 2007;86:133-141.	No relevant outcomes
Arden NK, Crozier S, Smith H, et al. Knee pain, knee osteoarthritis, and the risk of fracture. *Arthritis Rheum.* 2006;55:610-615.	Not a randomized controlled trial
Armstrong AL, Oborne J, Coupland CA, Macpherson MB, Bassey EJ, Wallace WA. Effects of hormone replacement therapy on muscle performance and balance in post-menopausal women. *Clin Sci (Lond).* 1996;91:685-690.	Population does not have an average age of 65 and older
Armstrong AL. Hormone Replacement Therapy: Effects on Strength, Balance, and Bone Density [MD Thesis]. Nottingham: University of Nottingham; 1996.	Provides no data not otherwise covered in other articles for this study
Baker MK, Atlantis E, Fiatarone Singh MA. Multi-modal exercise programs for older adults. *Age Ageing.* 2007;36:375-381.	Used only as source document
Ballard JE, McFarland C, Wallace LS, Holiday DB, Roberson G. The effect of 15 weeks of exercise on balance, leg strength, and reduction in falls in 40 women aged 65 to 89 years. *J Am Med Womens Assoc.* 2004;59:255-261.	Poor reporting
Barr RJ, Stewart A, Torgerson DJ, Seymour DG, Reid DM. Screening elderly women for risk of future fractures—participation rates and impact on incidence of falls and fractures. *Calcif Tissue Int.* 2005;76:243-248.	Poor reporting
Barry H. Can strengthening exercises prevent falls in community-living elders? *Evid Based Pract.* 2002;5:4.	Provides no data not otherwise covered in other articles for this study
Batchelor F, Hill K, Mackintosh S, Said C, Whitehead C. The FLASSH study: protocol for a randomised controlled trial evaluating falls prevention after stroke and two sub-studies. *BMC Neurology*. 2009;9:14.	No relevant outcomes
Becker C, Kron M, Lindemann U, et al. Effectiveness of a multifaceted intervention on falls in nursing home residents. *J Am Geriatr Soc.* 2003;51:306-313.	Not conducted in primary care or other setting with primary care-comparable population
Becker C, Walter-Jung B, Nikolaus T. The other side of hip protectors. *Age Ageing.* 2000;29:186.	Not conducted in primary care or other setting with primary care-comparable population
Becker C, Lindemann U, Nikolaus T. Multifactorial intervention on falls and fractures in nursing homes. *Age Ageing.* 2000; 29(Suppl 2):18.	Provides no data not otherwise covered in other articles for this study
Ben IR, Giladi N, Gruendlinger L. Methylphenidate may reduce risk of falling in the elderly. *Brown Univ Geriatr Psychopharmacol Update.* 2008;12:3.	Does not focus on reducing the risk or rate of falls or fallers
Berggren M, Stenvall M, Olofsson B, Gustafson Y. Evaluation of a fall-prevention program in older people after femoral neck fracture: a one-year follow-up. *Osteoporos Int.* 2008;19:801-809.	Not conducted in primary care or other setting with primary care-comparable population
Bernabei R, Landi F, Gambassi G, et al. Randomised trial of impact of model of integrated care and case management for older people living in the community. *BMJ.* 1998;316:1348-1351.	Does not focus on reducing the risk or rate of falls or fallers
Beswick AD, Rees K, Dieppe P, et al. Complex interventions to improve physical function and maintain independent living in elderly people: a systematic review and meta-analysis. *Lancet.* 2008;371:725-735.	Used only as source document
Binder EF, Schechtman KB, Ehsani AA, et al. Effects of exercise training on frailty in community-dwelling older adults: results of a randomized, controlled trial. *J Am Geriatr Soc.* 2002;50:1921-1928.	Does not focus on reducing the risk or rate of falls or fallers
Birks Y. A multifactorial intervention after a fall did not prevent falls in elderly patients with cognitive impairment and dementia. *Evid Based Nurs.* 2003;6:114-115.	Provides no data not otherwise covered in other articles for this study
Birks YF, Hildreth R, Campbell P, Sharpe C, Torgerson DJ, Watt I. Randomised controlled trial of hip protectors for the prevention of second hip fractures. *Age Ageing.* 2003;32:442-444.	Poor reporting
Bischoff HA, Stahelin HB, Dick W, et al. Effects of vitamin D and calcium supplementation on falls: a randomized controlled trial. *J Bone Mineral Res.* 2003;18:343-351.	Population is not comparable to primary care
Bischoff-Ferrari HA, Orav JE, Dawson HB. Effect of vitamin D3 plus calcium on fall risk in older men and women: a 3-year randomized controlled trial. *J Bone Mineral Res.* 2004;19:S57.	Provides no data not otherwise covered in other articles for this study
Bleijlevens MH, Hendriks MR, van-Haastregt JC, et al. Process factors explaining the ineffectiveness of a multidisciplinary fall prevention programme: a process evaluation. *BMC Pub Health.* 2008;8:332.	Provides no data not otherwise covered in other articles for this study
Bogaerts A, Verschueren S, Delecluse C, Claessens AL, Boonen S. Effects of whole body vibration training on postural control in older individuals: a 1 year randomized controlled trial. *Gait Posture.* 2007;26:309-316.	No relevant outcomes

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Boonen S, Bischoff-Ferrari HA, Cooper C, et al. Addressing the musculoskeletal components of fracture risk with calcium and vitamin D: a review of the evidence. *Calcif Tissue Int.* 2006;78:257-270.	Does not focus on reducing the risk or rate of falls or fallers
Bourke N, Persson UM. Effects of an exercise and education based falls prevention programme for community dwelling older people with and without computerised visual feedback training—a randomised controlled pilot study. *Phys Ther Rev.* 2008;13:200-201.	No relevant outcomes
Bowling A, Formby J, Grant K. Accidents in elderly care: a randomised controlled trial (Part 2). *Nurs Stand.* 1992;6:28-31.	Not conducted in primary care or other setting with primary care-comparable population
Brown C. Systematic review of the literature concluded that there is an evidence base for occupational therapy interventions with people aged 60+ living independently in the community. *Occup Ther Now.* 2006;8:13-14.	Not a randomized controlled trial
Buchner DM, Cress ME, de Lateur BJ, et al. A comparison of the effects of three types of endurance training on balance and other fall risk factors in older adults. *Aging (Milano).* 1997;9:112-119.	Does not focus on reducing the risk or rate of falls or fallers
Buchner DM, Cress ME, Wagner EH, de Lateur BJ. The role of exercise in fall prevention: developing targeting criteria for exercise programs. In: Vesllas B, Toupet M, Rubenstein L, et al, eds. Falls, Balance, and Gait Disorders in the Elderly. Amsterdam: Elsevier; 1992:55-68.	Not a randomized controlled trial
Buettner LL. Falls prevention in dementia populations: following a trial program of recreation therapy, falls were reduced by 164 percent. *Provider.* 2002;28:41-43.	Population is not comparable to primary care
Burton LC, Paglia MJ, German PS, Shapiro S, Damiano AM. The effect among older persons of a general preventive visit on three health behaviors: smoking, excessive alcohol drinking, and sedentary lifestyle. *Prev Med.* 1995;24:492-497.	Does not focus on reducing the risk or rate of falls or fallers
Byles JE, Tavener M, O'Connell RL, et al. Randomised controlled trial of health assessments for older Australian veterans and war widows. *Med J Aust.* 2004;181:186-190.	Does not focus on reducing the risk or rate of falls or fallers
Cameron ID, Stafford B, Cumming RG, et al. Hip protectors improve falls self-efficacy. *Age Ageing.* 2000;29:57-62.	Does not focus on reducing the risk or rate of falls or fallers
Cameron ID, Venman J, Kurrle SE, et al. Hip protectors in aged-care facilities: a randomized trial of use by individual higher-risk residents. *Age Ageing.* 2001;30:477-481.	Population is not comparable to primary care
Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Falls prevention over 2 years: a randomized controlled trial in women 80 years and older. *Age Ageing.* 1999;28:513-518.	High or differential attrition
Campbell AJ, Robertson MC. Rethinking individual and community fall prevention strategies: a meta-regression comparing single and multifactorial interventions. *Age Ageing.* 2007;36:656-662.	Used only as source document
Caplan GA, Ward JA, Brennan NJ, Coconis J, Board N, Brown A. Hospital in the home: a randomised controlled trial. *Med J Aust.* 1999;170:156-160.	Not conducted in primary care or other setting with primary care-comparable population
Carpenter GI, Demopoulos GR. Screening the elderly in the community: controlled trial of dependency surveillance using a questionnaire administered by volunteers. *BMJ.* 1990;300:1253-1256.	Does not focus on reducing the risk or rate of falls or fallers
Carter ND, Khan KM, McKay HA, et al. Community-based exercise program reduces risk factors for falls in 65- to 75-year-old women with osteoporosis: randomized controlled trial. *CMAJ.* 2002;167:997-1004.	Does not focus on reducing the risk or rate of falls or fallers
Carter ND, Khan KM, Petit MA, et al. Results of a 10 week community based strength and balance training programme to reduce fall risk factors: a randomised controlled trial in 65-75 year old women with osteoporosis. *Br J Sports Med.* 2001;35:348-351.	Does not focus on reducing the risk or rate of falls or fallers
Carter S, Campbell E, Sanson FR, Corkrey R, Gillespie W. A trial of two strategies aimed at reducing falls through home hazard modification and medication review. Unpublished information. 2002.	No relevant outcomes
Carter SE, Campbell EM, Sanson-Fisher RW, Redman S, Gillespie WJ. Environmental hazards in the homes of eldery people. *Age Ageing.* 1997;26:195-202.	No relevant outcomes
Cerny K. The effect of a multidimensional exercise program on strength, range of motion, balance, and gait in the well elderly. *Gait Posture.* 1998;7:185-186.	No relevant outcomes
Chandler JM, Duncan PW, Kochersberger G, Studenski S. Is lower extremity strength gain associated with improvement in physical performance and disability in frail, community-dwelling elders? *Arch Phys Med Rehabil.* 1998;79:24-30.	Does not focus on reducing the risk or rate of falls or fallers
Chapuy MC, Arlot ME, Duboeuf F, et al. Vitamin D3 and calcium to prevent hip fractures in the elderly women. *N Engl J Med.* 1992;327:1637-1642.	Does not focus on reducing the risk or rate of falls or fallers
Cheng PT, Wu SH, Liaw MY, Wong AM, Tang FT. Symmetrical body-weight distribution training in stroke patients and its effect on fall prevention. *Arch Phys Med Rehabil.* 2001;82:1650-1654.	Not conducted in primary care or other setting with primary care-comparable population
Choi JH, Moon J, Song R. Effects of Sun-style Tai Chi exercise on physical fitness and fall prevention in fall-prone older adults. *J Adv Nurs.* 2005;51:150-157.	Not a randomized controlled trial
Clarke M, Clarke SJ, Jagger C. Social intervention and the elderly: a randomized controlled trial. *Am J Epidemiol.* 1992;136:1517-1523.	Does not focus on reducing the risk or rate of falls or fallers
Close J. Prevention of Falls in the Elderly Trial (PROFET): a randomised controlled trial. *Curr Control Trials.* 2003.	Provides no data not otherwise covered in other articles for this study

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Close JC, Patel A, Hooper R, Glucksman E, Jackson SH, Swift CG. PROFET : improved clinical outcomes at no additional cost. *J Am Geriatr Soc*. 2000;29(Suppl 1):48.	Provides no data not otherwise covered in other articles for this study
Close J. Can the incidence of falls in the elderly be reduced by a secondary prevention protocol? Oxford: National Research Register; 2003.	Not a randomized controlled trial
Close J, Hooper R, Glucksman E, Jackson S, Swift C. Predictors of falls in a high risk population: results from the Prevention of Falls in the Elderly Trial (PROFET). *J Am Geriatr Soc.* 2000;48:S79.	Not a randomized controlled trial
Coleman EA, Wagner EH, Grothaus LC, Hecht J, Savarino J, Buchner DM. Predicting hospitalization and functional decline in older health plan enrollees: are administrative data as accurate as self-report? *J Am Geriatr Soc.* 1998;46:419-425.	Does not focus on reducing the risk or rate of falls or fallers
Coogler CE, Wolf SL. Balance training in elderly fallers and nonfallers. *Rehabil Rd Prog Rep.* 1994;96-97.	No relevant outcomes
Cranney A, Hanley D, Horsley T, et al. Effectiveness and Safety of Vitamin D in Relation to Bone Health. Rockville, MD: Agency for Healthcare Research and Quality; 2007.	Used only as source document
Crome P. A randomised controlled trial of a nurse led falls prevention clinic. *J Am Geriatr Soc.* 2000;48:S78.	No relevant outcomes
Cumming RG, Thomas M, Szonyi G, et al. Home visits by an occupational therapist for assessment and modification of environmental hazards: a randomized trial of falls prevention. *J Am Geriatr Soc.* 1999;47:1397-1402.	Population is not comparable to primary care
Cumming RG, Thomas M, Szonyi G, Frampton G, Salkeld G, Clemson L. Adherence to occupational therapist recommendations for home modifications for falls prevention. *Am J Occup Ther.* 2001;55:641-648.	Not a randomized controlled trial
Dalby DM, Sellors JW, Fraser FD, Fraser C, van IC, Howard M. Effect of preventive home visits by a nurse on the outcomes of frail elderly people in the community: a randomized controlled trial. *CMAJ.* 2000;162:497-500.	Does not focus on reducing the risk or rate of falls or fallers
Davis JC, Donaldson MG, Ashe MC, Khan KM. The role of balance and agility training in fall reduction: a comprehensive review. *Europa Medicophysica.* 2004;40:211-221.	Used only as source document
Dawson P, Chapman KL, Shaw FE, Kenny RA. Measuring the outcome of physiotherapy in cognitively impaired elderly patients who fall. *Physiotherapy.* 1997;83:352.	Does not focus on reducing the risk or rate of falls or fallers
Dean CM, Rissel C, Sharkey M, et al. Exercise intervention to prevent falls and enhance mobility in community dwellers after stroke: a protocol for a randomised controlled trial. *BMC Neurol.* 2009;9:38.	No relevant outcomes
Di Monaco M, Vallero F, De Toma E, De Lauso L, Tappero R, Cavanna A. A single home visit by an occupational therapist reduces the risk of falling after hip fracture in elderly women: a quasi-randomized controlled trial. *J Rehabil Med.* 2008;40:446-450.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Donald IP, Pitt K, Armstrong E, Shuttleworth H. Preventing falls on an elderly care rehabilitation ward. *Clin Rehabil.* 2000;14:178-185.	Not conducted in primary care or other setting with primary care-comparable population
Dukas L, Bischoff HA, Lindpaintner LS, Schacht E, Birkner BD, Thalmann B. Alfacalcidol reduces the number of fallers and falls in community-dwelling elderly provided a mainimum total daily intake of 500mg calcium. *Calcif Tissue Int.* 2003;72:371.	Provides no data not otherwise covered in other articles for this study
Dukas L, Schacht E, Mazor Z, Stahelin HB. Treatment with alfacalcidol in elderly people significantly decreases the high risk of falls associated with a low creatinine clearance of <65 ml/min. *Osteoporos Int.* 2005;16:198-203.	Provides no data not otherwise covered in other articles for this study
Dyer CA, Taylor GJ, Halpin M, Dyer CA, Robertson DR, Harrington R. Falls prevention in residential homes: a randomised controlled trial. *Age Ageing.* 2003;32:16.	Not conducted in primary care or other setting with primary care-comparable population
Ebrahim S, Thompson PW, Baskaran V, Evans K. Randomized placebo-controlled trial of brisk walking in the prevention of postmenopausal osteoporosis. *Age Ageing.* 1997;26:253-260.	Problems with baseline comparability between groups
Edwards N. A home based, nurse delivered exercise programme reduced falls and serious injuries in people ≥80 years of age. *Evid Based Nurs.* 2002;5:22.	Not a randomized controlled trial
Eekhof J, De Bock G, Schaapveld K, Springer M. Effects of screening for disorders among the elderly: an intervention study in general practice. *Fam Pract.* 2000;17:329-333.	Does not focus on reducing the risk or rate of falls or fallers
El-Faizy M, Reinsch S. Home safety intervention for the prevention of falls. *Phys Occup Ther Geriatr.* 1994;12:33-49.	Not a randomized controlled trial
Engelhardt JB, Toseland RW, O'Donnell JC, Richie JT, Jue D, Banks S. The effectiveness and efficiency of outpatient geriatric evaluation and management. *J Am Geriatr Soc.* 1996;44:847-856.	Does not focus on reducing the risk or rate of falls or fallers
Englund U, Littbrand H, Sondell A, Pettersson U, Bucht G. A 1-year combined weight-bearing training program is beneficial for bone mineral density and neuromuscular function in older women. *Osteoporos Int.* 2005;16:1117-1123.	Does not focus on reducing the risk or rate of falls or fallers
Epstein AM, Hall JA, Fretwell M, et al. Consultative geriatric assessment for ambulatory patients: a randomized trial in a health maintenance organization. *JAMA.* 1990;263:538-544.	Does not focus on reducing the risk or rate of falls or fallers

