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# Multifactorial and multiple component interventions for preventing falls in older people living in the community (Review)

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[Intervention Review]

# Multifactorial and multiple component interventions for preventing falls in older people living in the community

Sally Hopewell[1], Olubusola Adedire[2], Bethan J Copsey[1], Graham J Boniface[3], Catherine Sherrington[4], Lindy Clemson[5], Jacqueline CT Close[6], Sarah E Lamb[1]

[1]Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), University of Oxford, Oxford, UK. [2]Biomedical Engineering, Oxehealth, Oxford, UK. [3]Centre for Rehabilitation Research in Oxford (RRIO), Nuffield Department of Orthopaedics, Rheumatology & Musculoskeletal Sciences (NDORMS), University of Oxford, Oxford, UK. [4]Musculoskeletal Health Sydney, School of Public Health, The University of Sydney, Sydney, Australia. [5]Faculty of Health Sciences, The University of Sydney, Lidcombe, Australia. [6]Falls, Balance and Injury Research Centre, Neuroscience Research Australia, Randwick, Australia

**Contact address:** Sally Hopewell, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), University of Oxford, Botnar Research Centre, Windmill Road, Oxford, Oxfordshire, OX3 7LD, UK. sally.hopewell@csm.ox.ac.uk.

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## ABSTRACT

### Background

Falls and fall-related injuries are common, particularly in those aged over 65, with around one-third of older people living in the community falling at least once a year. Falls prevention interventions may comprise single component interventions (e.g. exercise), or involve combinations of two or more different types of intervention (e.g. exercise and medication review). Their delivery can broadly be divided into two main groups: 1) multifactorial interventions where component interventions differ based on individual assessment of risk; or 2) multiple component interventions where the same component interventions are provided to all people.

### Objectives

To assess the effects (benefits and harms) of multifactorial interventions and multiple component interventions for preventing falls in older people living in the community.

### Search methods

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register, the Cochrane Central Register of Controlled Trials, MEDLINE, Embase, the Cumulative Index to Nursing and Allied Health Literature, trial registers and reference lists. Date of search: 12 June 2017.

### Selection criteria

Randomised controlled trials, individual or cluster, that evaluated the effects of multifactorial and multiple component interventions on falls in older people living in the community, compared with control (i.e. usual care (no change in usual activities) or attention control (social visits)) or exercise as a single intervention.

### Data collection and analysis

Two review authors independently selected studies, assessed risks of bias and extracted data. We calculated the rate ratio (RaR) with 95% confidence intervals (CIs) for rate of falls. For dichotomous outcomes we used risk ratios (RRs) and 95% CIs. For continuous outcomes, we

used the standardised mean difference (SMD) with 95% CIs. We pooled data using the random-effects model. We used the GRADE approach to assess the quality of the evidence.

**Main results**

We included 62 trials involving 19,935 older people living in the community. The median trial size was 248 participants. Most trials included more women than men. The mean ages in trials ranged from 62 to 85 years (median 77 years). Most trials (43 trials) reported follow-up of 12 months or over. We assessed most trials at unclear or high risk of bias in one or more domains.

Forty-four trials assessed multifactorial interventions and 18 assessed multiple component interventions. ($I^2$ not reported if = 0%).

**Multifactorial interventions versus usual care or attention control**

This comparison was made in 43 trials. Commonly-applied or recommended interventions after assessment of each participant's risk profile were exercise, environment or assistive technologies, medication review and psychological interventions. Multifactorial interventions may reduce the rate of falls compared with control: rate ratio (RaR) 0.77, 95% CI 0.67 to 0.87; 19 trials; 5853 participants; $I^2$ = 88%; low-quality evidence. Thus if 1000 people were followed over one year, the number of falls may be 1784 (95% CI 1553 to 2016) after multifactorial intervention versus 2317 after usual care or attention control. There was low-quality evidence of little or no difference in the risks of: falling (i.e. people sustaining one or more fall) (RR 0.96, 95% CI 0.90 to 1.03; 29 trials; 9637 participants; $I^2$ = 60%); recurrent falls (RR 0.87, 95% CI 0.74 to 1.03; 12 trials; 3368 participants; $I^2$ = 53%); fall-related hospital admission (RR 1.00, 95% CI 0.92 to 1.07; 15 trials; 5227 participants); requiring medical attention (RR 0.91, 95% CI 0.75 to 1.10; 8 trials; 3078 participants). There is low-quality evidence that multifactorial interventions may reduce the risk of fall-related fractures (RR 0.73, 95% CI 0.53 to 1.01; 9 trials; 2850 participants) and may slightly improve health-related quality of life but not noticeably (SMD 0.19, 95% CI 0.03 to 0.35; 9 trials; 2373 participants; $I^2$ = 70%). Of three trials reporting on adverse events, one found none, and two reported 12 participants with self-limiting musculoskeletal symptoms in total.

**Multifactorial interventions versus exercise**

Very low-quality evidence from one small trial of 51 recently-discharged orthopaedic patients means that we are uncertain of the effects on rate of falls or risk of falling of multifactorial interventions versus exercise alone. Other fall-related outcomes were not assessed.

**Multiple component interventions versus usual care or attention control**

The 17 trials that make this comparison usually included exercise and another component, commonly education or home-hazard assessment. There is moderate-quality evidence that multiple interventions probably reduce the rate of falls (RaR 0.74, 95% CI 0.60 to 0.91; 6 trials; 1085 participants; $I^2$ = 45%) and risk of falls (RR 0.82, 95% CI 0.74 to 0.90; 11 trials; 1980 participants). There is low-quality evidence that multiple interventions may reduce the risk of recurrent falls, although a small increase cannot be ruled out (RR 0.81, 95% CI 0.63 to 1.05; 4 trials; 662 participants). Very low-quality evidence means that we are uncertain of the effects of multiple component interventions on the risk of fall-related fractures (2 trials) or fall-related hospital admission (1 trial). There is low-quality evidence that multiple interventions may have little or no effect on the risk of requiring medical attention (RR 0.95, 95% CI 0.67 to 1.35; 1 trial; 291 participants); conversely they may slightly improve health-related quality of life (SMD 0.77, 95% CI 0.16 to 1.39; 4 trials; 391 participants; $I^2$ = 88%). Of seven trials reporting on adverse events, five found none, and six minor adverse events were reported in two.

**Multiple component interventions versus exercise**

This comparison was tested in five trials. There is low-quality evidence of little or no difference between the two interventions in rate of falls (1 trial) and risk of falling (RR 0.93, 95% CI 0.78 to 1.10; 3 trials; 863 participants) and very low-quality evidence, meaning we are uncertain of the effects on hospital admission (1 trial). One trial reported two cases of minor joint pain. Other falls outcomes were not reported.

**Authors' conclusions**

Multifactorial interventions may reduce the rate of falls compared with usual care or attention control. However, there may be little or no effect on other fall-related outcomes. Multiple component interventions, usually including exercise, may reduce the rate of falls and risk of falling compared with usual care or attention control.

## PLAIN LANGUAGE SUMMARY

### Interventions based on individual assessment of falls risk and multiple component interventions for preventing falls in older people in the community

**Review question**

To assess whether fall-prevention strategies which target two or more risk factors for falls (multifactorial interventions) or fixed combinations of interventions (multiple component interventions) are effective in preventing falls in older people living in the community.

**Background**

As people age they are more likely to fall. Although most fall-related injuries are minor, they can cause significant pain and discomfort, affect a person's confidence and lead to a loss of independence. Some falls can cause serious long-term health problems. A combination of factors increases the risk of falls with ageing, such as weak muscles, stiff joints, hearing problems, changes in sight, side effects of medications, tiredness or confusion. Poor lighting, slippery or uneven surfaces, and issues with poor footwear can also increase the risk of falling.

Different interventions have been developed to help prevent falls in older people. They may involve a single type of intervention, such as exercise to increase muscle strength, or combinations of interventions, such as exercise and adjustment of a person's medication. A combination of two or more components can be delivered as either a multifactorial intervention based on an assessment of a person's risk factors for falling or as a multiple component intervention where the same combination of interventions is provided to all participants.