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Eriksson BG, Mellstrom D, Svanborg A. Medical-social intervention in a 70-year-old Swedish population: a general presentation of methodological experience. *Compr Gerontol [C].* 1987;1:49-56.	Does not focus on reducing the risk or rate of falls or fallers
Faddis MN, Rich MW. Pacing interventions for falls and syncope in the elderly. *Clin Geriatr Med.* 2002;18:279-294.	Not a randomized controlled trial
Feder G, Cryer C, Donovan S, Carter Y. Guidelines for the prevention of falls in people over 65. *BMJ.* 2000;321:1007-1011.	Provides no data not otherwise covered in other articles for this study
Ferreri S, Roth MT, Casteel C, Demby KB, Blalock SJ. Methodology of an ongoing, randomized controlled trial to prevent falls through enhanced pharmaceutical care. *Am J Geriatr Pharmacother.* 2008;6:61-81.	No relevant outcomes
Fosnight SM, Zafirau WJ, Hazelett SE. Vitamin D supplementation to prevent falls in the elderly: evidence and practical considerations. *Pharmacother.* 2008;28:225-234.	Not a randomized controlled trial
Freiberger E, Menz HB, bu-Omar K, Rutten A. Preventing falls in physically active community-dwelling older people: a comparison of two intervention techniques. *Gerontology.* 2007;53:298-305.	Problems with baseline comparability between groups
Fuzhong L, Harmer P, Glasgow R, et al. Translation of an effective Tai Chi intervention into a community-based falls-prevention program. *Am J Pub Health.* 2008;98:1195-1198.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Gallagher EM, Brunt H. Head over heels: impact of a health promotion program to reduce falls in the elderly. *Can J Aging.* 1996;15:84-96.	Poor reporting
Gallagher JC, Haynatski G, Fowler S. Calcitriol therapy reduces falls and fractures in elderly women. *Calcif Tissue Int.* 2003;72:334.	Provides no data not otherwise covered in other articles for this study
Gallagher JC, Rapuri P, Smith L. Falls are associated with decreased renal function and insufficient calcitriol production by the kidney. *J Steroid Biochem Mol Bio.* 2007;103:610-613.	Provides no data not otherwise covered in other articles for this study
Gallagher JC, Rapuri PB, Smith LM. An age-related decrease in creatinine clearance is associated with an increase in number of falls in untreated women but not in women receiving calcitriol treatment. *J Clin Endocrinol Metab.* 2007;92:51-58.	Provides no data not otherwise covered in other articles for this study
Gardner MM, Phty M, Robertson MC, McGee R, Campbell AJ. Application of a falls prevention program for older people to primary health care practice. *Prev Med.* 2002;34:546-553.	Not a randomized controlled trial
Gardner M. Home-based exercises to prevent falls in elderly women. *N Z J Physiother.* 1998;26:6.	Provides no data not otherwise covered in other articles for this study
Gates S, Fisher JD, Cooke MW, Carter YH, Lamb SE. Multifactorial assessment and targeted intervention for preventing falls and injuries among older people in community and emergency care settings: systematic review and meta-analysis. *BMJ.* 2008;336:130-133.	Used only as source document
Grahn Kronhed AC, Blomberg C, Lofman O, Timpka T, Moller M. Evaluation of an osteoporosis and fall risk intervention program for community-dwelling elderly. A quasi-experimental study of behavioral modifications. *Aging Clin Exp Res.* 2006;18:235-241.	Not a randomized controlled trial
Greenspan SL, Resnick NM, Parker RA. The effect of hormone replacement on physical performance in community-dwelling elderly women. *Am J Med.* 2005;118:1232-1239.	Comparative effectiveness design
Gunner-Svensson F, Ipsen J, Olsen J, Waldstrom B. Prevention of relocation of the aged in nursing homes. *Scand J Prim Health Care.* 1984;2:49-56.	Does not focus on reducing the risk or rate of falls or fallers
Healey F, Monro A, Cockram A, et al. Using targeted risk factor reduction to prevent falls in older inpatients: a randomised controlled trial. *Age Ageing.* 2005;34:311-312.	Not a randomized controlled trial
Hakim RM, Roginski A, Walker J. Comparison of fall risk education methods for primary prevention with community-dwelling older adults in a senior center setting. *J Geriatr Phys Ther.* 2007;30:60-68.	No relevant outcomes
Hall N, De Beck P, Johnson D, Mackinnon K, Gutman G, Glick N. Randomized trial of a health promotion program for frail elders. *Can J Aging.* 1992;11:72-91.	Does not focus on reducing the risk or rate of falls or fallers
Harling A, Simpson JP. A systematic review to determine the effectiveness of Tai Chi in reducing falls and fear of falling in older adults. *Phys Ther Rev.* 2008;13:237-248.	Used only as source document
Hauer K, Rost B, Rutschle K, et al. Exercise training for rehabilitation and secondary prevention of falls in geriatric patients with a history of injurious falls. *J Am Geriatr Soc.* 2001;49:10-20.	Not conducted in primary care or other setting with primary care-comparable population
Helbostad JL, Sletvold O, Moe-Nilssen R. Effects of home exercises and group training on functional abilities in home-dwelling older persons with mobility and balance problems: a randomized study. *Aging Clin Exp Res.* 2004;16:113-121.	Not a randomized controlled trial
Hendriks MR, van Haastregt JC, Diederiks JP, Evers SM, Crebolder HF, van Eijk JT. Effectiveness and cost-effectiveness of a multidisciplinary intervention programme to prevent new falls and functional decline among elderly persons at risk: design of a replicated randomised controlled trial. *BMC Pub Health.* 2005;5:6.	Provides no data not otherwise covered in other articles for this study

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Hendriksen C, Lund E, Stromgard E. Consequences of assessment and intervention among elderly people: a three year randomised controlled trial. *Br Med J (Clin Res Ed).* 1984;289:1522-1524.	Does not focus on reducing the risk or rate of falls or fallers
Hien le TT, Cumming RG, Cameron ID, et al. Atypical antipsychotic medications and risk of falls in residents of aged care facilities. *J Am Geriatr Soc.* 2005;53:1290-1295.	Not conducted in primary care or other setting with primary care-comparable population
Hill K. Review: intrinsic and environmental risk-factor modification reduces falls in elderly persons. *ACP J Club.* 2002;137:9.	Used only as source document
Homoud M. Cardiac pacing reduced nonaccidental falls in older adults with cardioinhibitory carotid sinus hypersensitivity. *ACP J Club.* 2002;137:8.	Provides no data not otherwise covered in other articles for this study
Hornbrook MC, Stevens VJ, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Preventing falls among community-dwelling older persons: results from a randomized trial. *Gerontologist.* 1994;34:16-23.	Comparative effectiveness study design
Hourigan SR, Nitz JC, Brauer SG, O'Neill S, Wong J, Richardson CA. Positive effects of exercise on falls and fracture risk in osteopenic women. *Osteoporos Int.* 2008;19:1077-1086.	Population does not have an average age of 65 and older
Inokuchi S, Matsusaka N, Hayashi T, Shindo H. Feasibility and effectiveness of a nurse-led community exercise programme for prevention of falls among frail elderly people: a multi-centre controlled trial. *J Rehabil Med.* 2007;39:479-485.	Not a randomized controlled trial
Iyer S, Naganathan V, McLachlan AJ, Le Couteur DG. Medication withdrawal trials in people aged 65 years and older: a systematic review. *Drugs Aging.* 2008;25:1021-1031.	Not conducted in primary care or other setting with primary care-comparable population
Jacobs R, Campbell AJ, Robertson MC. Randomized controlled trial of falls prevention in people 75 years and older with severe visual impairment. *Am Acad Optom.* 2005.	Provides no data not otherwise covered in other articles for this study
Jensen J, Lundin-Olsson L, Nyberg L, Gustafson Y. Fall and injury prevention in older people living in residential care facilities: a cluster randomized trial. *Ann Intern Med.* 2002;136:733-741.	Not conducted in primary care or other setting with primary care-comparable population
Jessup JV, Horne C, Vishen RK, Wheeler D. Effects of exercise on bone density, balance, and self-efficacy in older women. *Biol Res Nurs.* 2003;4:171-180.	Does not focus on reducing the risk or rate of falls or fallers
Jitapunkul S. A randomised controlled trial of regular surveillance in Thai elderly using a simple questionnaire administered by non-professional personnel. *J Med Assoc Thai.* 1998;81:352-356.	Setting: country below 0.90 on Human Development Index
Jones CJ, Robichaux J, Williams P, Rikli R. The effects of a 16-week exercise program on the dynamic balance of older adults. *J Clin Exp Gerontol.* 1992;14:165-182.	Does not focus on reducing the risk or rate of falls or fallers
Kannus P, Parkkari J, Niemi S, et al. Prevention of hip fracture in elderly people with use of a hip protector. *N Engl J Med.* 2000;343:1506-1513.	Not conducted in primary care or other setting with primary care-comparable population
Karachalios T, Lyritis GP, Kaloudis J, Roidis N, Katsiri M. The effects of calcitonin on acute bone loss after pertrochanteric fractures: a prospective, randomised trial. *J Bone Joint Surg Br.* 2004;86:350-358.	Does not focus on reducing the risk or rate of falls or fallers
Karmisholt K, Gyntelberg F, Gotzche PC. Physical activity for primary prevention of disease: systematic reviews of randomised clinical trials. *Dan Med Bull.* 2005;52:86-89.	Article covered by an included systematic review
Kennedy JS, Young CA, Hoffman VP, Feldman PD, Deberdt W. A placebo-controlled 10-week prospective comparison of the occurrence of falls in dementia: olanzapine versus risperidone. Poster presented at: International College of Geriatric Psychoneuropharmacology; October 10-12, 2002; Barcelona, Spain.	Population is not comparable to primary care
Kenny RA, Richardson DA, Steen N, Bexton RS, Shaw FE, Bond J. Carotid sinus syndrome: a modifiable risk factor for nonaccidental falls in older adults (SAFE PACE). *J Am Coll Cardiol.* 2001;38:1491-1496.	Population is not comparable to primary care
Kenny RA, Richardson DA. Carotid sinus syndrome and falls in older adults. *Am J Geriatr Cardiol.* 2001;10:97-99.	Population is not comparable to primary care
Kenny RA, Seifer C. Brief report: SAFE PACE 2 (Syncope and Falls in the Elderly—Pacing and Carotid Sinus Evaluation): a randomized control trial of cardiac pacing in older patients with falls and carotid sinus hypersensitivity. *Am J Geriatr Cardiol.* 1999;8:87.	Provides no data not otherwise covered in other articles for this study
Kercher BJ, Rubenstein LZ. Home-safety checklists for elders in print and on the Internet. *Generations.* 2002;26:69-74.	Not a randomized controlled trial
Kerse NM, Flicker L, Jolley D, Arroll B, Young D. Improving the health behaviours of elderly people: randomised controlled trial of a general practice education programme. *BMJ.* 1999;319:683-687.	Does not focus on reducing the risk or rate of falls or fallers
King MB, Tinetti ME. A multifactorial approach to reducing injurious falls. *Clin Geriatr Med.* 1996;12:745-759.	Provides no data not otherwise covered in other articles for this study
Kingston P. Older people and falls: a randomized controlled trial of a health visitor (HV) intervention. *Rev Clin Gerontol.* 2001;11:209-214.	Poor reporting
Kingston P. Elderly people and accidents: a prospective analysis of accidental causation among elderly populations and their post discharge requirements. Oxford: National Research Register; 2000.	Poor reporting

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Study reference	Reason for exclusion
Kingston P. RCT of health visitor (HV) intervention in falls. *Age Ageing.* 2001;30(Suppl 1):40.	Poor reporting
Kinirons MT, Martin F, Lightbody E, et al. Randomised controlled trial of a nurse-led falls prevention programme. *Age Ageing.* 2003;32:361-363.	Not a randomized controlled trial
Komagata S, Newton R. The effectiveness of Tai Chi on improving balance in older adults: an evidence-based review. *J Geriatr Phys Ther.* 2003;26:9-16.	Not a randomized controlled trial
Kono A, Kai I, Sakato C, Harker JO, Rubenstein LZ. Effect of preventive home visits for ambulatory housebound elders in Japan: a pilot study. *Aging Clin Exp Res.* 2004;16:293-299.	Does not focus on reducing the risk or rate of falls or fallers
Kriska AM, Bayles C. A randomized exercise trial in older women: increased activity over two years and the factors associated with compliance. *Med Sci Sports Exerc.* 1986;18:557-562.	Population does not have an average age of 65 and older
La Grow SJ, Robertson MC, Campbell AJ, Clarke GA, Kerse NM. Reducing hazard related falls in people 75 years and older with significant visual impairment: how did a successful program work? *Injury Prev.* 2006;12:296-301.	Provides no data not otherwise covered in other articles for this study
Larsen ER, Mosekilde L, Foldspang A. Vitamin D and calcium supplementation prevents severe falls in elderly community-dwelling women: a pragmatic population-based 3-year intervention study. *Aging Clin Exp Res.* 2005;17:125-132.	No relevant outcomes
Latham NK, Anderson CS, Reid IR. Effects of vitamin D supplementation on strength, physical performance, and falls in older persons: a systematic review. *J Am Geriatr Soc*. 2003;51:1219-1226.	Used only as source document
Latham NK, Bennett DA, Stretton CM, Anderson CS. Systematic review of progressive resistance strength training in older adults. *J Gerontol A Biol Sci Med Sci.* 2004;59A:48-61.	Used only as source document
Lawton BA, Rose SB, Elley CR, Dowell AC, Fenton A, Moyes SA. Exercise on prescription for women aged 40-74 recruited through primary care: two year randomised controlled trial. *BMJ.* 2008;337:a2509.	Population does not have an average age of 65 and older
Leathley M. Fallers attending casualty. Oxford: National Research Register; 2001.	Provides no data not otherwise covered in other articles for this study
Lee MS, Pittler MH, Shin BC, Ernst E. Tai Chi for osteoporosis: a systematic review. *Osteoporos Int.* 2008;19:139-146.	No relevant outcomes
Leveille SG, Wagner EH, Davis C, et al. Preventing disability and managing chronic illness in frail older adults: a randomized trial of a community-based partnership with primary care. *J Am Geriatr Soc.* 1998;46:1191-1198.	Does not focus on reducing the risk or rate of falls or fallers
Li F, Harmer P, Fisher KJ, McAuley E. Tai Chi: improving functional balance and predicting subsequent falls in older persons. *Med Sci Sports Exerc.* 2004;36:2046-2052.	Provides no data not otherwise covered in other articles for this study
Li Y, Devault CN, Van Oteghen S. Effects of extended Tai Chi intervention on balance and selected motor functions of the elderly. *Am J Chin Med.* 2007;35:383-391.	No relevant outcomes
Lichtenstein MJ, Shields SL, Shiavi RG, Burger C. Exercise and balance in aged women: a pilot controlled clinical trial. *Arch Phys Med Rehabil.* 1989;70:138-143.	Does not focus on reducing the risk or rate of falls or fallers
Lin MR, Wolf SL, Hwang HF, Gong SY, Chen CY. A randomized, controlled trial of fall prevention programs and quality of life in older fallers. *J Am Geriatr Soc.* 2007;55:499-506.	Not a randomized controlled trial
Lips P, Graafmans WC, Ooms ME, Bezemer PD, Bouter LM. Vitamin D supplementation and fracture incidence in elderly persons: a randomized, placebo-controlled clinical trial. *Ann Intern Med.* 1996;124:400-406.	Does not focus on reducing the risk or rate of falls or fallers
Liu-Ambrose T, Donaldson MG, Ahamed Y, et al. Otago home-based strength and balance retraining improves executive functioning in older fallers: a randomized controlled trial. *J Am Geriatr Soc.* 2008;56:1821-1830.	Comparative effectiveness design
Liu-Ambrose T, Khan KM, Eng JJ, Janssen PA, Lord SR, McKay HA. Resistance and agility training reduce fall risk in women aged 75 to 85 with low bone mass: a 6-month randomized, controlled trial. *J Am Geriatr Soc.* 2004;52:657-665.	Does not focus on reducing the risk or rate of falls or fallers
Liu PY, Swerdloff RS, Veldhuis JD. The rationale, efficacy and safety of androgen therapy in older men: future research and current practice recommendations. *J Clin Endocrinol Metab.* 2004;89:4789-4796.	Does not focus on reducing the risk or rate of falls or fallers
Lord SR, Castell S, Corcoran J, et al. The effect of group exercise on physical functioning and falls in frail older people living in retirement villages: a randomized, controlled trial. *J Am Geriatr Soc.* 2003;51:1685-1692.	Not conducted in primary care or other setting with primary care-comparable population
Lord SR, Lloyd DG, Nirui M, Raymond J, Williams P, Stewart RA. The effect of exercise on gait patterns in older women: a randomized controlled trial. *J Gerontol A Biol Sci Med Sci.* 1996;51:M64-M70.	Does not focus on reducing the risk or rate of falls or fallers
Lord SR, Ward JA, Williams P, Zivanovic E. The effects of a community exercise program on fracture risk factors in older women. *Osteoporos Int.* 1996;6:361-367.	No relevant outcomes
Lyons RA, John A, Brophy S, et al. Modification of the home environment for the reduction of injuries. *Cochrane Database Syst Rev.* 2006:CD003600.	Used only as source document
MacRae PG, Feltner ME, Reinsch S. A 1-year exercise program for older women: effects on falls, injuries, and physical performance. *J Aging Phys Activ.* 1994;2:127-142.	High or differential attrition
Madureira MM, Takayama L, Gallinaro AL, Caparbo VF, Costa RA, Pereira RM. Balance training program is highly effective in improving functional status and reducing the risk of falls in elderly women with osteoporosis: a randomized controlled trial. *Osteoporos Int.* 2007;18:419-425.	Not conducted in primary care or other setting with primary care-comparable population