**Search date**

We searched the healthcare literature for reports of randomised controlled trials relevant to this review up to 12 June 2017.

**Study characteristics**

We included 62 randomised trials involving 19,935 older participants. Most trials included more women than men; the average ages in the trials ranged from 62 to 85 years. Trials compared the interventions to an inactive control group receiving usual care (no change in usual activities) or a matched level of attention (such as social visits) or to an active control group receiving an exercise programme.

**Key results**

We identified 43 trials that compared a multifactorial intervention with an inactive control. Multifactorial interventions led to some reduction in the rate at which people fall compared with the inactive control group, but the quality of evidence was low because of large differences in how studies were conducted. There may be little or no difference in the number of people who experienced one or more falls (fallers), recurrent falls, fall-related fractures, or experienced a fall requiring hospital admission or medical attention. Multifactorial interventions may make little difference to people's health-related quality of life. There was very limited evidence on adverse events related to the intervention; all 12 reported musculoskeletal complaints such as back pain were minor.

We did not find enough evidence to determine the effects of multifactorial interventions compared with exercise as this was only assessed in one small trial.

We identified 18 trials assessing the effects of multiple component interventions. Seventeen compared the intervention with an inactive control group and five compared the intervention with exercise. Seventeen of the trials included exercise in the intervention and another component, often education on falls prevention or home safety assessment. There was limited evidence on adverse events related to the intervention; all six reported events were minor.

Multiple component interventions probably reduce the rate at which people fall and the number of fallers compared with the inactive control group. They may also reduce the number of people who experienced recurrent falls. The evidence was not enough to determine their effects on fall-related fractures or hospital admission. Multiple component interventions may make little or no difference to the risk of a fall requiring medical attention. However, they may slightly improve a person's health-related quality of life.

Trials comparing multiple component interventions with exercise showed there may be little or no difference in the rate at which people fall and the number of fallers, but not enough evidence to determine the effects on hospital admission. Other falls outcomes were not reported.

**Quality of the evidence**

We rated the quality of the available evidence as of low or very low quality. This means that we have limited confidence about the results where the evidence is low quality, but are uncertain where the evidence is of very low quality.

**Summary of findings for the main comparison. Multifactorial interventions compared with usual care or attention control for preventing falls in older people living in the community**

**Multifactorial interventions[a] compared with usual care or attention control for preventing falls in older people living in the community**

**Patient or population:** Older people living in the community
**Setting:** Community (home or places of residence that do not provide residential health-related care)

**Intervention:** Multifactorial interventions (i.e. where component interventions are based on individual assessment of falls risk)[b]
**Comparison:** Usual care or attention control