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Mahoney JE, Shea TA, Przybelski R, et al. Kenosha County falls prevention study: a randomized, controlled trial of an intermediate-intensity, community-based multifactorial falls intervention. *J Am Geriatr Soc.* 2007;55:489-498.	Not a randomized controlled trial
Mansfield A, Peters AL, Liu BA, Maki BE. A perturbation-based balance training program for older adults: study protocol for a randomised controlled trial. *BMC Geriatrics.* 2007;7:12.	Does not focus on reducing the risk or rate of falls or fallers
Mariano C. A 16-week Tai Chi programme prevented falls in healthy older adults. *Evid Based Nurs.* 2008;11:60.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
Marigold DS, Eng JJ, Dawson AS, Inglis JT, Harris JE, Gylfadottir S. Exercise leads to faster postural reflexes, improved balance and mobility, and fewer falls in older persons with chronic stroke. *J Am Geriatr Soc.* 2005;53:416-423.	Not a randomized controlled trial
Masud T, Coupland C, Drummond A, et al. Multifactorial day hospital intervention to reduce falls in high risk older people in primary care: a multi-centre randomised controlled trial. *Trials.* 2006;7:5.	Provides no data not otherwise covered in other articles for this study
Mayo NE, Gloutney L, Levy AR. A randomized trial of identification bracelets to prevent falls among patients in a rehabilitation hospital. *Arch Phys Med Rehabil.* 1994;75:1302-1308.	Not conducted in primary care or other setting with primary care-comparable population
McKiernan FE. A simple gait-stabilizing device reduces outdoor falls and nonserious injurious falls in fall-prone older people during the winter. *J Am Geriatr Soc.* 2005;53:943-947.	Poor reporting
McMurdo ME, Millar AM, Daly F. A randomized controlled trial of fall prevention strategies in old peoples' homes. *Gerontology.* 2000;46:83-87.	Not conducted in primary care or other setting with primary care-comparable population
McMurdo ME, Mole PA, Paterson CR. Controlled trial of weight bearing exercise in older women in relation to bone density and falls. *BMJ.* 1997;314:569.	Population is not comparable to primary care
McNeely E, Clements SD, Wolf SL. A program to reduce frailty in the elderly. In: Funk SG, Tornquist EM, Champagne MT, Wiese RA, eds. Key Aspects of Elder Care: Managing Falls, Incontinence, and Cognitive Impairment. New York: Springer; 1992:89-92.	Provides no data not otherwise covered in other articles for this study
Means KM, Rodell DE, O'Sullivan PS, Cranford LA. Rehabilitation of elderly fallers: pilot study of a low to moderate intensity exercise program. *Arch Phys Med Rehabil.* 1996;77:1030-1036.	Not a randomized controlled trial
Means KM, Rodell DE, O'Sullivan PS. Balance, mobility, and falls among community-dwelling elderly persons: effects of a rehabilitation exercise program. *Am J Phys Med Rehabil.* 2005;84:238-250.	High or differential attrition
Millar AM, McMurdo ME. A trial of falls prevention. *Age Ageing.*1999;28(Suppl 1):15.	Not conducted in primary care or other setting with primary care-comparable population
Moreland J, Richardson J, Chan DH, et al. Evidence-based guidelines for the secondary prevention of falls in older adults. *Gerontology.* 2003;49:93-116.	Used only as source document
Mulrow CD, Gerety MB, Kanten D, DeNino LA, Cornell JE. Effects of physical therapy on functional status of nursing home residents. *J Am Geriatr Soc.* 1993;41:326-328.	Not conducted in primary care or other setting with primary care-comparable population
Nakamura T, Meguro K, Sasaki H. Relationship between falls and stride length variability in senile dementia of the Alzheimer type. *Gerontology.* 1996;42:108-113.	Not conducted in primary care or other setting with primary care-comparable population
Nakamura Y, Tanaka K, Yabushita N, Sakai T, Shigematsu R. Effects of exercise frequency on functional fitness in older adult women. *Arch Gerontol Geriatr.* 2007;44:163-173.	Does not focus on reducing the risk or rate of falls or fallers
Nelson ME, Layne JE, Bernstein MJ, et al. The effects of multidimensional home-based exercise on functional performance in elderly people. *J Gerontol A Biol Sci Med Sci.* 2004;59:154-160.	Does not focus on reducing the risk or rate of falls or fallers
Newbury J, Marley J. Preventive home visits to elderly people in the community: visits are most useful for people aged ≥75. *BMJ.* 2000;321:512.	Not a randomized controlled trial
Newbury J, Marley J. Functional assessment of the elderly (letter). *BMJ.* 1999:Oct 5.	Does not focus on reducing the risk or rate of falls or fallers
Newcomer R, Maravilla V, Faculjak P, Graves MT. Outcomes of preventive case management among high-risk elderly in three medical groups: a randomized clinical trial. *Eval Health Prof.* 2004;27:323-348.	Does not focus on reducing the risk or rate of falls or fallers
Nichols JF, Hitzelberger LM, Sherman JG, Patterson P. Effects of resistance training on muscular strength and funcational abilities of community-dwelling older adults. *J Aging Phys Activ.* 1995;238-250.	Does not focus on reducing the risk or rate of falls or fallers
Nikolaus T, Bach M. Preventing falls in community-dwelling frail older people using a home intervention team (HIT): results from the randomized Falls-HIT trial. *J Am Geriatr Soc.* 2003;51:300-305.	Population is not comparable to primary care
Nitz JC, Choy NL. The efficacy of a specific balance-strategy training programme for preventing falls among older people: a pilot randomised controlled trial. *Age Ageing.* 2004;33:52-58.	Not a randomized controlled trial
Nnodim JO, Strasburg D, Nabozny M, et al. Dynamic balance and stepping versus Tai Chi training to improve balance and stepping in at-risk older adults. *J Am Geriatr Soc.* 2006;54:1825-1831.	Does not focus on reducing the risk or rate of falls or fallers

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Nowalk MP, Prendergast JM, Bayles CM, D'Amico FJ, Colvin GC. A randomized trial of exercise programs among older individuals living in two long-term care facilities: the FallsFREE program. *J Am Geriatr Soc.* 2001;49:859-865.	Not conducted in primary care or other setting with primary care-comparable population
O'Donnell S, Moher D, Thomas K, Hanley DA, Cranney A. Systematic review of the benefits and harms of calcitriol and alfacalcidol for fractures and falls. *J Bone Mineral Metab.* 2008;26:531-542.	Used only as source document
Pahor M, Blair SN, Espeland M, et al. Effects of a physical activity intervention on measures of physical performance: results of the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) study. *J Gerontol A Biol Sci Med Sci.* 2006;61:1157-1165.	Does not focus on reducing the risk or rate of falls or fallers
Pardessus V, Puisieux F, Di Pompeo C, Gaudefroy C, Thevenon A, Dewailly P. Benefits of home visits for falls and autonomy in the elderly: a randomized trial study. *Am J Phys Med Rehabil.* 2002;81:247-252.	Population is not comparable to primary care
Peel N, Cartwright C, Steinberg M. Monitoring slips, trips and falls in the older community: preliminary results. *Health Promot J Aust.* 1998;148-150.	Does not focus on reducing the risk or rate of falls or fallers
Peel N, Steinberg M, Williams G. Home safety assessment in the prevention of falls among older people. *Aust N Z J Pub Health.* 2000;24:536-539.	Not a randomized controlled trial
Peeters GM, de Vries OJ, Elders PJ, Pluijm SM, Bouter LM, Lips P. Prevention of fall incidents in patients with a high risk of falling: design of a randomised controlled trial with an economic evaluation of the effect of multidisciplinary transmural care. *BMC Geriatr.* 2007;7:15.	Provides no data not otherwise covered in other articles for this study
Pereira MA, Kriska AM, Day RD, Cauley JA, LaPorte RE, Kuller LH. A randomized walking trial in postmenopausal women: effects on physical activity and health 10 years later. *Arch Intern Med.* 1998;158:1695-1701.	Does not focus on reducing risk or rate of falls or fallers
Pereira MA. Ten year follow-up of a randomized exercise trial in post-menopausal women [PhD thesis]. Pittsburgh: University of Pittsburgh; 1996.	Does not focus on reducing the risk or rate of falls or fallers
Perry SD, Radtke A, McIlroy WE, Fernie GR, Maki BE. Efficacy and effectiveness of a balance-enhancing insole. *J Gerontol A Biol Sci Med Sci.* 2008;63:595-602.	Population-based or community, non-referral population
Peterson JF, Kuperman GJ, Shek C, Patel M, Avorn J, Bates DW. Guided prescription of psychotropic medications for geriatric inpatients. *Arch Intern Med.* 2005;165:802-807.	Not conducted in primary care or other setting with primary care-comparable population
Peterson JF, Rosenbaum BP, Waitman LR, et al. Physicians' response to guided geriatric dosing: initial results from a randomized trial. *Medinfo.* 2007;12:2-40.	No relevant outcomes
Pfeifer M, Dobnig H, Begerow B, Suppan K. Effects of vitamin D and calcium supplementation on falls and parameters of muscle function: a prospective randomized, double-blind muliti-centre study. *J Bone Mineral Res.* 2004;19:S58.	Not a randomized controlled trial
Piirtola M, Era P. Force platform measurements as predictors of falls among older people: a review. *Gerontology.* 2006;52:1-16.	Not a randomized controlled trial
Pit SW, Byles JE, Henry DA, Holt L, Hansen V, Bowman DA. A Quality Use of Medicines program for general practitioners and older people: a cluster randomised controlled trial. *Med J Aust.* 2007;187:23-30.	Does not focus on reducing the risk or rate of falls or fallers
Protas EJ, Mitchell K, Williams A, Qureshy H, Caroline K, Lai EC. Gait and step training to reduce falls in Parkinson's disease. *NeuroRehabilitation.* 2005;20:183-190.	Not feasible in primary care
Province MA, Hadley EC, Hornbrook MC, et al. The effects of exercise on falls in elderly patients: a preplanned meta-analysis of the FICSIT Trials. *JAMA*. 1995;273:1341-1347.	Provides no data not otherwise covered in other articles for this study
Ray WA, Taylor JA, Meador KG, et al. A randomized trial of a consultation service to reduce falls in nursing homes. *JAMA.* 1997;278:557-562.	Not conducted in primary care or other setting with primary care-comparable population
Reinsch S, MacRae P, Lachenbruch PA, Tobis JS. Attempts to prevent falls and injury: a prospective community study. *Gerontologist.* 1992;32:450-456.	Poor reporting
Resnick B. Testing the effect of the WALC intervention on exercise adherence in older adults. *J Gerontol Nurs.* 2002;28:40-49.	Not conducted in primary care or other setting with primary care-comparable population
Reuben DB, Frank JC, Hirsch SH, McGuigan KA, Maly RC. A randomized clinical trial of outpatient comprehensive geriatric assessment coupled with an intervention to increase adherence to recommendations. *J Am Geriatr Soc.* 1999;47:269-276.	Does not focus on reducing the risk or rate of falls or fallers
Richardson DA, Steen N, Bond J, Bexton R, Kenny RA. Cardiac pacing reduces falls in cartoid sinus hypersensitivity. *Age Ageing.* 2000;29(Suppl 1):46.	Provides no data not otherwise covered in other articles for this study
Ringe JD, Farahmand P, Schacht E, Rozehnal A. Superiority of a combined treatment of alendronate and alfacalcidol compared to the combination of alendronate and plain vitamin D or alfacalcidol alone in established postmenopausal or male osteoporosis (AAC-Trial). *Rheumatol Int.* 2007;27:425-434.	Not a randomized controlled trial
Rizzo JA, Baker DI, McAvay G, Tinetti ME. The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. *Med Care.* 1996;34:954-969.	Provides no data not otherwise covered in other articles for this study

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Ro OC, Hjort PF. Interventional research in primary health care for the elderly. *Scand J Prim Health Care.* 1985;3:133-136.	Not a randomized controlled trial
Robertson MC, Campbell AJ, Gardner MM, Devlin N. Preventing injuries in older people by preventing falls: a meta-analysis of individual-level data. *J Am Geriatr Soc.* 2002;50:905-911.	Provides no data not otherwise covered in other articles for this study
Robertson MC, Devlin N, Scuffham P, Gardner MM, Buchner DM, Campbell AJ. Economic evaluation of a community based exercise programme to prevent falls. *J Epidemiol Community Health.* 2001;55:600-606.	Provides no data not otherwise covered in other articles for this study
Robertson MC, Gardner MM, Devlin N, McGee R, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls, 2: controlled trial in multiple centres. *BMJ.* 2001;322:701-704.	Not a randomized controlled trial
Robertson MC. Development of a Falls Prevention Programme for Elderly People: Evaluation of Efficacy, Effectiveness, and Efficiency. Dunedin, New Zealand: University of Otago; 2001.	Provides no data not otherwise covered in other articles for this study
Robson E, Edwards J, Gallagher E, Baker D. Steady As You Go (SAYGO): a falls-prevention program for seniors living in the community. *Can J Aging.* 2003;22:207-216.	Poor reporting
Rockwood K, Stadnyk K, Carver D, et al. A clinimetric evaluation of specialized geriatric care for rural dwelling, frail older people. *J Am Geriatr Soc.* 2000;48:1080-1085.	Does not focus on reducing the risk or rate of falls or fallers
Rooks DS, Ransil BJ, Hayes WC. Self-paced exercise and neuromotor performance in community-dwelling older adults. *J Aging Phys Activ.* 1997;135-149.	Does not focus on reducing the risk or rate of falls or fallers
Rubenstein LZ, Alessi CA, Josephson KR, Trinidad HM, Harker JO, Pietruszka FM. A randomized trial of a screening, case finding, and referral system for older veterans in primary care. *J Am Geriatr Soc.* 2007;55:166-174.	Not a randomized controlled trial
Ryan JW, Spellbring AM. Implementing strategies to decrease risk of falls in older women. *J Gerontol Nurs.* 1996;22:25-31.	Poor reporting
Sakamoto K, Nakamura T, Hagino H, et al. Effects of unipedal standing balance exercise on the prevention of falls and hip fracture among clinically defined high-risk elderly individuals: a randomized controlled trial. *J Orthopaed Sci.* 2006;11:467-472.	Population is not comparable to primary care
Salkeld G, Cumming RG, O'Neill E, Thomas M, Szonyi G, Westbury C. The cost effectiveness of a home hazard reduction program to reduce falls among older persons. *Aust N Z J Pub Health.* 2000;24:265-271.	Population is not comparable to primary care
Santana-Sosa E, Barriopedro MI, Lopez-Mojares LM, Perez M, Lucia A. Exercise training is beneficial for Alzheimer's patients. *Int J Sports Med.* 2008;29:845-850.	Not conducted in primary care or other setting with primary care-comparable population
Sato T, Ebihara S, Kudo H, Fujii M, Sasaki H, Butler JP. Toe clearance rehabilitative slipper for gait disorder in the elderly. *Geriatr Gerontol Int.* 2007;7:310-311.	Does not focus on reducing the risk or rate of falls or fallers
Sato Y, Iwamoto J, Kanoko T, Satoh K. Low-dose vitamin D prevents muscular atrophy and reduces falls and hip fractures in women after stroke: a randomized controlled trial. *Cerebrovasc Dis.* 2005;20:187-192.	Not conducted in primary care or other setting with primary care-comparable population
Sato Y, Manabe S, Kuno H, Oizumi K. Amelioration of osteopenia and hypovitaminosis D by 1alpha-hydroxyvitamin D3 in elderly patients with Parkinson's disease. *J Neurol Neurosurg Psychiatry.* 1999;66:64-68.	Does not focus on reducing the risk or rate of falls or fallers
Schnelle JF, Alessi CA, Simmons SF, Al-Samarrai NR, Beck JC, Ouslander JG. Translating clinical research into practice: a randomized controlled trial of exercise and incontinence care with nursing home residents. *J Am Geriatr Soc.* 2002;50:1476-1483.	Not conducted in primary care or other setting with primary care-comparable population
Schnelle JF, Kapur K, Alessi C, et al. Does an exercise and incontinence intervention save healthcare costs in a nursing home population? *J Am Geriatr Soc.* 2003;51:161-168.	Not conducted in primary care or other setting with primary care-comparable population
Schoenfelder DP. A fall prevention program for elderly individuals: exercise in long-term care settings. *J Gerontol Nurs.* 2000;26:43-51.	Population is not comparable to primary care
Schwarting AE, Listerman LR, Harrison AL. The effectiveness of an intervention plan in decreasing fear of falling. *J Geriatri Phys Ther.* 2002;25:39.	Does not focus on reducing the risk or rate of falls or fallers
Scott IU. Falls and health status in elderly women following first eye cataract surgery: a randomized controlled trial. *Evid Based Ophthalmol.* 2005;6:119-120.	No relevant outcomes
Shapiro A, Taylor M. Effects of a community-based early intervention program on the subjective well-being, institutionalization, and mortality of low-income elders. *Gerontologist.* 2002;42:334-341.	Does not focus on reducing the risk or rate of falls or fallers
Shaw FE, Bond J, Richardson DA, et al. Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomised controlled trial. *BMJ.* 2003;326:73.	Population is not comparable to primary care
Shaw FE. Can multidisciplinary intervention prevent falls in patients with cognitive impairment and dementia attending a casualty department? *Age Ageing.* 2000;29(Suppl 1):47.	Population is not comparable to primary care
Shaw FE. Physiotherapy intervention for cognitively impaired elderly fallers attending casualty. Oxford: National Research Register; 2003.	Population is not comparable to primary care
Shekelle PG, Maglione M, Chang JT, et al. Falls Prevention Interventions in the Medicare Population. Baltimore, MD: Centers for Medicare and Medicaid Services; 2004.	Used only as source document

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Sherrington C, Lord SR, Finch CF. Physical activity interventions to prevent falls among older people: update of the evidence. *J Sci Med Sport.* 2004;7:43-51.	Used only as source document
Shigematsu R, Chang M, Yabushita N, et al. Dance-based aerobic exercise may improve indices of falling risk in older women. *Age Ageing.* 2002;31:261-266.	Not a randomized controlled trial
Shigematsu R, Okura T, Nakagaichi M, et al. Square-stepping exercise and fall risk factors in older adults: a single-blind, randomized controlled trial. *J Gerontol A Biol Sci Med Sci.* 2008;63:76-82.	Not a randomized controlled trial
Shigematsu R, Okura T, Sakai T, Rantanen T. Square-stepping exercise versus strength and balance training for fall risk factors. *Aging Clin Exp Res.* 2008;20:19-24.	Not a randomized controlled trial
Silverman M, Musa D, Martin DC, Lave JR, Adams J, Ricci EM. Evaluation of outpatient geriatric assessment: a randomized multi-site trial. *J Am Geriatr Soc.* 1995;43:733-740.	Does not focus on reducing the risk or rate of falls or fallers
Sjösten N, Vaapio S, Kivelä SL. The effects of fall prevention trials on depressive symptoms and fear of falling among the aged: a systematic review. *Aging Ment Health.* 2008;12:30-46.	Used only as source document
Sjösten NM, Salonoja M, Piirtola M, et al. A multifactorial fall prevention programme in home-dwelling elderly people: a randomized-controlled trial. *Public Health.* 2007;121:308-318.	No relevant outcomes
Sjösten NM, Salonoja M, Piirtola M, et al. A multifactorial fall prevention programme in the community-dwelling aged: predictors of adherence. *Eur J Public Health.* 2007;17:464-470.	No relevant outcomes
Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise—FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age Ageing.* 2005;34:636-639.	Not a randomized controlled trial
Skelton D, Dinan S, Campbell M, Rutherford O. FaME (Falls Management Exercise): an RCT on the effects of a 9-month group exercise programme in frequently falling community dwelling women aged 65 and over. *J Aging Phys Activ.* 2004;12:457-458.	Provides no data not otherwise covered in other articles for this study
Skelton D, Dinan S. Exercise for falls management: rationale for an exercise programme to reduce postural instability. *Physio Theory Pract*. 1999;15:105-120.	Provides no data not otherwise covered in other articles for this study
Skelton D, Stranzinger K, Dinan S, Rutherford O. BMD improvements following FaME (Falls Management Exercise) in frequently falling women age 65 and over: an RCT. *J Aging Phys Activ.* 2008;16:S89-S90.	No relevant outcomes
Smith H, Anderson F, Raphael H, Maslin P, Crozier S, Cooper C. Effect of annual intramuscular vitamin D on fracture risk in elderly men and women—a population-based, randomized, double-blind, placebo-controlled trial. *Rheumatology.* 2007;46:1852-1857.	Does not focus on reducing the risk or rate of falls or fallers
Smith L. Falls prevention using 'best practice outcomes'. *Can Nurs Home.* 2004;15:13-19.	Not conducted in primary care or other setting with primary care-comparable population
Sorensen KH, Sivertsen J. Follow-up three years after intervention to relieve unmet medical and social needs of old people. *Compr Gerontol [B].* 1988;2:85-91.	Does not focus on reducing the risk or rate of falls or fallers
Spink MJ, Menz HB, Lord SR. Efficacy of a multifaceted podiatry intervention to improve balance and prevent falls in older people: study protocol for a randomised trial. *BMC Geriatrics.* 2008;8:30.	No relevant outcomes
Steinberg M, Cartwright C, Peel N, Williams G. A sustainable programme to prevent falls and near falls in community dwelling older people: results of a randomised trial. *J Epidemiol Community Health.* 2000;54:227-232.	Not a randomized controlled trial
Steultjens E, Clemson L. A preventative home safety programme for community-dwelling older people with low vision reduced falls and was more cost-effective than an exercise programme: commentary. *Aust Occup Ther J.* 2006;53:243-244.	Provides no data not otherwise covered in other articles for this study
Steultjens EM, Dekker J, Bouter LM, Jellema S, Bakker EB, van den Ende CH. Occupational therapy for community dwelling elderly people: a systematic review. *Age Ageing.* 2004;33:453-460.	Used only as source document
Stevens M, Holman CD, Bennett N. Preventing falls in older people: impact of an intervention to reduce environmental hazards in the home. *J Am Geriatr Soc.* 2001;49:1442-1447.	Provides no data not otherwise covered in other articles for this study
Stevens VJ, Hornbrook MC, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Design and implementation of a falls prevention intervention for community-dwelling older persons. *Behav Health Ageing.* 1991;2:57-73.	No relevant outcomes
Strever T. Trauma library in review. [Commentary on] A meta-analysis of fall prevention programs for the elderly. *J Trauma Nurs.* 2002;9:84.	Provides no data not otherwise covered in other articles for this study
Stuck AE, Aronow HU, Steiner A, et al. A trial of annual in-home comprehensive geriatric assessments for elderly people living in the community. *N Engl J Med.* 1995;333:1184-1189.	Does not focus on reducing the risk or rate of falls or fallers
Stuck AE, Minder CE, Peter-Wuest I, et al. A randomized trial of in-home visits for disability prevention in community-dwelling older people at low and high risk for nursing home admission. *Arch Intern Med.* 2000;160:977-986.	Does not focus on reducing the risk or rate of falls or fallers
Suzuki T, Kim H, Yoshida H, Ishizaki T. Randomized controlled trial of exercise intervention for the prevention of falls in community-dwelling elderly Japanese women. *J Bone Mineral Metabol.* 2004;22:602-611.	High or differential attrition

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Swanenburg J, de Bruin ED, Stauffacher M, Mulder T, Uebelhart D. Effects of exercise and nutrition on postural balance and risk of falling in elderly people with decreased bone mineral density: randomized controlled trial pilot study. *Clin Rehabil.* 2007;21:523-534.	Comparative effectiveness study design
Tennstedt S, Howland J, Lachman M, Peterson E, Kasten L, Jette A. A randomized, controlled trial of a group intervention to reduce fear of falling and associated activity restriction in older adults. *J Gerontol B Psychol Sci Soc Sci.* 1998;53:384-392.	Does not focus on reducing the risk or rate of falls or fallers
Tinetti ME, McAvay G, Claus E. Does multiple risk factor reduction explain the reduction in fall rate in the Yale FICSIT Trial? *Am J Epidemiol.* 1996;144:389-399.	Does not focus on reducing the risk or rate of falls or fallers
Tinetti ME, Mendes de Leon CF, Doucette JT, Baker DI. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *J Gerontol.* 1994;49:M140-M147.	Not a randomized controlled trial
Tinetti ME. Prevention of falls and fall injuries in elderly persons: a research agenda. *Prev Med.* 1994;23:756-762.	Not a randomized controlled trial
Tobis J, Reinsch S, MacRae P, Lachenbruch T. Experimental intervention at senior centres for the prevention of falls. *J Am Geriatr Soc*. 1990;38:A28.	Provides no data not otherwise covered in other articles for this study
Tulloch AJ, Moore V. A randomized controlled trial of geriatric screening and surveillance in general practice. *J R Coll Gen Pract.* 1979;29:733-740.	Does not focus on reducing the risk or rate of falls or fallers
Vaillant J, Vuillerme N, Martigne P, et al. Balance, aging, and osteoporosis: effects of cognitive exercises combined with physiotherapy. *Joint Bone Spine.* 2006;73:414-418.	Does not focus on reducing the risk or rate of falls or fallers
van der Velde N, Meerding WJ, Looman CW, Pols HA, van der Cammen TJ. Cost effectiveness of withdrawal of fall-risk-increasing drugs in geriatric outpatients. *Drugs Aging.* 2008;25:521-529.	Editorial, letter, non-systematic reviews, opinions, clinical controlled trial, case-control, or cohort
van Haastregt JC, van Rossum E, Diederiks JP, de Witte LP, Voorhoeve PM, Crebolder HF. Process-evaluation of a home visit programme to prevent falls and mobility impairments among elderly people at risk. *Patient Educ Couns.* 2002;47:301-309.	Not a randomized controlled trial
Vass M, Avlund K, Kvist K, Hendriksen C, Andersen CK, Keiding N. Structured home visits to older people: are they only of benefit for women? A randomised controlled trial. *Scand J Prim Health Care.* 2004;22:106-111.	Does not focus on reducing the risk or rate of falls or fallers
Vassallo M, Vignaraja R, Sharma JC, Briggs RS, Allen SC. Can intervention prevent falls and injury in geriatric wards? Hospital Injury Prevention (HIP) study. *Age Ageing.* 2001;30(Suppl 2):15.	Not conducted in primary care or other setting with primary care-comparable population
Verfaillie DF, Nichols JF, Turkel E, Hovell MF. Effects of resistance, balance, and gait training on reduction of risk factors leading to falls in elders. *J Aging Phys Activ.* 1997;213-228.	Does not focus on reducing the risk or rate of falls or fallers
Vetter NJ, Jones DA, Victor CR. Effect of health visitors working with elderly patients in general practice: a randomised controlled trial. *Br Med J (Clin Res Ed).* 1984;288:369-372.	Does not focus on reducing the risk or rate of falls or fallers
Wallace JI, Buchner DM, Grothaus L, et al. Implementation and effectiveness of a community-based health promotion program for older adults. *J Gerontol A Biol Sci Med Sci.* 1998;53:M301-M306.	Does not focus on reducing the risk or rate of falls or fallers
Ward CD, Turpin G, Dewey ME, et al. Education for people with progressive neurological conditions can have negative effects: evidence from a randomized controlled trial. *Clin Rehabil.* 2004;18:717-725.	Population is not comparable to primary care
Weber V, White A, McIlvried R. An electronic medical record (EMR)-based intervention to reduce polypharmacy and falls in an ambulatory rural elderly population. *J Gen Intern Med.* 2008;23:399-404.	Other quality issue
Weerdesteyn V, Rijken H, Geurts AC, Smits-Engelsman BC, Mulder T, Duysens J. A five-week exercise program can reduce falls and improve obstacle avoidance in the elderly. *Gerontology.* 2006;52:131-141.	Problems with baseline comparability between groups
White D. Vitamin D prevents falls in the elderly. *Evid Based Pract.* 2005;8:1-2.	Article covered by an included systematic review
Widen HL, von Koch L, Kostulas V, et al. A randomized controlled trial of rehabilitation at home after stroke in southwest Stockholm. *Stroke.* 1998;29:591-597.	Population is not comparable to primary care
Wilkins S, Jung B, Wishart L, Edwards M, Norton SG. The effectiveness of community-based occupational therapy education and functional training programs for older adults: a critical literature review. *Can J Occup Ther.* 2003;70(4):214-225.	Used only as source document
Williams ME, Williams TF, Zimmer JG, Hall WJ, Podgorski CA. How does the team approach to outpatient geriatric evaluation compare with traditional care: a report of a randomized controlled trial. *J Am Geriatr Soc.* 1987;35:1071-1078.	Does not focus on reducing the risk or rate of falls or fallers
Wilson P, Rodgers B. Research on falls prevention and physical activity in older adults and a notice of a new Web-based quality system by the Agency for Healthcare Research and Quality. *Home Healthcare Nurs.* 2006;24:632-633.	Not a randomized controlled trial
Wolf B, Feys H, De Weerdt W, et al. Effect of a physical therapeutic intervention for balance problems in the elderly: a single-blind, randomized, controlled multicentre trial. *Clin Rehabil.* 2001;15:624-636.	Does not focus on reducing the risk or rate of falls or fallers
Wolf SL, Barnhart HX, Ellison GL, Coogler CE. The effect of Tai Chi Quan and computerized balance training on postural stability in older subjects. *Phys Ther.* 1997;77:371-381.	No relevant outcomes

Appendix C Table 7. Studies Excluded From the Review for Key Questions 2 and 4

Study reference	Reason for exclusion
Wolf SL, Barnhart HX, Kutner NG, et al. Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized balance training. *J Am Geriatr Soc.* 2003;51:1794-1803.	Provides no data not otherwise covered in other articles for this study
Wolf SL, Kutner NG, Green RC, McNeely E. The Atlanta FICSIT study: two exercise interventions to reduce frailty in elders. *J Am Geriatr Soc.* 1993;41:329-332.	Provides no data not otherwise covered in other articles for this study
Wolf SL, Sattin RW, Kutner M, O'Grady M, Greenspan AI, Gregor RJ. Intense Tai Chi exercise training and fall occurrences in older, transitionally frail adults: a randomized, controlled trial. *J Am Geriatr Soc.* 2003;51:1693-1701.	Not conducted in primary care or other setting with primary care-comparable population
Wolf SL, Sattin RW, O'Grady M, et al. A study design to investigate the effect of intense Tai Chi in reducing falls among older adults transitioning to frailty. *Control Clin Trials.* 2001;22:689-704.	Not conducted in primary care or other setting with primary care-comparable population
Wolfson L, Whipple R, Derby C, et al. Balance and strength training in older adults: intervention gains and Tai Chi maintenance. *J Am Geriatr Soc.* 1996;44:498-506.	Does not focus on reducing the risk or rate of falls or fallers
Woo J, Hong A, Lau E, Lynn H. A randomised controlled trial of Tai Chi and resistance exercise on bone health, muscle strength and balance in community-living elderly people. *Age Ageing.* 2007;36:262-268.	Does not focus on reducing the risk or rate of falls or fallers
Wyman JF, Croghan CF, Nachreiner NM, et al. Effectiveness of education and individualized counseling in reducing environmental hazards in the homes of community-dwelling older women. *J Am Geriatr Soc.* 2007;55:1548-1556.	Does not focus on reducing the risk or rate of falls or fallers
Yardley L, Nyman SR. Internet provision of tailored advice on falls prevention activities for older people: a randomized controlled evaluation. *Health Promot Int.* 2007;22:122-128.	No relevant outcomes
Yates SM, Dunnagan TA. Evaluating the effectiveness of a home-based fall risk reduction program for rural community-dwelling older adults. *J Gerontol A Biol Sci Med Sci.* 2001;56:M226-M230.	Does not focus on reducing the risk or rate of falls or fallers
Young CM, Weeks BK, Beck BR. Simple, novel physical activity maintains proximal femur bone mineral density, and improves muscle strength and balance in sedentary, postmenopausal Caucasian women. *Osteoporos Int.* 2007;18:1379-1387.	No relevant outcomes
Zhang JG, Ishikawa-Takata K, Yamazaki H, Morita T, Ohta T. The effects of Tai Chi Chuan on physiological function and fear of falling in the less robust elderly: an intervention study for preventing falls. *Arch Gerontol Geriatr.* 2006;42:107-116.	Does not focus on reducing the risk or rate of falls or fallers
Zimmer JG, Groth-Juncker A, McCusker J. A randomized controlled study of a home health care team. *Am J Public Health.* 1985;75:134-141.	Does not focus on reducing the risk or rate of falls or fallers

Appendix D Table 1. Harms of Interventions to Prevent Falls in Older Adults: Meta-Analyses

Study ID USPSTF quality rating	Health condition	Aim of meta-analysis	Trial identification	Trial characteristics	Adverse effects reported	Meta-analysis of adverse effects
Milne 2006[120] Good	Protein and Energy Supplements	To assess whether oral protein and energy supplementation improves clinical and nutritional outcomes for older people	**Databases**: Cochrane Central Register of Controlled Trials; MEDLINE; EMBASE; HealthStar; CINAHL; BIOSIS; CAB. **Dates**: June 2005 English and non-English language	**Abstracts screened:** 34,870 **Articles reviewed:** 242 **N (trials)**: 55 **N (participants)**: 9187 **N (trials reporting Adverse Effects)**: 18 Patients > 65 yrs Included patients in hospital, institution, or community settings. Excluded those in critical care of cancer treatment. Randomized or quazi-randomized trials Supplementation ≥ 1 week.	8/18 reported that there were no side effects. 10/18 studies reported participants having adverse effects. -Nausea & vomiting: 3/26 -Diarrhea: 2/49 -Tx stopped due to poor glycemic control in intervention group: 33/2016 -Loss of appetitie, nausea, or diarrhea: 5/39 -Dysphagia, nausea, diarrhea, fatigue reason for drop-out: 4/17 -Postoperative nausea: IG-8/75; CG- 0/25 -Malabsorption: IG-6/26; CG-5/25 -Excluded due to GI discomfort: 10/37 -Nause & vomiting: IG-3/29; CG-1/27 -GI disturbances: IG- 26/66; CG-10/70	Meta-analysis- 6 trials (n=477) that reported adverse effects in both groups *Gastrointestinal disturbances (nausea, vomiting, and diarrhea)* : Peto odds ratio 3.19 CI [1.83, 5.56]

Appendix D Table 1. Harms of Interventions to Prevent Falls in Older Adults: Meta-Analyses

Study ID USPSTF quality rating	Funding source	External validity	Comments
Milne 2006[120] Good	The Medical Research Council, UK; Chief Scientist Office of the Scottish Executive Health Department, UK; Student Awards Agency for Scotland, UK.	Poor, mainly inpatients	Most studies were of poor quality due to lack of concealment allocation and blinding of outcome assessors. Studies were often small with short duration of follow-up. Most trials didn't report adequate methods for assessing potential adverse effects. Often no control group to compare against.