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | No. of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with usual care or attention control[c] | Risk with Multifactorial intervention | | | | |
| Rate of falls (falls per person years)<br>Follow-up: range 3 to 24 months | Study population<br>2317 per 1000 | 1784 per 1000 (1553 to 2016) | Rate ratio 0.77 (0.67 to 0.87) | 5853 (19 RCTs) | ⊕⊕⊖⊖ LOW[d,e] | This is just a guide to the data.<br>If 1000 people were followed over 1 year, the number of falls would be 1784 (95% CI 1553 to 2016) compared with 2317 in the group receiving usual care or attention control. Overall, there may be a reduction of 23% (13% to 33%) in the number of falls. |
| Number of people sustaining one or more falls<br>Follow-up: range 3 to 48 months | Study population<br>472 per 1000 | 454 per 1000 (425 to 487) | RR 0.96 (0.90 to 1.03) | 9637 (29 RCTs) | ⊕⊕⊖⊖ LOW[d,e] | This is just a guide to the data.<br>If 1000 people were followed over 1 year, the number of fallers would be 454 (95% CI 425 to 487) compared with 472 in the group receiving usual care or attention control. Overall, there may be a reduction of 4% (10% reduction to 3% increase) in the number of fallers. |
| Number of people sustaining recurrent falls (defined as 2 or more falls in a specified time period) | Study population<br>279 per 1000 | 242 per 1000 | RR 0.87 (0.74 to 1.03) | 3368 (12 RCTs) | ⊕⊕⊖⊖ LOW[d,e] | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| Follow-up: range 6 to 24 months | | (206 to 287) | | | | |
| Number of people sustaining one or more fall-related fractures<br>Follow-up: range 3 to 48 months | Study population | | RR 0.73<br>(0.53 to 1.01) | 2850<br>(9 RCTs) | ⊕⊕⊖⊖<br>LOW[d,f] | - |
| | 60 per 1000 | 44 per 1000<br>(32 to 61) | | | | |
| Number of people who experience a fall that required hospital admission<br>Follow-up: range 3 to 36 months | Study population | | RR 1.00<br>(0.92 to 1.07) | 5227<br>(15 RCTs) | ⊕⊕⊖⊖<br>LOW[d,g] | - |
| | 267 per 1000 | 267 per 1000<br>(246 to 286) | | | | |
| Number of people who experience a fall that required medical attention<br>Follow-up: range 12 to 24 months | Study population | | RR 0.91<br>(0.75 to 1.10) | 3078<br>(8 RCTs) | ⊕⊕⊖⊖<br>LOW[d,f] | - |
| | 126 per 1000 | 115 per 1000<br>(95 to 139) | | | | |
| Health-related quality of life assessed with: SF-36<br>Scale from: 0 (worst) to 100 (best)<br>Follow-up: range 3 to 36 months | - | MD 2.47<br>(0.39 lower to 4.55 higher) | - | 2373<br>(9 RCTs) | ⊕⊕⊖⊖<br>LOW[d,e] | SMD 0.19 (95% CI 0.03 to 0.35) converted back to MD using SF-36 scale, based on data for 9 trials reporting end point scores.<br><br>MID for the SF-36 is typically 3 to 5 (Walters 2003)<br><br>EQ-5D (0 to 1; best score) changes scores reported by 1 other trial (212 participants) (MD −0.06, 95% CI −0.10 to −0.02) were also not important differences. |
| Adverse effects | See comment | | Not estimable | See comment | - | Only 3 trials reported on adverse events which may have been related to the intervention. 1 trial reported 2 participants with back pain (2% of 107), 1 trial reported 10 with musculoskeletal symptoms (7% of 147); the remaining trial found none. All 12 events were self-limiting. |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

__CI:__ Confidence interval; __MID:__ Minimal important difference; __RR:__ Risk ratio

**GRADE Working Group grades of evidence**

**High quality:** We are very confident that the true effect lies close to that of the estimate of the effect
**Moderate quality:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
**Low quality:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
**Very low quality:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a]A multifactorial intervention is one in which the selection of falls-prevention interventions (such as exercise, home-hazard modification or medication review) prescribed or provided to each individual is matched to their risk-of-falls profile, which is assessed beforehand. This individually-tailored intervention means that after receiving an assessment of known risk factors for falling, individuals are likely to received different combinations of interventions: i.e. one person may receive supervised exercise and home-hazard modification whereas another may receive home-hazard modification and medication review.
[b]Commonly-used component interventions in the 43 trials testing this comparison included exercise, environment/assistive technologies, medication review, and psychological interventions. Given that the selection of component intervention is matched to the individual's risk profile, the clinical heterogeneity within a trial and across trials is to be expected.
[c]We calculated the risk in the control group based on the number of events and the total number of participants in the control group for each outcome.
[d]Downgraded one level for risk of bias (more than one trial at high or unclear risk of bias).
[e]Downgraded one level for inconsistency (there was moderate to considerable statistical heterogeneity in these outcomes that could not be explained by prespecified sensitivity and subgroup analyses).
[f]Downgraded one level for imprecision (relatively broad overall confidence interval).
[g]Downgraded one level for indirectness (poor reporting meant that it was sometimes unclear how many hospital admissions were falls-related. Therefore, we included outcome data on hospital admissions in general).