GI-gastrointestinal; USPSTF-United States Preventive Services Task Force; IG-intervention group; CG-control group; UK-United Kingdom

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics
Nelson 2004[119] Fair	**Location:** Boston **Target population:** Functionally impaired older adults **Recruitment strategy:** Recruited through newspaper ads, radio ads, community presentations. Potential participants were phone screened, and those eligible were further screened at the center	**Inclusion:** Aged ≥70 years, not currently exercising more than 1 day per week, self-report ≥2 functional limitations on the physical function subscale of the Medical Outcome Survey, score of ≤10 on the Established Populations for Epidemiologic Studies of the Elderly (EPESE) short physical performance battery **Exclusion:** Unstable cardiovascular disease, terminal illness, or cognitive impairment (<23 on the Folstein Mini-Mental State Examination)	**Assessed for eligibility:** 565 **Excluded:** 523 **Not meeting inclusion criteria:** 493 **For other reasons:** 0 **Randomized:** 72 **IG:** 34 **CG:** 38 **Age: mean (SD):** IG: 77.7 (5.3) CG: 77.8 (5.3) **Female (calc):** IG: 79.4% CG: 78.9% **Ethnicity:** NR **SES:** NR **Fall History:** NR

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	High risk for falls	Intervention(s) evaluated
Nelson 2004[119] Fair	**Risk category:** Screening tool - physical function subscale of the Medical Outcome Survey (A509) **Definition:** Self-report of ≥2 functional limitations **Proportion:** 100% **Instrument:** physical function subscale of the Medical Outcome Survey	**Category:** Exercise/physical therapy **Description** IG: In-home strength and balance exercise program which included a detailed booklet and several sets of weights CG: Attention control was nutrition education **Format (single or combo, individual or group, where)** **IG:** Single, individual, in-home **CG:** Single, individual, in-home **Intensity (frequency and duration)** **IG:** Visited 6 times in first month and once per month for the next 5 months. Instructed to exercise 3 times per week for 6 months at 120 minutes per week **CG:** Visited 2 times in the first month and once per month for the next 5 months **Delivery** **IG:** Visits by exercise physiologist **CG:** Registered dietitian

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	Outcome Measures	Results	Comments
Nelson 2004[119] Fair	NR	One participant in the IG fell while doing the tandem walk at home, which resulted in bruises to both arms and one knee One participant in the CG had an episode of food poisoning	

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	Setting	Inclusion and exclusion criteria	Patient characteristics
LIFE / Pahor 2006[121] Fair	**Location:** multicenter: four field centers (Cooper Institute, Stanford University, University of Pittsburgh, and Wake Forest University **Target population:** community, 70-89, sedentary **Recruitment strategy:** mass mailing, community outreach, media advertising. Participants eligible after an initial phone screening were invited for clinic visits, during which they signed the informed consent form and completed a personal interview, the SPPB, a physical exam, an electrocardiogram, and a 400-meter walk test. Eligible participants received detailed instructions for a 1-week to 2-week behavioral run-in, during which they were asked to self-monitor specific behaviors and to complete forms related to these behaviors. Participants who successfully completed the behavioral run-in received additional baseline assessments and were randomized to the study interventions via a web-based system. April 2004 - February 2005	**Inclusion:** age 70-89, having a sedentary lifestyle (<20 min per week in structured physical activity in past month), being able to walk 400 meters within 15 minutes without sitting and without use of any assistive device, having a SPPB score <= 9 (on a scale of 0 to 12), having completed a behavioral run-in related to logging health behavior, given informed consent, living in the study area, and not planning to move for at least 9 months. **Exclusion:** severe heart failure, uncontrolled angina, severe pulmonary disease, chest pain or severe shortness of breath during the 400-meter walk test,severe arthritis, cancer requiring treatment in the past 3 years, Parkinson's disease, other severe illness that may interfere with physical activity, illness with life expectancy of less than 12 months, MMSE score <21. Temporary exclusion criteria: acute myocardial infarction, deep venous thrombosis, pulmonary embolism, major arrhythmias, or stroke within 6 months, recent major surgery, uncontrolled hypertension, uncontrolled diabetes, and ongoing lower extremity physical therapy.	**Assessed for eligibility:** 3141 screened by phone **Excluded:** 2717 **Not meeting inclusion criteria:** **For other reasons:** refused = **Randomized:** 424 **IG:** 213 **CG:** 211 **Age (calc):** IG: <80: years: 160/213 (75.1%) ≥80 years: 53-213 (24.9%) CG: <80: years: 149/211 (70.6%) ≥80 years: 80/211 (37.9%) **Female:** IG = 69% CG = 69% **Ethnicity:** IG CG White: 75% 74% Black 17% 19% **SES:** IG CG College 67% 68% **Fall History:** NR

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	High risk for falls	Intervention(s) evaluated
LIFE / Pahor 2006[121] Fair	**Risk category:** NR **Definition:** NA **Proportion:** NA **Instrument:** NA	**Category:** Exercise/physical therapy **Description** **IG:** Combination of aerobic, strength, balance, and flexibility exercises. 3 phases: adoption (weeks 1-8), transition (weeks 9-24), and maintenance (week 25 to end of the trial). Each in IG received a 45-min individualized, introductory session to describe the intervention and to provide individual counseling to optimize safety and participation. Group-based behavioral counseling sessions focused on PA participation and disability prevention, and on encouraging participants to increase all forms of PA. Focused on walking as the primary mode of exercise. Each session preceded by a brief warmup and followed by a brief cooldown period. To complement the walking program, participants completed lower extremity strengthening exercises, followed by lower extremity stretching exercises. Balance training was introduced during the adoption phase. The intensity of training was gradually increased over the first 2-3 weeks. **CG:** Successful aging intervention, designed to provide attention and health education. Sessions included health topics relevant to older adults such as nutrition, medications, foot care, and recommended preventive services at different ages. Basic educational information related to physical activity was provided. At the end of each session, a short instructor-led intervention (5-10 min) of gentle upper extremity stretching exercises was delivered. Calls were made after each missed session, and participants got a newsletter. **Format (single or combo, individual or group, where)** **IG:** Combo, both, home and at a center **CG:** Combo, group, at a center **Intensity (frequency and duration)** **IG:** For the first 2 months, 3 center-based exercise sessions (40-60 min)/week were conducted in a supervised setting. During next 4 months, the number of center-based sessions was reduced (2/week) and home-based endurance/ strengthening/flexibility exercises (3/week) were started. The subsequent phase consisted of the home-based intervention, optional 1-2 times/week center-based sessions, and monthly phone contacts. Group-based behavioral counseling sessions (1/week for first 10 weeks) **CG:** weekly for the first 26 weeks and then monthly **Delivery** **IG:** Instructor **CG:** Instructor Follow-up planned for 12 to 18 months, depending on the date of randomization, and included semiannual clinic visits for data collection

Appendix D Table 2. Harms of Interventions to Prevent Falls in Older Adults: Randomized Controlled Trials

Study ID USPSTF quality rating	Outcome Measures	Results	Comments
LIFE / Pahor 2006[121] Fair	**HARMS:** <u>Nonserious adverse events</u> Outpatient surgical procedure Sought advice from a physician or medical professional for any of the following: Back injury Fainting/passing out Shortness of breath/asthma Abnormal heart rhythm Joint sprain Other problem affecting walking Experienced any of the following: Muscle strain, stiffness or soreness Foot pain Fatigue Dizziness Other illness restricting activity <u>Serious adverse events</u> Death Life-threatening event Inpatient hospitalization Clinically significant abnormal laboratory or diagnostic test	**IG CG p** <u>Nonserious adverse events</u> Outpatient surgical p 82 (38.5%) 62 (29.4%) 0.06 *Sought advice from a physician or medical professional for any of the following* : Back injury 30 (14.1%) 36 (17.1%) 0.42 Fainting/passing out 12 (5.6%) 8 (3.8%) 0.49 Shortness of breath/asthma 34 (16.0%) 40 (19.0%) 0.44 Abnormal heart rhythm 43 (20.2%) 24 (11.4%) 0.016 Joint sprain 21 (9.9%) 20 (9.5%) >0.99 Other problem affecting walking 98 (46.0%) 83 (39.3%) 0.23 *Experienced any of the following* : Muscle strain, stiffness or soreness 178 (83.6%) 168 (79.6%) .52 Foot pain 112 (52.6%) 104 (49.3%) .62 Fatigue 169 (79.3%) 165 (78.2%) >.99 Dizziness 91 (42.7%) 87 (41.2%) .92 Other illness restricting activity 75 (35.2%) 68 (32.2%) .60 Total 208 (97.7%) 207 (98.1%) .21 <u>Serious adverse events</u> Death 2 (0.9%) 2 (0.9%) >.99 Life-threatening event 3 (1.4%) 3 (1.4%) >.99 Inpatient hospitalization 44 (20.7%) 44 (20.9%) >.99 Clinically significant abnormal laboratory or diagnostic test 6 (2.8%) 8 (3.8%) .60 Total 48 (22.5%) 50 (23.7%) .82	**External validity:** good, though older only

Appendix D Table 3. Studies Excluded From the Review for Key Question 3

Reference	Reason for exclusion
Beard K. Are drugs really toxic for older people? *Expert Opin Drug Saf.* 2003;2:211-213.	Does not report outcomes listed in inclusion criteria
Binder EF, Schechtman KB, Ehsani AA, et al. Effects of exercise training on frailty in community-dwelling older adults: results of a randomized, controlled trial. *J Am Geriatr Soc.* 2002;50:1921-1928.	Comparative effectiveness study design
Bircher AJ, Stern WB. Allergic contact dermatitis from "titanium" spectacle frames. *Contact Dermatitis.* 2001;45:244-245.	Editorial, letter, non-systematic reviews, opinion
Brukner PD, Brown WJ. Is exercise good for you? *Med J Aust.* 2005;183:538-541.	Editorial, letter, non-systematic reviews, opinion
Bulat T, Castle SC, Rutledge M, Quigley P. Clinical practice algorithms: medication management to reduce fall risk in the elderly, 3: benzodiazepines, cardiovascular agents, and antidepressants. *J Am Acad Nurs Pract.* 2008;20:55-62.	Editorial, letter, non-systematic reviews, opinion
Clarke J, Newsom R, Canning C. Ocular trauma with small framed spectacles. *Br J Ophthalmol.* 2002;86:484.	Editorial, letter, non-systematic reviews, opinion
Dukas L, Schacht E, Mazor Z, Stahelin HB. Treatment with alfacalcidol in elderly people significantly decreases the high risk of falls associated with a low creatinine clearance of <65 ml/min. *Osteoporos Int.* 2005;16:198-203.	Provides no data not otherwise included in other articles for this study
Gardner MM, Buchner DM, Robertson MC, Campbell AJ. Practical implementation of an exercise-based falls prevention programme. *Age Ageing.* 2001;30:77-83.	Editorial, letter, non-systematic reviews, opinion
Gault JA, Vichnin MC, Jaeger EA, Jeffers JB. Ocular injuries associated with eyeglass wear and airbag inflation. *J Trauma.* 1995;38:494-497.	Editorial, letter, non-systematic reviews, opinion
Gloth FM III. An adverse event associated with hip protectors. *J Am Geriatr Soc.* 2005;53:553.	Editorial, letter, non-systematic reviews, opinion
Greenspan SL, Resnick NM, Parker RA. The effect of hormone replacement on physical performance in community-dwelling elderly women. *Am J Med.* 2005;118:1232-1239.	Comparative effectiveness study design
Hathcock JN, Shao A, Vieth R, Heaney R. Risk assessment for vitamin D. *Am J Clin Nutr.* 2007;85:6-18.	Does not focus on reducing risk or rate of falls or fallers
Hill KD, Moore KJ, Dorevitch MI, Day LM. Effectiveness of falls clinics: an evaluation of outcomes and client adherence to recommended interventions. *J Am Geriatr Soc.* 2008;56:600-608.	Does not report outcomes listed in inclusion criteria
Holick MF. High prevalence of vitamin D inadequacy and implications for health. *Mayo Clin Proc.* 2006;81:353-373.	Does not focus on reducing risk or rate of falls or fallers
Iwamoto J, Otaka Y, Kudo K, Takeda T, Uzawa M, Hirabayashi K. Efficacy of training program for ambulatory competence in elderly women. *Keio J Med.* 2004;53:85-89.	Editorial, letter, non-systematic reviews, opinion
Katoh N, Ono M, Fujisawa K, Kojima M, Sakamoto Y, Sasaki K. Relationship between pure cortical cataract appearance and the wearing of glasses: a preliminary report of a case-control study performed on the subjects in the Noto area, Japan. *Dev Ophthalmol.* 1997;27:56-62.	Does not report outcomes listed in inclusion criteria
Kiel DP, Magaziner J, Zimmerman S, et al. Efficacy of a hip protector to prevent hip fracture in nursing home residents: the HIP PRO randomized controlled trial. *JAMA.* 2007;298:413-422.	Conducted in population that is not comparable to primary care
Lamberg-Allardt C. Vitamin D in foods and as supplements. *Prog Biophys Mol Biol.* 2006;92:33-38.	Does not focus on reducing risk or rate of falls or fallers
Laybourne AH, Biggs S, Martin FC. Falls exercise interventions and reduced falls rate: always in the patient's interest? *Age Ageing.* 2008;37:10-13.	Editorial, letter, non-systematic reviews, opinion
Li W, Keegan TH, Sternfeld B, Sidney S, Quesenberry CP Jr, Kelsey JL. Outdoor falls among middle-aged and older adults: a neglected public health problem. *Am J Public Health.* 2006;96:1192-1200.	Does not report outcomes listed in inclusion criteria
Nitz JC, Choy NL. The efficacy of a specific balance-strategy training programme for preventing falls among older people: a pilot randomised controlled trial. *Age Ageing.* 2004;33:52-58.	Comparative effectiveness study design
Parker MJ, Gillespie WJ, Gillespie LD. Hip protectors for preventing hip fractures in older people. *Cochrane Database Syst Rev.* 2005;CD001255.	Poor reporting
Periodic health examination, 1995 update: 3. Screening for visual problems among elderly patients. Canadian Task Force on the Periodic Health Examination. *CMAJ.* 1995;152:1211-1222.	Editorial, letter, non-systematic reviews, opinion
Reddy B. Prescribing in older people. *Nurse Prescrib.* 2006;4:378-381.	Does not report outcomes listed in inclusion criteria
Ringe JD, Farahmand P, Schacht E, Rozehnal A. Superiority of a combined treatment of alendronate and alfacalcidol compared to the combination of alendronate and plain vitamin D or alfacalcidol alone in established postmenopausal or male osteoporosis (AAC-Trial). *Rheumatol Int.* 2007;27:425-434.	Comparative effectiveness study design
Rudolph JL, Salow MJ, Angelini MC, McGlinchey RE. The anticholinergic risk scale and anticholinergic adverse effects in older persons. *Arch Intern Med.* 2008;168:508-513.	Does not focus on reducing risk or rate of falls or fallers
Shigematsu R, Chang M, Yabushita N, et al. Dance-based aerobic exercise may improve indices of falling risk in older women. *Age Ageing.* 2002;31:261-266.	Other quality issues
Shigematsu R, Okura T, Sakai T, Rantanen T. Square-stepping exercise versus strength and balance training for fall risk factors. *Aging Clin Exp Res.* 2008;20:19-24.	Comparative effectiveness study design
Shono M, Kaniwa MA. Allergic contact dermatitis from a perinone-type dye C.I. Solvent Orange 60 in spectacle frames. *Contact Dermatitis.* 1999;41:181-184.	Editorial, letter, non-systematic reviews, opinion

Appendix D Table 3. Studies Excluded From the Review for Key Question 3

Reference	Reason for exclusion
Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (Falls Management Exercise—FaME) reduces falls in community-dwelling older frequent fallers (an RCT). *Age Ageing.* 2005;34:636-639.	Comparative effectiveness study design
Skelton DA, Beyer N. Exercise and injury prevention in older people. *Scand J Med Sci Sports.* 2003;13:77-85.	Editorial, letter, non-systematic reviews, opinion
Skelton DA, Dinan SM. Exercise for falls management: rationale for an exercise programme to reduce postural instability. *Physio Theory Pract.* 1999;15:105-120.	Provides no data not otherwise covered in other articles for this study
Soung DY, Patade A, Khalil DA, et al. Soy protein supplementation does not cause lymphocytopenia in postmenopausal women. *Nutrition J.* 2006;5:12.	Does not report outcomes listed in inclusion criteria
Willford CH, Kisner C, Glenn TM, Sachs L. The interaction of wearing multifocal lenses with head posture and pain. *J Orthop Sports Phys Ther.* 1996;23:194-199.	Conducted in a population that does not have an average age of 65 or older
Sjösten N, Vaapio S, Kivelä SL. The effects of fall prevention trials on depressive symptoms and fear of falling among the aged: a systematic review. *Aging Ment Health.* 2008;12:30-46.	Does not focus on reducing risk or rate of falls or fallers
Zinnecker L. Safe patient movement for therapists. *Rehab Manag.* 2007;20:32-37.	Does not report outcomes listed in inclusion criteria

Appendix E Table 1. Role of Falls History in Identifying High-Risk Older Adults

Study ID	High risk selection: fall history	High risk selection: any other factors	Percent in fall risk group	Patient population	CG fall risk during followup	Effect on falls risk
Multifactorial assessment and management - comprehensive						
Close 1999[80] n = 397	Emergency department visit, fall primary diagnosis	-	100%	Age, mean: 78.2 (7.5) Female: 68% 30% recurrent fallers	79%	0.46 (sig)
Hogan 2001[82] n = 163	≥1 falls in last 3 months; fall could not have resulted in fracture	-	100%	Age, mean: 77.4 (7.3) Female: 74%	79%	0.91 (ns)
Multifactorial assessment and management - noncomprehensive						
Elley 2008[79] n = 312	≥1 in last year	75+	100%	Age, mean: 80.8 (5.0) Female: 69%	68%	1.16 (ns)
Hendriks 2008[84] n = 333	Emergency department visit, fall primary diagnosis	-	100%	Age, mean: 74.5 (5.9) Female: 69%	46%	0.97 (ns)
Lightbody 2002[77] n = 348	Emergency department visit, fall primary diagnosis	-	100%	Age, median: 75 Female: 77%	26%	0.98 (ns)
Van Haastregt 2000[71] n = 316	≥2 in last 6 months	Mobility limitation; 70+		Age: 77.2 (5.1) Female: 65%	43%	1.13 (ns)
Clinical education/behavioral counseling						
Clemson 2004[103] n = 310	≥1 in last year, or reported concern about falling	70+		Age: **IG:** 78.31 (5.26) **CG:** 78.47 (5.66) Female: 74%	58%	0.69 (sig)
Single clinical treatment - hip protectors						
Cameron 2003[96] n = 600	≥2, or 1 requiring hospital admit, in last year	Female gender, 70+		Age, mean: **IG:** 83.2 (5.1) **CG:** 83.0 (4.9) Female: 100%	**% fallers**: NR **% frequent fallers (2+ falls) (calc)**: **IG:** 46% **CG:** 44% (ns) **# falls/person**: **IG:** 2.70/person **CG:** 2.20/person	1.23 (ns)
Single clinical treatment - vitamin D						
Dhesi 2004[102] n = 139	≥1 in last 8 weeks	Vitamin D deficient		Age: **IG:** 77.0 (6.3) **CG:** 76.6 (6.1) Female: **IG:** 53/70 (76%) **CG:** 55/69 (80%)	23%	0.77 (ns)
Prince 2008[89] n = 302	≥1 in last year	Female gender, 70+, vitamin D deficient		Age: **IG:** 77.0 (4.2) **CG:** 77.4 (5.0) Female: 100%	63%	0.84 (ns)
Exercise/physical therapy						
Luukinen 2007[93] n = 486	≥2 in last year	Gait/balance impairment, poor vision, 80+; or loneliness, depression, poor self-rated health, hearing, or cognition		Age: 88 (3) Female: **IG:** 78% **CG:** 80%	62%	0.94 (ns)
Rubenstein 2000[100] n = 59	≥1 in last 6 months	Gait/balance impairment		Age: **IG:** 76.4 (4.9) **CG:** 74.4 (4.3) Female: 0%	32%	1.20 (ns)

IG - intervention group; CG - control group; sig - significant; ns - not significant

Appendix F Table 1. Samples of Code Used in Conducting the Meta-Analysis

1. Calculation of log (relative risk) and related standard error (used in analyses of fallers and fractures)

SAS code:

```
*If raw data is available, use it to calculate log(RR) and SE of log(RR);

if n(n_fallers_ig, totn_ig_fallsanalyzed, n_fallers_cg, totn_cg_fallsanalyzed)=4 then do;
    logrr_faller=log((n_fallers_ig /totn_ig_fallsanalyzed) /(n_fallers_cg /totn_cg_fallsanalyzed));
  selogrr_faller=sqrt((1/n_fallers_ig)-(1/totn_ig_fallsanalyzed)+
  (1/n_fallers_cg)-(1/totn_cg_fallsanalyzed));
end;

*if raw data is not available, use reported RR (or OR) and CI to calculate log(RR) and SE of log(RR);

else if rr_faller ne . then do;
  logrr_faller=log(rr_faller);
  logrr_faller_lci=log(rr_faller_lci);
  logrr_faller_uci=log(rr_faller_uci);
  selogrr_faller = (logrr_faller_uci - logrr_faller_lci)/1.96/2;
end;

*only using OR as a substitute for RR because we know the only observation where this is the case has an OR close
to 1 (actual value=0.98). If the OR was not close to 1, we would not do this;

else if or_faller ne . then do;
  logrr_faller=log(or_faller);
  logrr_faller_lci=log(or_faller_lci);
  logrr_faller_uci=log(or_faller_uci);
  selogrr_faller = (logrr_faller_uci - logrr_faller_lci)/1.96/2;
end;
```

2. Adjustment for cluster randomization

SAS code:

```
if idpart1="Hornbrook 1994" then do;
  cluster_size = 3182/2509;
  ifactor = 1 + (cluster_size -1) * 0.60;
  selogrr_faller = selogrr_faller*sqrt(ifactor);
end;

if idpart1="Tinetti 1994" then do;
  cluster_size = 301/16;
  ifactor = 1 + (cluster_size -1) * 0.05;
  selogrr_faller = selogrr_faller*sqrt(ifactor);
end;
```

3. Meta-analysis and forest plot

Stata code:

```
meta logrr_faller selogrr_faller if iv_type==1, ///
  eform graph(r) print cline xline(1) xlab(.25,.5,1,2) id(idcgfallers)
```

4. Test of publication bias

Stata code:

```
metabias logrr_faller selogrr_faller if iv_type==1, graph(Begg)
```

5. Meta-regression

Stata code:

```
metareg logrr_faller iv_medwithdr if iv_type==1, wsse(selogrr_faller)
```

Appendix F Table 2. Data for Meta-Analysis

Study ID	Number of deaths - IG	Number of deaths - CG	Fall History - IG (% fallers in last year)	Fall History - CG (% fallers in last year)	Outcomes follow-up time (mos)	Number of falls in IG 12-month	Number of falls in CG 12-month	Person years in IG	Person years in CG	Falls per person year in IG	Falls per p-y IG, LCI	Falls per p-y IG, UCI	Falls per person year in CG	Falls per p-y cG, LCI	Falls per p-y cG, UCI	Number of fallers in IG 12-month	Number of fallers in CG 12-month	Relative Risk of being a faller	Lower CI Limit - RR	Upper CI Limit - RR	Odds Ratio for being a faller	Lower CI Limit - OR	Upper CI Limit - OR
Ashburn 2007[96]	1	2	100	100	6											46	49						
Barnett 2003[104]			43.4	41.3	12					0.61			0.95			27	37	0.71	0.49	1.04			
Birks 2004[85]	117	247	43	43	12											261	726						
Bischoff-Ferrari 2006[111]					36											107	124				0.77	0.51	1.15
Buchner 1997[105]			21.4	23	6					0.49			0.81			32	18						
Cameron 2003[66]	33	46	100	100	24	798	639											1.23	0.89	1.57			
Campbell 1997[97]	2	4	41	47	12	88	152	113.4	108.8	0.87			1.34			53	62						
Campbell 1999[112]			50	33	11	17	40			0.52			1.16			17	40	0.34	0.16	0.74			
Campbell 1999[112]			31.3	33	11	22	35			0.71			0.97			22	35	0.87	0.36	2.09			
Campbell 2005[63]	2	7	42	50	12	120	151			1.3			1.65			47	59						
Campbell 2005[63]	3	7	45	50	12	64	151			0.65			1.65			36	59						
Campbell 2005[63]	4	7	43	50	12	108	151			1.17			1.65			47	59						
Clemson 2004[103]			65	65	14											82	89	0.9	0.73	1.1			
Close 1999[80]	19	27	100	100	12											59	111				0.39	0.23	0.6
Coleman 1999[101]	15	12	44.2	48.6	24											34	24						

Appendix F Table 2. Data for Meta-Analysis

Study ID	Incident rate ratio for being a faller	Lower CI Limit - IRR	Upper CI Limit - IRR	Adjusted Ratio	Number of fallers with fractures in IG 12-month	Number of fallers with fractures in CG 12-month	N in IG at baseline (intention to treat)	N in CG at baseline (intention to treat)	Number of clusters	Size of cluster (or average)	Inter-cluster correlation	N in IG at baseline (n analyzed for falls)	N in CG at baseline (n analyzed for falls)	N in IG at baseline (n analyzed for fractures)	N in CG at baseline (n analyzed for fractures)	Type of Intervention	High risk	Setting	Quality rating	Pct Female in IG	Pct Female in CG	Mean age in IG	Mean age in CG
Ashburn 2007[96]					2	6	70	72				63	63	67	67	3	3	2	2	46	33	72.7	71.6
Barnett 2003[104]	0.6	0.36	0.99	0			83	80				76	74			3	2	2	2	69.9	63.8	74.4	75.4
Birks 2004[85]					135	310	1388	2781				1388	2781	1388	2781	2	3	2	2	100	100	77.9	77.8
Bischoff-Ferrari 2006[111]							219	226				219	226			2	3	1	2	55.3	55.3	70.6	71
Buchner 1997[105]	0.61	0.39	0.93	0			75	30				75	30			3	2	1	2	52	50	74.7	75
Cameron 2003[66]					46	47	302	298						302	298	2	1	2	2	100	100	83.2	83
Campbell 1997[97]							116	117				116	117			3	4	2	2	100	100	84.1	84.1
Campbell 1999[112]							48	45				48	45			2	4	2	2	77	75.5	75.1	74.2
Campbell 1999[112]							45	48				45	48			3	3	2	2	75.5	77	74.4	74.9
Campbell 2005[63]							97	96				97	96			3	3	2	2	74	70	83.4	84
Campbell 2005[63]							100	96				100	96			5	3	2	2	66	70	83.1	84
Campbell 2005[63]							98	96				98	96			6	3	2	2	63	70	83.8	84
Clemson 2004[103]							157	153				147	138			4	3	2	1	74	74	78.3	78.5
Close 1999[80]							184	213				141	163			1	1	2	2	68	67	77.3	78.9
Coleman 1999[101]							96	73	9	19		79	63			1	3	1	2	47.9	49.3	77.3	77.4

Appendix F Table 2. Data for Meta-Analysis

Study ID	Falls risk assessment	Falls risk assessment and individualized intervention	Vitamin D (alone or in combination with calcium)	Medication assessment and management	Medication assessment and withdrawal	Cardiac pacing	Hormone replacement therapy	Vision assessment and treatment (including Cataract surgery)	Hip protectors	Home hazard modification	Home hazard assessment	Education low intensity *(1x ≤30 mins)*	Education moderate intensity *(between low & high)*	Education high intensity *(multiple times, >2 hours)*	Tai Chi or 3D exercises	Gait, balance, functional training	Strength/ resistance exercise	Intensity of physical activity interventions (hours)	Intensity of clinical assessment interventions (1=low, 2=mod, 3=high)
Ashburn 2007[96]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	6	
Barnett 2003[104]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	37	
Birks 2004[85]	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
Bischoff-Ferrari 2006[111]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Buchner 1997[105]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	72	
Cameron 2003[66]	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
Campbell 1997[97]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	78	
Campbell 1999[112]	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0		
Campbell 1999[112]	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	21	
Campbell 2005[63]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	78	
Campbell 2005[63]	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0		
Campbell 2005[63]	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	78	
Clemson 2004[103]	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0		
Close 1999[80]	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0		3
Coleman 1999[101]	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0		2

Appendix F Table 2. Data for Meta-Analysis

Study ID	Number of deaths - IG	Number of deaths - CG	Fall History - IG (% fallers in last year)	Fall History - CG (% fallers in last year)	Outcomes follow-up time (mos)	Number of falls in IG 12-month	Number of falls in CG 12-month	Person years in IG	Person years in CG	Falls per person year in IG	Falls per p-y IG, LCI	Falls per p-y IG, UCI	Falls per person year in CG	Falls per p-y cG, LCI	Falls per p-y cG, UCI	Number of fallers in IG 12-month	Number of fallers in CG 12-month	Relative Risk of being a faller	Lower CI Limit - RR	Upper CI Limit - RR	Odds Ratio for being a faller	Lower CI Limit - OR	Upper CI Limit - OR
Cumming 2007[90]	16	19	53.8	54.7	12											201	153	1.57	1.2	2.05			
Davison 2005[76]	3	5	100	100	12	387	617									94	102	0.95	0.81	1.12			
Day 2002[61]					18											76	87	1.31	1.13	1.5			
Day 2002[61]					18											78	87						
Day 2002[61]					18											84	87						
Day 2002[61]					18											65	87						
Day 2002[61]					18											72	87						
Day 2002[61]					18											66	87						
Day 2002[61]					18											78	87						
Dhesi 2004[102]			100	100	6											11	14						
Dukas 2004[92]	1	1			9											40	46				0.69	0.41	1.16
Elley 2008[79]	7	4	100	100	12	285	299	149	149	1.91			2.01			106	98						
Foss 2006[91]	1	2	48	45	12					1.06			1.57			48	41						
Gallagher 2001[86]	1	1			36					0.27			0.43			59	77						
Gray-Donald 1995[21]	3	1			3											0	5						
Green 2002[94]	4	5			9											30	23						
Harwood 2005[87]	3	1	51	47	6					0.37			0.56			76	69						
Hendriks 2008[84]	5	1	100	100	12											55	61						
Hogan 2001[82]	2	5	100	100	12											54	61						
Li 2005[116]			42	31	6											27	43						

Appendix F Table 2. Data for Meta-Analysis

Study ID	Incident rate ratio for being a faller	Lower CI Limit - IRR	Upper CI Limit - IRR	Adjusted Ratio	Number of fallers with fractures in IG 12-month	Number of fallers with fractures in CG 12-month	N in IG at baseline (intention to treat)	N in CG at baseline (intention to treat)	Number of clusters	Size of cluster (or average)	Inter-cluster correlation	N in IG at baseline (n analyzed for falls)	N in CG at baseline (n analyzed for falls)	N in IG at baseline (n analyzed for fractures)	N in CG at baseline (n analyzed for fractures)	Type of Intervention	High risk	Setting	Quality rating	Pct Female in IG	Pct Female in CG	Mean age in IG	Mean age in CG
Cumming 2007[90]					31	18	309	307				309	307	309	307	2	3	2	2	67	68	80.9	80.3
Davison 2005[76]	0.64	0.46	0.9		6	11	159	154				144	149	144	149	1	1	2	2	73	72	77	77
Day 2002[61]	0.82	0.7	0.97				135	137				135	137			3	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.92	0.78	1.08				136	137				136	137			5	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.89	0.75	1.04				139	137				139	137			2	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.67	0.51	0.88				135	137				135	137			6	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.76	0.6	0.95				135	137				135	137			6	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.73	0.58	0.91				136	137				136	137			6	4	2	2	59.8	59.8	76.1	76.1
Day 2002[61]	0.81	0.65	1.02				137	137				137	137			6	4	2	2	59.8	59.8	76.1	76.1
Dhesi 2004[102]							70	69				62	61			2	1	2	2	76	80	77	76.6
Dukas 2004[92]							193	187				192	186			2	3	2	2	51	51	75	75
Elley 2008[79]							155	157				135	145			1	1	2	1	68	70	80.4	81.1
Foss 2006[91]	0.68	0.39	1.19	0	5	2	120	119				110	103	110	103	2	3	2	2	100	100	79.2	79.9
Gallagher 2001[86]					6	13	123	123				123	123	123	123	2				100	100	72	71
Gray-Donald 1995[21]							25	25				22	24			2	3	2	2	74	67	76	79
Green 2002[94]							85	85				72	74	72	74	3	3	2	2	42	46	71.5	73.5
Harwood 2005[87]	0.66	0.45	0.96	0	4	12	154	152				154	152	154	152	2	3	2	1	100	100	78.8	78.1
Hendriks 2008[84]							166	167				124	134			1	1	2	2	66.9	70.1	74.5	75.2
Hogan 2001[82]					3	5	79	84				75	77			1	1	2	2	69.6	73.8	77.4	77.9
Li 2005[116]							125	131				95	93			3	4	1	2	70	70	76.9	78

Appendix F Table 2. Data for Meta-Analysis

Study ID	Falls risk assessment	Falls risk assessment and individualized intervention	Vitamin D (alone or in combination with calcium)	Medication assessment and management	Medication assessment and withdrawal	Cardiac pacing	Hormone replacement therapy	Vision assessment and treatment (including Cataract surgery)	Hip protectors	Home hazard modification	Home hazard assessment	Education low intensity *(1x ≤30 mins)*	Education moderate intensity *(between low & high)*	Education high intensity *(multiple times, >2 hours)*	Tai Chi or 3D exercises	Gait, balance, functional training	Strength/ resistance exercise	Intensity of physical activity interventions (hours)	Intensity of clinical assessment interventions (1=low, 2=mod, 3=high)
Cumming 2007[90]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
Davison 2005[76]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3
Day 2002[61]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	15	
Day 2002[61]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
Day 2002[61]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
Day 2002[61]	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	15	
Day 2002[61]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	15	
Day 2002[61]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	15	
Day 2002[61]	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0		
Dhesi 2004[102]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Dukas 2004[92]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Elley 2008[79]	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		1
Foss 2006[91]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
Gallagher 2001[86]			1																
Gray-Donald 1995[21]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Green 2002[94]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	
Harwood 2005[87]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
Hendriks 2008[84]	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0		1
Hogan 2001[82]	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		2
Li 2005[116]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	78	