## Summary of findings 2. Multifactorial interventions compared with exercise for preventing falls in older people living in the community

**Multifactorial intervention[a] compared with exercise for preventing falls in older people living in the community**

**Patient or population:** Older people living in the community[b]
**Setting:** Community (home or places of residence that do not provide residential health-related care)
**Intervention:** Multifactorial interventions (i.e. where component interventions are based on individual assessment of risk) for preventing falls[b]
**Comparison:** Exercise

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | No. of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with exercise[c] | Risk with multifactorial intervention | | | | |
| Rate of falls (falls per person years)<br>Follow-up: 1 month | Study population | | Rate ratio 0.13 (0.01 to 2.46) | 51 (1 RCT) | ⊕⊖⊖⊖ VERY LOW[d,e] | |
| | 1850 per 1000 | 241 per 1000 (16 to 4551) | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of people sustaining one or more falls<br>Follow-up: 1 month | Study population<br>77 per 1000 | 20 per 1000<br>(1 to 425) | RR 0.26<br>(0.01 to 5.52) | 51<br>(1 RCT) | ⊕⊖⊖⊖<br>VERY LOW[d,e] | |
| Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Number of people sustaining one or more fall-related fractures | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Number of people who experience a fall that required hospital admission | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Number of people who experience a fall that required medical attention | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Health-related quality of life | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Adverse effects | See comment | | Not estimable | See comment | - | This outcome was not reported |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).
**CI:** Confidence interval; **RR:** Risk ratio

**GRADE Working Group grades of evidence**
**High quality:** We are very confident that the true effect lies close to that of the estimate of the effect
**Moderate quality:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
**Low quality:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
**Very low quality:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a]A multifactorial intervention is one in which the selection of falls prevention interventions (such as exercise, home-hazard modification or medication review) prescribed or provided to each individual is matched to their risk-of-falls profile, which is assessed beforehand. This individually-tailored intervention means that after receiving an assessment of known risk factors for falling, individuals are likely to received different combinations of interventions: i.e. one person may receive supervised exercise and home-hazard modification whereas another may receive home-hazard modification and medication review.
[b]The participants in the only trial testing this comparison were recently-discharged orthopaedic patients in Japan. The specific multifactorial intervention comprised a tailored education programme using home floor plans.
[c]We calculated the risk in the exercise group based on the number of events and the total number of participants in the exercise group for each outcome.
[d]Downgraded one level for risk of bias (more than one domain is at high or unclear risk of bias).
[e]Downgraded by two levels for imprecision (wide confidence interval due to small sample size and few events).

**Summary of findings 3. Multiple component interventions compared with usual care or attention control for preventing falls in older people living in the community**

**Multiple component intervention[a] compared to usual care or attention control for preventing falls in older people living in the community**

**Patient or population:** Older people living in the community
**Setting:** Community (home or places of residence that do not provide residential health-related care)
**Intervention:** Multiple component interventions (i.e. where the same component interventions are provided to all people) for preventing falls[b]
**Comparison:** Usual care or attention control