Appendix F Table 2. Data for Meta-Analysis

Study ID	Number of deaths - IG	Number of deaths - CG	Fall History - IG (% fallers in last year)	Fall History - CG (% fallers in last year)	Outcomes follow-up time (mos)	Number of falls in IG 12-month	Number of falls in CG 12-month	Person years in IG	Person years in CG	Falls per person year in IG	Falls per p-y IG, LCI	Falls per p-y IG, UCI	Falls per person year in CG	Falls per p-y cG, LCI	Falls per p-y cG, UCI	Number of fallers in IG 12-month	Number of fallers in CG 12-month	Relative Risk of being a faller	Lower CI Limit - RR	Upper CI Limit - RR	Odds Ratio for being a faller	Lower CI Limit - OR	Upper CI Limit - OR
Lightbody 2002[77]	7	11	100	100	6											39	41						
Logghe 2009[114]	1		64	60	12	115	90									58	59						
Lord 1995[108]			28	28.9	12											26	33						
Lord 2005[62]	2	6			12											94	90						
Lord 2005[62]	0	6			12											93	90						
Luukinen 2007[93]	48	50			16					1.15	1.02	1.32	1.23	1.03	1.29	126	136						
Morgan 2004[113]			38.7	32.7	12											34	34						
Newbury 2001[81]	1	5			12											12	17						
Pfeifer 2000[98]					12											11	19						
Pfeifer 2009[99]					20	106	169									49	75						
Porthouse 2005[67]	57	68	33.7	44.2	12																0.98	0.79	1.2
Prince 2008[89]	0	1	100	100	12											80	95						
Robertson 2001[95]	1	6	36	38	12	80	109	117	108	0.69			1.01										
Rubenstein 2000[100]			48.4	64.3	3											12	9						
Shumway-Cook 2007[83]	2	3			12	297	398			1.33			1.77			124	130	0.96	0.82	1.13			
Spice 2009 (PC)[75]	23	29	100	100	12											112	123				1.17	0.57	2.37
Spice 2009 (SC)[75]	34	29	100	100	12											135	123						
Stevens 2001[70]			26	27	12					0.69			0.72								0.93	0.75	1.15

Appendix F Table 2. Data for Meta-Analysis

Study ID	Incident rate ratio for being a faller	Lower CI Limit - IRR	Upper CI Limit - IRR	Adjusted Ratio	Number of fallers with fractures in IG 12-month	Number of fallers with fractures in CG 12-month	N in IG at baseline (intention to treat)	N in CG at baseline (intention to treat)	Number of clusters	Size of cluster (or average)	Inter-cluster correlation	N in IG at baseline (n analyzed for falls)	N in CG at baseline (n analyzed for falls)	N in IG at baseline (n analyzed for fractures)	N in CG at baseline (n analyzed for fractures)	Type of Intervention	High risk	Setting	Quality rating	Pct Female in IG	Pct Female in CG	Mean age in IG	Mean age in CG
Lightbody 2002[77]							171	177				155	159			1	1	2	2	77	72	75	75
Logghe 2009[114]	1.16	0.86	1.56	1.16			138	131				114	99			3	3	2	2	70	73	78	77
Lord 1995[108]							100	97				75	94			3	4	2	2	100	100	71.6	71.7
Lord 2005[62]							206	204				194	201			1	2	2	2	62.1	69.1	80.7	80.2
Lord 2005[62]							210	204				202	201			1	2	2	2	66.7	69.1	80.3	80.2
Luukinen 2007[93]							243	243				217	220			3	3	2	2	78	80	88	88
Morgan 2004[113]							119	110				119	110			3	3	1	2	72.3	69.1	81	80.1
Newbury 2001[81]							50	50				45	44			1	4	2	2	66	60	78.5	80
Pfeifer 2000[98]					3	6	74	74				67	70	67	70	2	3	2	2	100	100	74.8	74.7
Pfeifer 2009[99]					7	12	121	121				122	120	122	120	2	3	2	2	74	75	76	77
Porthouse 2005[67]				1	58	91	1321	1993						1321	1993	2	4	2	2	100	100	77	76.7
Prince 2008[89]					4	3	151	151				151	151	151	151	2	1	2	2	100	100	77	77.4
Robertson 2001[95]	0.54	0.32	0.9	0			121	119				121	119			3	4	2	2	68	67	80.8	81.1
Rubenstein 2000[100]							31	28				31	28			3	2	1	2	0	0	76.4	74.4
Shumway-Cook 2007[83]	0.75	0.52	1.09				226	227				226	227			1	4	1	1	77	76	75.6	75.6
Spice 2009 (PC)[75]					29	35	136	159	18	29		130	149	130	149	1	1	1	2	74	76	83	83
Spice 2009 (SC)[75]					40	35	210	159	18	29		186	149	186	149	1	1	1	2	71	76	81	83
Stevens 2001[70]	1.02	0.83	1.27	1			635	1244				570	1167			5	4	2	2	54	52	76	76

Appendix F Table 2. Data for Meta-Analysis

Study ID	Falls risk assessment	Falls risk assessment and individualized intervention	Vitamin D (alone or in combination with calcium)	Medication assessment and management	Medication assessment and withdrawal	Cardiac pacing	Hormone replacement therapy	Vision assessment and treatment (including Cataract surgery)	Hip protectors	Home hazard modification	Home hazard assessment	Education low intensity *(1x ≤30 mins)*	Education moderate intensity *(between low & high)*	Education high intensity *(multiple times, >2 hours)*	Tai Chi or 3D exercises	Gait, balance, functional training	Strength/ resistance exercise	Intensity of physical activity interventions (hours)	Intensity of clinical assessment interventions (1=low, 2=mod, 3=high)
Lightbody 2002[77]	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0		1
Logghe 2009[114]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	33	
Lord 1995[108]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	80	
Lord 2005[62]	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0		3
Lord 2005[62]	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2
Luukinen 2007[93]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Morgan 2004[113]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	18	
Newbury 2001[81]	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1
Pfeifer 2000[98]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Pfeifer 2009[99]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Porthouse 2005[67]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Prince 2008[89]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Robertson 2001[95]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	78	
Rubenstein 2000[100]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	54	
Shumway-Cook 2007[83]	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	156	2
Spice 2009 (PC)[75]	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0		1
Spice 2009 (SC)[75]	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0		3
Stevens 2001[70]	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0		

Appendix F Table 2. Data for Meta-Analysis

Study ID	Number of deaths - IG	Number of deaths - CG	Fall History - IG (% fallers in last year)	Fall History - CG (% fallers in last year)	Outcomes follow-up time (mos)	Number of falls in IG 12-month	Number of falls in CG 12-month	Person years in IG	Person years in CG	Falls per person year in IG	Falls per p-y IG, LCI	Falls per p-y IG, UCI	Falls per person year in CG	Falls per p-y cG, LCI	Falls per p-y cG, UCI	Number of fallers in IG 12-month	Number of fallers in CG 12-month	Relative Risk of being a faller	Lower CI Limit - RR	Upper CI Limit - RR	Odds Ratio for being a faller	Lower CI Limit - OR	Upper CI Limit - OR
Tinetti 1994[131]	7	5	41	44	12	94	164			0.62			0.94			52	68						
Van Haastregt 2000[714]			38	36	12											63	53						
Voukelatos 2007[115]			31	36	6											71	81						
Wagner 1994[78]	17	22	35	33	12											175	223						
Wolf 1996[107]			42	34	13.5	56	77	34	29														
Wolf 1996[107]			31	34	13.5	76	77	29	29												0.52	0.35	0.79

Appendix F Table 2. Data for Meta-Analysis

Study ID	Incident rate ratio for being a faller	Lower CI Limit - IRR	Upper CI Limit - IRR	Adjusted Ratio	Number of fallers with fractures in IG 12-month	Number of fallers with fractures in CG 12-month	N in IG at baseline (intention to treat)	N in CG at baseline (intention to treat)	Number of clusters	Size of cluster (or average)	Inter-cluster correlation	N in IG at baseline (n analyzed for falls)	N in CG at baseline (n analyzed for falls)	N in IG at baseline (n analyzed for fractures)	N in CG at baseline (n analyzed for fractures)	Type of Intervention	High risk	Setting	Quality rating	Pct Female in IG	Pct Female in CG	Mean age in IG	Mean age in CG
Tinetti 1994[131]					4	7	153	148	16	19		147	144	147	144	1	3	1	2	69	69	78.3	77.5
Van Haastregt 2000[714]							159	157				127	120			1	3	2	2	65	65	77.2	77.2
Voukelatos 2007[115]							353	349				347	337			3	4	2	1	85	83	69	69
Wagner 1994[78]							635	607				635	607			1	3	1	2	60	59	72.5	72.5
Wolf 1996[107]							72	64				72	64			3	4	1	2	81	84	76.9	75.4
Wolf 1996[107]							64	64				64	64			3	4	1	2	77	84	76.3	75.4

Appendix F Table 2. Data for Meta-Analysis

Study ID	Falls risk assessment	Falls risk assessment and individualized intervention	Vitamin D (alone or in combination with calcium)	Medication assessment and management	Medication assessment and withdrawal	Cardiac pacing	Hormone replacement therapy	Vision assessment and treatment (including Cataract surgery)	Hip protectors	Home hazard modification	Home hazard assessment	Education low intensity *(1x ≤30 mins)*	Education moderate intensity *(between low & high)*	Education high intensity *(multiple times, >2 hours)*	Tai Chi or 3D exercises	Gait, balance, functional training	Strength/ resistance exercise	Intensity of physical activity interventions (hours)	Intensity of clinical assessment interventions (1=low, 2=mod, 3=high)
Tinetti 1994[131]	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0		3
Van Haastregt 2000[714]	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0		2
Voukelatos 2007[115]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	16	
Wagner 1994[78]	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0		3
Wolf 1996[107]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	23	
Wolf 1996[107]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	11	

Appendix F Table 3. Meta-Analysis Data Table Coding Key

Type of intervention:

1. Multifactorial assessment and management
2. Single clinical treatment
3. Physical activity
4. Clinical education/behavioral counseling
5. Home hazard modification
6. Combination

High risk categories:

1. Fall history
2. Functional limitation
3. Other high risk
4. None

Setting:

1. In United States
2. Outside of United States

Quality rating:

1. Good
2. Fair

Intervention type (fall risk assessment – strength/resistance exercise columns):

0. No
1. Yes

Intensity of clinical assessment interventions:

1. Low: assessment and referral only
2. Medium: assessment, referral, and targeted intervention or education
3. High: assessment and multifactorial treatment

Appendix F Table 4. Meta-Regression Analysis Details

A series of meta-regressions were used to examine possible sources of heterogeneity and investigate whether the size of effect measure estimates were associated with various study-level characteristics. In all cases the outcome was the log of the risk ratio for having a fall. Separate models were run for each predictor.

The following predictors were examined among the trials categorized as "Clinical Assessment": (a) use of medication withdrawal as part of the intervention (yes vs. no); (b) the presence of any educational component as part of the intervention (yes vs. no); (c) intensity of the educational components (moderate- or high-intensity education vs. none or low-intensity education); (d) presence of home hazard assessment or modification as part of the intervention (yes vs. no); (e) comprehensiveness of the intervention (comprehensive vs. not comprehensive); and (f) whether the sample was comprised of high-risk participants. "High risk" was defined in four different ways, each tested in separate regression models: (1) sample selected because of a previous fall; (2) sample selected for functional limitation; (3) either of the previous two definitions or any other specified by the trial; and (4) average age of 80 or older.

Among the trials categorized as "Exercise/Physical Therapy," predictors included (a) whether the sample was composed of people at high risk for a fall (using the same four definitions as above); (b) proportion of participants with a fall in the previous year (defined using two "dummy" variables indicating 50%–75% or 75%–100% of participants with previous falls, using 0%–49% as the reference group); and (c) intensity of the intervention. Intensity was defined in three different ways: (1) as the estimated hours of intervention (a continuous variable); (2) as a dichotomous variable indicating at least 76 or more hours of intervention vs. 75 or fewer hours; and (3) as two dummy variables indicating 50–75 hours or 76 or more hours, with 0–49 hours as the reference group.

Additional models were run pooling all intervention types and by intervention type, examining the predictors: mean age, average age of 80 or older (yes vs. no), percent female, presence of any educational component as part of the intervention, and percent with a fall in the previous year (defined in two ways, as described above).

Appendix G Table 1. Pending and Ongoing Trials

Principal investigators	Location	Population	Approximate size	Investigations	Outcomes	Status as of 2009
KQ1: Interventions to prevent fall-related injury, improve quality of life, reduce disability, or reduce mortality when used to reduce falls						
Susan E. Carter	Wales	Aged >70 years	NR	Brief intervention: Home hazard assessment and pamphlet on home safety and use of medications Intensive intervention: Same as above plus development of home hazard modification action plan with follow-up prompts and medication review Control group: no intervention	Falls and falls resulting in medical attention	Unknown
Tahir Masud	UK	Aged >70 years and at high risk for falling	NR	Intervention: Attend day hospital for assessment and subsequent multifactorial intervention to decrease rate of falls Control: Usual care	Rate of falling over 12 months Fall-related injuries, disability and mortality over 12 months	Analyzing data
N.M. Sjösten	Finland	Aged ≥65 years, ≥1 fall in past year, and moderate to high physical and cognitive abilities	n=591	Multifactorial fall prevention intervention consisting of seven parts	Risk factors for falling, incidence of falls and injurious falls Health habits, physical function, psychosocial and cognitive function, social function	Baseline results published in 2007, results not yet published
KQ2: Interventions to reduce risk for or rate of falls						
Susan E. Carter	Wales	Aged >70 years	NR	Brief intervention: Home hazard assessment and pamphlet on home safety and use of medications Intensive intervention: Same as above plus development of home hazard modification action plan with follow-up prompts and medication review Control group: No intervention	Falls and falls resulting in medical attention	Unknown
Kay Cerny	Long Beach, CA	Community-dwelling seniors	n=28	Community-based group exercise program	Gait, balance, strength, and range of motion	Never published, data thrown out in early 2008

Appendix G Table 1. Pending and Ongoing Trials

Principal investigators	Location	Population	Approximate size	Investigations	Outcomes	Status as of 2009
Carol E. Coogler	Atlanta, GA	Aged 65–99 years, from independent living communities	n=86	Balance biofeedback training in fallers and nonfallers	Falls and postural control	Unknown
Catherine Dean	Australia	Community dwellers post stroke	Unknown	Exercise intervention, no further information	Falls	Trial under way, results not yet available
Stefanie Ferreri	Chapel Hill, NC	Aged ≥65 years and at high risk for falls	n=186	Medication consultation, report recommendations to physician, implement any authorized changes	Time to first fall and number of fallers	Plan to submit for publication by May 2009
Maria A. Fiatarone	Boston	Mean age 82 years, 94% female	n=34	Intervention: High-intensity resistance training program; 16 weeks, 3 days/week in home Control: Wait list	Falls, health care visits, bed days	Published abstract
Keith Hill	Australia	Stroke patients	Uknown	Multifactorial falls prevention program	Falls	Unknown
Tahir Masud	UK	Aged >70 years and at high risk for falling	NR	Intervention: Attend day hospital for assessment and subsequent multifactorial intervention to decrease rate of falls Control: Usual care	Rate of falling over 12 months Fall-related injuries, disability, and mortality over 12 months	Analyzing data
N.M. Sjösten	Finland	Aged ≥65 years, ≥1 fall in past year, and moderate to high physical and cognitive abilities	n=591	Multifactorial fall prevention intervention consisting of seven parts	Risk factors for falling, incidence of falls and injurious falls Health habits, physical function, psychosocial and cognitive function, social function	Baseline results published in 2007, results not yet published
Martin J. Spink	Australia	Aged ≥65 years, with foot pain and at high risk for falling	n=300	Footwear advice and provision, foot orthoses, home-based exercise program, and falls prevention education	Incidence and rate of falling	Results expected 2011
KQ3: Adverse effects of interventions to reduce falls						
None						
KQ4: Identification of high-risk older adults						
None						