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | No. of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with usual care or attention control[c] | Risk with Multiple intervention | | | | |
| Rate of falls (falls per person years)<br>Follow-up: range 3 to 24 months | Study population | | Rate ratio 0.74 (0.60 to 0.91) | 1085 (6 RCTs) | ⊕⊕⊕⊖ MODERATE[d] | This is just a guide to the data.<br>If 1000 people were followed over 1 year, the number of falls would be 1206 (95% 978 to 1483) compared with 1630 in the group receiving usual care or attention control. |
| | 1630 per 1000 | 1206 per 1000 (978 to 1483) | | | | |
| Number of people sustaining one or more falls<br>Follow-up: range 3 to 18 months | Study population | | RR 0.82 (0.74 to 0.90) | 1980 (11 RCTs) | ⊕⊕⊕⊖ MODERATE[d] | This is just a guide to the data.<br>If 1000 people were followed over 1 year, the number of fallers would be 243 (95% CI 220 to 267) compared with 297 in the group receiving usual care or attention control. |
| | 297 per 1000 | 243 per 1000 (220 to 267) | | | | |
| Number of people sustaining recurrent falls (defined as two or more falls in a specified time period)<br>Follow-up: range 6 to 14 months | Study population | | RR 0.81 (0.63 to 1.05) | 662 (4 RCTs) | ⊕⊕⊖⊖ LOW[d,e] | - |
| | 123 per 1000 | 99 per 1000 (77 to 129) | | | | |
| Number of people sustaining one or more fall-related fractures<br>Follow-up: range 3 to 3 months | Study population | | RR 0.50 (0.05 to 5.32) | 232 (2 RCTs) | ⊕⊖⊖⊖ VERY LOW[d,f] | There were just 2 fractures reported. |
| | 17 per 1000 | 9 per 1000 (1 to 92) | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of people who experience a fall that required hospital admission<br>Follow-up: 12 months | Study population<br>40 per 1000 | 122 per 1000 (26 to 577) | RR 3.06 (0.65 to 14.42) | 99 (1 RCT) | ⊕⊖⊖⊖<br>VERY LOW[d,f] | - |
| Number of people who experience a fall that required medical attention<br>Follow-up: 12 months | Study population<br>333 per 1000 | 317 per 1000 (223 to 450) | RR 0.95 (0.67 to 1.35) | 291 (1 RCT) | ⊕⊕⊖⊖<br>LOW[d,e] | - |
| Health-related quality of life assessed with: SF-36<br>Scale from: 0 (worst) to 100 (best)<br>Follow-up: range 3 months to 12 months | - | MD 9.12 (1.89 lower to 16.46 higher) | - | 391 (4 RCTs) | ⊕⊕⊖⊖<br>LOW[d,g] | SMD 0.77 (95% CI 0.16 to 1.39) converted back to MD using SF-36 scale, based on data for 8 trials reporting endpoint scores.<br><br>MID for the SF-36 is typically 3 to 5 (Walters 2003).<br><br>MD -19.73 (95% CI -30.94 to -8.52) for the one trial (33 participants) reporting change scores. |
| Adverse effects | See comment | | Not estimable | See comment | - | 7 trials reported on adverse events that may have been related to the intervention. 1 trial reported resolvable joint pain in 2 participants undergoing exercise; 1 trial (Wesson 2013) reported minor complaints in 4 participants relating to stiffness, dizziness and mild joint pain. The other 5 trials reported no adverse events. |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

**CI:** Confidence interval; **RR:** Risk ratio **MID:** minimal important difference

**GRADE Working Group grades of evidence**
**High quality:** We are very confident that the true effect lies close to that of the estimate of the effect
**Moderate quality:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
**Low quality:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
**Very low quality:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a]Multiple component interventions are those where people receive a fixed combination of two or more fall prevention interventions selected from different categories of intervention (e.g. exercises, medication review, environment/assistive technology).
[b]The multiple component interventions used in the 17 trials testing this comparison were: exercise and education (2 trials); exercise and home safety (4 trials); exercise and nutrition (2 trials); exercise and psychological intervention (2 trials); exercise and home safety and nutrition (1 trial); exercise and home safety and vision assessment (3 trials); or exercise and nutrition and psychological intervention (1 trial), home safety and vision (1 trial) and nutrition and psychological intervention (1 trial).
[c]We calculated the risk in the control group based on the number of events and the total number of participants in the control group for each outcome.
[d]Downgraded one level for risk of bias (more than one trial at high or unclear risk of bias).
[e]Downgraded one level for imprecision (wide confidence interval due to small sample size).
[f]Downgraded two levels for serious imprecision (few events and wide confidence interval due to small sample size).
[g]Downgraded one level for inconsistency (there was considerable statistical heterogeneity ($I^2$ = 91%)).

**Summary of findings 4. Multiple component interventions compared with exercise for preventing falls in older people living in the community**

**Multiple component intervention[a] compared with exercise for preventing falls in older people living in the community**

**Patient or population:** Older people living in the community
**Setting:** Community (home or places of residence that do not provide residential health-related care)
**Intervention:** Multiple component interventions (i.e. where the same component interventions are provided to all people) for preventing falls[b]
**Comparison:** Exercise

| Outcomes | Anticipated absolute effects* (95% CI) | | Relative effect (95% CI) | No. of participants (studies) | Quality of the evidence (GRADE) | Comments |
|---|---|---|---|---|---|---|
| | Risk with exercise[c] | Risk with multiple intervention | | | | |
| Rate of falls (falls per person years)<br>Follow-up: 24 months | Study population<br>1280 per 1000 | 1178 per 1000 (986 to 1408) | Rate ratio 0.92 (0.77 to 1.10) | 191 (1 RCT) | ⊕⊕⊖⊖ LOW[d,e] | This is just a guide to the data.<br>If 1000 people were followed over 1 year, the number of falls would be 1178 (95% CI 986 to 1408) compared with 1280 in the group receiving usual care or attention control. |
| Number of people sustaining one or more falls<br>Follow-up: range 12 to 18 months | Study population<br>363 per 1000 | 337 per 1000 (283 to 399) | RR 0.93 (0.78 to 1.10) | 863 (3 RCTs) | ⊕⊕⊖⊖ LOW[d,e] | - |
| Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | See comment | | Not estimable | See comment | - | This outcome was not reported |

| | | | | | | |
|---|---|---|---|---|---|---|
| Number of people sustaining one or more fall-related fractures | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Number of people who experience a fall that require hospital admission<br>Follow-up: 12 months | Study population | | RR 1.95<br>(0.52 to 7.41) | 97<br>(1 RCT) | ⊕⊖⊖⊖<br>VERY LOW[d,f] | - |
| | 63 per 1000 | 122 per 1000<br>(33 to 463) | | | | |
| Number of people who experience a fall that require medical attention | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Health-related quality of life | See comment | | Not estimable | See comment | - | This outcome was not reported |
| Adverse effects | See comment | | Not estimable | See comment | - | 2 trials reported on adverse events that may be related to the intervention. 1 trial reported resolvable joint pain in 2 participants and 1 trial reported no adverse events |

*__The risk in the intervention group__ (and its 95% confidence interval) is based on the assumed risk in the comparison group and the __relative effect__ of the intervention (and its 95% CI).

**CI:** Confidence interval; **RR:** Risk ratio

**GRADE Working Group grades of evidence**
**High quality:** We are very confident that the true effect lies close to that of the estimate of the effect
**Moderate quality:** We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
**Low quality:** Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
**Very low quality:** We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

[a]Multiple component interventions are those where people receive a fixed combination of two or more fall prevention interventions selected from different categories of intervention (e.g. exercises, medication review, environment/assistive technology).
[b]The multiple component interventions used in the five trials testing this comparison were: exercise and education (1 trial); exercise and nutrition (1 trial); exercise, nutrition and psychological (1 trial); exercise, home safety and vision assessment (1 trial); and exercise, nutrition and psychological intervention (1 trial).
[c]We calculated the risk in the exercise group based on the number of events and the total number of participants in the exercise group for each outcome.
[d]Downgraded one level for risk of bias (more than one trial at high or unclear risk of bias).
[e]Downgraded one level for imprecision (wide confidence interval due to small sample size).
[f]Downgraded two levels for serious imprecision (very wide confidence interval due to small sample size).

# BACKGROUND

## Description of the condition

Falls and fall-related injuries are common and a serious problem in older people. People over 65 years of age have the highest risk of falling, with an estimated one-third of older people living in the community falling at least once a year (Campbell 1990; NICE 2013). The rate of fall-related injuries also increases with age (Peel 2002). Most fall-related injuries are minor, such as bruising, abrasions, lacerations, strains and sprains, but can still cause significant pain and discomfort. However, some falls can have serious long-term consequences, including fall-related fractures and head injuries (Peel 2002). Around 10% of falls result in a fracture (Berry 2008; Campbell 1990; Tinetti 1988), and fall-associated fractures in older people are a significant source of morbidity and mortality (Burns 2016; Scuffham 2003).