Appendix G Table 2. Trials Included in the Cochrane Review

Study ID	Inclusion decision for USPSTF review
Ashburn 2007[1]	Included in the review
Assantachai 2002[2]	Out of scope at abstract review
Ballard 2004[3]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Barnett 2003[4]	Included in the review
Bischoff-Ferrari 2006[5]	Included in the review
Brown 2002 & Brown 1999[6]	Not reviewed (Brown 2002), reviewed bibliography of systematic evidence review (Brown 1999)
Buchner 1997a[7]	Included in the review
Bunout 2005[8]	Out of scope at abstract review
Campbell 1997[9]	Included in the review
Campbell 1999[10]	Included in the review
Campbell 2005[11]	Included in the review
Carpenter 1990[12]	Excluded for lack of focus on reducing risk for or rate of fallers
Carter 1997	Unpublished data, not included
Carter 2002[13]	Excluded for lack of focus on reducing risk for or rate of fallers
Cerny 1998[14]	Excluded for not reporting desired outcomes
Clemson 2004[15]	Included in the review
Close 1999[16]	Included in the review
Coleman 1999[17]	Included in the review
Cornillon 2002[18]	Excluded for nonEnglish language
Cumming 1999[19]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Cumming 2007[20]	Included in the review
Davison 2005[21]	Included in the review
Day 2002[22]	Included in the review
Dhesi 2004[23]	Included in the review
Dukas 2004[24]	Included in the review
Elley 2008[25]	Included in the review
Fabacher 1994[26]	Excluded for unblinded outcome assessment
Fiatrone 1997[27]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Foss 2006[28]	Included in the review
Gallagher 1996[29]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Grant 2005[31]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Gray-Donald 1995[32]	Included in the review
Green 2002[33]	Included in the review
Greenspan 2005[34]	Excluded for comparative effectiveness study design
Harwood 2004[35]	Out of scope at abstract review
Harwood 2005[36]	Included in the review
Hauer 2001[37]	Excluded for intervention not conducted in primary care or other setting with primary care-comparable population (hospital, nursing home, rehabilitation center, or other long-term care facility)
Helbostad 2004[38]	Excluded for comparative effectiveness study design
Hendriks 2008[39]	Out of scope at abstract review
Hill 2000 & Crome 2000[40]	Primary paper used did not come up in our literature search (Hill 2000), other paper excluded for not reporting desired outcomes (Crome 2000)
Hogan 2001[41]	Included in the review
Hornbrook 1994[42]	Excluded for not reporting desired outcomes
Huang 2004[43]	Out of scope at abstract review
Huang 2005[44]	Out of scope at abstract review
Jitapunkul 1998[45]	Excluded for intervention not conducted in primary care or other setting with primary care-comparable population (hospital, nursing home, rehabilitation center, or other long-term care facility)
Kenny 2001[46]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Kingston 2001[47]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Korpelainen 2006[48]	Out of scope at abstract review
Lannin 2007[49]	Out of scope at abstract review
Latham 2003[50]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Li 2005[51]	Included in the review
Lightbody 2005[52]	Included in the review
Lin 2007[53]	Excluded for study design (not a randomized controlled trial)
Liu-Ambrose 2004[54]	Excluded for lack of focus on reducing risk for or rate of fallers
Lord 1995[55]	Included in the review

Appendix G Table 2. Trials Included in the Cochrane Review

Study ID	Inclusion decision for USPSTF review
Lord 2003[56]	Excluded for intervention not conducted in primary care or other setting with primary care-comparable population (hospital, nursing home, rehabilitation center, or other long-term care facility)
Lord 2005[57]	Included in the review
Luukinen 2007[58]	Included in the review
Mahoney 2007[59]	Excluded for comparative effectiveness study design
McKiernan 2005[60]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
McMurdo 1997[61]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Means 2005[62]	Excluded for high or differential attrition
Meredith 2002	Not reviewed
Morgan 2004[63]	Included in the review
Newbury 2001[64]	Included in the review
Nikolaus 2003[65]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Nitz 2004[66]	Excluded for comparative effectiveness study design
Pardessus 2002[67]	Excluded for being conducted in a population that is not comparable with primary care (e.g., persons in hospitals, nursing homes, rehabilitation centers, or other long-term care facilities)
Pereira 1998[68]	Excluded for lack of focus on reducing risk for or rate of fallers
Pfeifer 2000[69]	Included in the review
Pit 2007[70]	Excluded for lack of focus on reducing risk for or rate of fallers
Porthouse 2005[71]	Included in the review
Reinsch 1992[72]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Resnick 2002[73]	Excluded for intervention not conducted in primary care or other setting with primary care-comparable population (hospital, nursing home, rehabilitation center, or other long-term care facility)
Robertson 2001a[74]	Included in the review
Robson 2003[75]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Rubenstein 2000[76]	Included in the review
Rubenstein 2007[77]	Excluded for study design (not randomized controlled trial)
Ryan 1996[78]	Excluded for poor reporting (missing information needed to evaluate quality, inconsistent data)
Salminen 2008	Unpublished data
Sato 1999[79]	Excluded for lack of focus on reducing risk for or rate of fallers
Schrijnemaekers 1995	Not reviewed
Sherrington 2004[80]	Out of scope at abstract review
Shigematsu 2008[81]	Excluded for comparative effectiveness study design
Shumway-Cook 2007[82]	Included in the review
Skelton 2005[83]	Excluded for comparative effectiveness study design
Smith 2007[84]	Excluded for lack of focus on reducing risk for or rate of fallers
Speechley 2008	Unpublished data
Spice 2009[85]	Included in the review
Steadman 2003[86]	Out of scope at abstract review
Steinberg 2000[87]	Excluded for comparative effectiveness study design
Stevens 2001[88]	Included in the review
Suzuki 2004[89]	Excluded for high or differential attrition
Swanenburg 2007[90]	Excluded for comparative effectiveness study design
Tinetti 1994[91]	Included in the review
Trivedi 2003[92]	Excluded for outcome assessment (did not report cumulative falls)
Van Haastregt 2000[93]	Included in the review
Van Rossum 1993[94]	Excluded for lack of focus on reducing risk for or rate of fallers
Vellas 1991[95]	Out of scope at abstract review
Vetter 1992[96]	Excluded for high or differential attrition
Voukelatos 2007[97]	Included in the review
Wagner 1994[98]	Included in the review
Weerdesteyn 2006[99]	Excluded for problems with baseline comparability between groups
Whitehead 2003[100]	Out of scope at abstract
Wilder 2001	Not reviewed
Wolf 1996[101]	Included in the review
Wolf 2003[102]	Excluded for intervention not conducted in primary care or other setting with primary care-comparable population (hospital, nursing home, rehabilitation center, or other long-term care facility)
Woo 2007[103]	Excluded for lack of focus on reducing risk for or rate of fallers
Wyman 2005 & Wyman 2007[104]	Not reviewed (Wyman 2005) and excluded for not reporting desired outcomes (Wyman 2007)

Appendix G Table 2. Trials Included in the Cochrane Review

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Appendix G Table 2. Trials Included in the Cochrane Review

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Appendix H Table 1. Profane Risk Categories: Chronic Diseases, Symptoms, Impairments

Category	Description
Osteoporosis/osteoporotic (bone fragility) fractures (A500)	Osteoporosis: Reduction of bone mass without alteration in the composition of bone, leading to fractures. Primary osteoporosis can be of two major types: postmenopausal osteoporosis (OSTEOPOROSIS, POSTMENOPAUSAL) and age-related or senile osteoporosis. [MeSH D010024] Osteoporosis, postmenopausal: Metabolic disorder associated with fractures of the femoral neck, vertebrae, and distal forearm. It occurs commonly in women within 15–20 years after menopause, and is caused by factors associated with menopause, including estrogen deficiency. [MeSH D015663]
Parkinson's disease syndrome (A501)	Parkinson's disease: A progressive, degenerative neurologic disease characterized by a TREMOR that is maximal at rest, retropulsion (i.e., a tendency to fall backwards), rigidity, stooped posture, slowness of voluntary movements, and a masklike facial expression. Pathologic features include loss of melanin containing neurons in the substantia nigra and other pigmented nuclei of the brainstem. LEWY BODIES are present in the substantia nigra and locus coeruleus but may also be found in a related condition (LEWY BODY DISEASE, DIFFUSE) characterized by dementia in combination with varying degrees of parkinsonism. (From Adams RD, Victor M, Ropper AH, eds. Principles of Neurology. 6th ed. New York: McGraw-Hill; 1997.) [MeSH D010300]
Cerebrovascular disorders (A502)	A broad category of disorders characterized by impairment of blood flow in the arteries and veins which supply the brain. These include CEREBRAL INFARCTION; BRAIN ISCHEMIA; HYPOXIA, BRAIN; INTRACRANIAL EMBOLISM AND THROMBOSIS; INTRACRANIAL ARTERIOVENOUS MALFORMATIONS; and VASCULITIS, CENTRAL NERVOUS SYSTEM. In common usage, the term cerebrovascular disorders is not limited to conditions that affect the cerebrum, but refers to vascular disorders of the entire brain, including the DIENCEPHALON; BRAIN STEM; and CEREBELLUM. [MeSH D002561]
Eye diseases, visual impairments (A503)	Eye diseases. [MeSH D005128] Vision disorders: Visual impairments limiting one or more of the basic functions of the eye: visual acuity, dark adaptation, color vision, or peripheral vision. These may result from EYE DISEASES; OPTIC NERVE DISEASES; VISUAL PATHWAY diseases; OCCIPITAL LOBE diseases; OCULAR MOTILITY DISORDERS; and other conditions. Visual disability refers to inability of the individual to perform specific visual tasks, such as reading, writing, orientation, or travelling unaided. (From Newell FW. Ophthalmology: Principles and Concepts. 7th ed. St. Louis: Mosby; 1992.) [MeSH D014786]
Dementia, cognitive impairment (A504)	Dementia, cognitive dementia: An acquired organic mental disorder with loss of intellectual abilities of sufficient severity to interfere with social or occupational functioning. The dysfunction is multifaceted and involves memory, behavior, personality, judgment, attention, spatial relations, language, abstract thought, and other executive functions. The intellectual decline is usually progressive, and initially spares the level of consciousness. [MeSH D003704] This category includes also less severe cognitive impairments affecting the ability to think, concentrate, formulate ideas, reason, and remember.
Depression symptoms (A505)	Depression: Depressive states usually of moderate intensity, in contrast with major depression present in neurotic and psychotic disorders. [MeSH D003863] Depressive disorder: An affective disorder manifested by either a dysphoric mood or loss of interest or pleasure in usual activities. The mood disturbance is prominent and relatively persistent. [MeSH D003866] Dysthymic disorder: Chronically depressed mood that occurs for most of the day, more days than not, for at least 2 years. The required minimum duration in children to make this diagnosis is 1 year. During periods of depressed mood, at least two of the following additional symptoms are present: poor appetite or overeating, insomnia or hypersomnia, low energy or fatigue, low self-esteem, poor concentration or difficulty making decisions, and feelings of hopelessness. [MeSH D019263]
Syncope (A506)	A transient loss of consciousness and postural tone caused by diminished blood flow to the brain (i.e., BRAIN ISCHEMIA). Presyncope refers to the sensation of lightheadedness and loss of strength that precedes a syncopal event or accompanies an incomplete syncope. (From Adams RD, Victor M, Ropper AH, eds. Principles of Neurology. 6th ed. New York: McGraw-Hill; 1997.) [MeSH D013575].
Gait and/or balance impairment (A507)	Gait is the way one locomotes or walks [MeSH D005684]. Examples include walking patterns and running patterns; impairments such as spastic gait, hemiplegic gait, paraplegic gait, asymmetric gait, limping. and stiff gait pattern. [ICF b770] Postural balance or musculoskeletal equilibrium: A state of the body being evenly balanced in POSTURE. The biomechanical responses of the MUSCULOSKELETAL SYSTEM during standing, walking, sitting, and other movements. [MeSH D004856] Balance impairments include impairments of sitting, static standing, or dynamic balance. In the context of falls, gait and balance impairments are often detected with timed or qualitative performance tests, such as the Get Up & Go test.

Appendix H Table 1. Profane Risk Categories: Chronic Diseases, Symptoms, Impairments

Category	Description
Urinary incontinence (A508) various	Involuntary loss of URINE, such as leaking of urine. It is a symptom of various underlying pathological processes. Major types of incontinence include URINARY URGE INCONTINENCE and URINARY STRESS INCONTINENCE. [MeSH D014549]
Screening tool (A509)	A fall screening tool is a short test intended to determine an older person's risk for falling in order to determine eligibility for a fall risk intervention. It is not usually used to determine treatment received. Examples are the FRAT and AGS/BGS fall screening algorithms.
Others (A599/A599A)	Not described under A500–A509. A599A: Brief description (free text).
Medication specific (A600)	Individuals have been selected because they are taking specified classes of medication with a known association with fall risk (e.g., selective serotonin reuptake inhibitors, sedatives, or hypnotics) or as identified by the authors of the paper.

Appendix H Table 2. Other Positive Outcome Measures Audited From Studies Included for Key Questions 1 and 2

Category	Studies
Aerobic capacity	Buchner 1997[105] Buchner 1993[106]
Blood pressure	Luukinen 2007[93], Dukas 2004[92], Wolf 1996[107]
Body mass index and skin fold caliper	Luukinen 2007[93], Gray-Donald 1995[88]
Body sway	Voukelatos 2007[115], Lord 1995[108], Day 2002[61], Barnett 2003[104], Pfeifer 2000[98]
Bone measures	Pfeifer 2000[98], Dukas 2004[92]
Chair stand/ sit-to-stand	Rubenstein 2000[100], Luukinen 2007[93], Campbell 1997[97], Barnett 2003[104], Ashburn 2007[96], Greenspan 2005, Dhesi 2004[102], Shumway-Cook 2007[83], Lord 2005[62], Elley 2008[79]
Cognitive status	Luukinen 2007[93], Van Haastregt 2000[71], Newbury 2001[81], Greenspan 2005
Dietary intake	Gray-Donald 1995[88], Dukas 2004[92], Dhesi 2004[102]
Falls Behavioral Scale	Clemson 2004[103]
Fear of falling	Hendriks 2008[84]
Hip protector adherence	Cameron 2003[66]
Hormonal measures	Pfeifer 2000[98], Dukas 2004[92], Dhesi 2004[102]
Medical visits	Hogan 2001[82], Newbury 2001[81], Lightbody 2002[77]
Mood	Clemson 2004[103], Green 2002[94], Foss 2006[91], Van Haastregt 2000[71], Newbury 2001[81], Lightbody 2002[77], Hendriks 2008[84], Harwood 2005[87]
Muscle strength	Wolf 1996[107], Luukinen 2007[93], Lord 1995[108], Day 2002[61], Campbell 1997[97], Buchner 1997[105], Buchner 1993[106], Barnett 2003[104], Gray-Donald 1995[88], Dukas 2004[92], Dhesi 2004[102], Green 2002[94]
Number of medications	Luukinen 2007[93], Lightbody 2002[77]
One-leg balance and tandem leg balance	Rubenstein 2000[100], Li 2005[116], Greenspan 2005
Other activity scales	Rubenstein 2000[100], Green 2002[94], Clemson 2004[103], Greenspan 2005, Hendriks 2008[84], Elley 2008[79], Van Haastregt 2000[71]
Other balance and stability measures	Voukelatos 2007[115], Luukinen 2007[93], Day 2002[61], Campbell 1997[97], Buchner 1997[105], Buchner 1993[106], Barnett 2003[104], Greenspan 2005, Dukas 2004[92], Dhesi 2004[102], Elley 2008[79], Lord 1995[108]
Other disability scales	Harwood 2005[87]
Other gait and mobility measures	Rubenstein 2000[100], Li 2005[116], Green 2002[94], Buchner 1997[105], Buchner 1993[106], Voukelatos 2007[115]
Other general health questionnaires	Green 2002[94], Gray-Donald 1995[88], Buchner 1997[105], Buchner 1993[106], Van Haastregt 2000[71], Newbury 2001[81], Hendriks 2008[84]
Other timed walks	Wolf 1996[107], Rubenstein 2000[100], Luukinen 2007[93], Li 2005[116], Campbell 1997[97], Greenspan 2005, Buchner 1997[105], Buchner 1993[106], Dhesi 2004[102]
Parkinson's Disease Disability Scale	Ashburn 2007[96]
Reaction time	Lord 1995[108], Barnett 2003[104], Dhesi 2004[102]
Risk factor reassessment	Tinetti 1994[131], Buchner 1993[106]
Visual acuity	Day 2002[61], Harwood 2005[87], Foss 2006[91], Cumming 2007[90]

Appendix H Table 3. Other Fall-Related Injury Outcome Measures Audited From Studies Included for Key Questions 1 and 2

Category	Studies
Bruises, strains, cuts and abrasions, back pain, and fractures	Lord 20056[62]
Fracture, dislocation, sprains, strains, bruises, lacerations, scrapes, and others	Wolf 1996[107]
Fractures, dislocations, and soft tissue injuries needing suturing and even more severe injuries	Luukinen 2007[93]
Fractures, head injuries, sprains, bruises, scrapes, or other serious joint injuries, or fall resulting in medical care	Li 2005[116]
Incidence of other injury besides hip fracture	Cameron 2003[66]
Injuries requiring medical attention	Close 1999[80], Elley 2008[79], Hendriks 2008[84], Hogan 2001[82], Lightbody 2002[77], Shumway-Cook 2007[83]
Injurious fall or fall resulting in medical care (no further detail)	Van Haastregt 2000[71], Wagner 1994[78], Stevens 2001[70]
Moderate injury (bruising, sprains, cuts, abrasions, seeking medical attention, or decrease in physical function for 3 days or more)	Elley 2008[79]
Serious injury (fracture or admission to hospital or wounds needing stitches) or Moderate injury (bruising, sprains, cuts, abrasions, or a reduction in physical function for 3 days or more)	Campbell 1997[97]
Serious injury (fracture or admission to hospital or wounds needing stitches) or Moderate injury (bruising, sprains, cuts, abrasions, or reduction in physical function for 3 days or more or if the participant sought medical help)	Robertson 2001[95]
Serious injury (fractures, head injuries, joint dislocations, severe sprains, lacerations requiring suturing)	Tinetti 1994[131]
Serious injury (no further detail)	Close 1999[80], Rubenstein 2000[100]