Despite early attempts to achieve a consensus definition of 'a fall' (Kellogg 1987), many definitions still exist in the literature. It is particularly important to have a clear, simple definition for studies in which older people record their own falls, as their concept of a fall may differ from that of researchers or healthcare professionals (Zecevic 2006). An international consensus statement defined a fall as "an unexpected event in which the participant comes to rest on the ground, floor or lower level" (Lamb 2005). The recommended wording when asking individuals about falls is "In the past month, have you had any fall including a slip or trip in which you lost your balance and landed on the floor or ground or lower level?" (Lamb 2005).

Epidemiological studies of varying quality have identified a number of risk factors for falling in community-dwelling older people (Deandrea 2010). These risk factors can be broadly categorised as either intrinsic or extrinsic. Intrinsic fall-related risk factors include advanced age, history of previous falls, muscle weakness, gait and balance problems, poor vision, and chronic diseases such as arthritis, diabetes, stroke, Parkinson's, dementia and incontinence. Extrinsic fall-related risk factors include environmental factors such as lack of hand rails, poor lighting, slippery or uneven surfaces, use of walking aids and poor footwear (Todd 2004). It is estimated that around 15% of falls result from a major external event that would cause most people to fall. A similar percentage of falls result from a single identifiable event such as syncope (fainting). However, most result from multiple interacting factors (e.g. a person has balance problems, poor vision and slips on an uneven surface which results in a fall) (Campbell 2006). Generally, the more risk factors a person has, the greater their chances are of having a fall.

Falls can have major psychological consequences, such as a fear of falling and loss of confidence, which can result in self-restricted activity levels and may lead in turn to a reduction in physical function and social interactions (Yardley 2002). There is evidence that exercise interventions in older people living in the community probably reduce fear of falling to a limited extent immediately after the intervention (without increasing the risk or frequency of falls). However, there is insufficient evidence to determine whether this reduces fear beyond the end of the intervention (Kendrick 2014). Falling also puts a strain on the family and is an independent predictor of admission to a nursing home (Laird 2001; Tinetti 1997).

## Description of the intervention

Many interventions and programmes of interventions for preventing falls have been established and evaluated. These are often based on known, modifiable risk factors for falling and some interventions specifically target people at high risk of falling, such as those with a history of falling. Most fall prevention interventions can be classified according to the taxonomy developed by the Prevention of Falls Network Europe (ProFANE) (Lamb 2007; Lamb 2011). Drawing on this, with some modifications that primarily reflect categorisation in Gillespie 2012, the main intervention categories that we use in this review plus examples of individual interventions are shown below.

- Exercises (supervised or unsupervised, or both): including gait, balance and functional training; strength/resistance exercises; flexibility exercises; 3D training (e.g. Tai Chi); general physical activity; endurance training or others.
- Medication (drug target): including vitamin D and calcium supplementation.
- Medication (review): including medication withdrawal, dose reduction or increase, substitution or provision.
- Surgery: including cataract extraction, pacemaker provision, podiatric surgery or others.
- Management of urinary incontinence (e.g. assisted toileting, bladder retraining).
- Fluid or nutrition therapy where the basic objective was to restore the volume and composition of the body fluids to normal with respect to water-electrolyte balance (fluid therapy) or to improve the health status of the individual by adjusting the quantities, qualities and methods of nutrient intake (nutrition therapy).
- Psychological intervention, either individual or in a group: including cognitive (behavioural) interventions.
- Environment/assistive technology: furnishings and adaptations to homes and other premises; aids for personal mobility (e.g. walking aids); aids for communication and signalling (e.g. alarm systems); body-worn aids for personal care and protection (e.g. anti-slip devices for shoes).
- Environment/assistive technology: aids for communication (e.g. eyeglasses, hearing aids). This includes vision assessment.
- Social environment: including staff ratio, staff training, service model change, telephone support, caregiver training, homecare services or others.
- Knowledge/education interventions: including written material, videos and lectures (in addition to the information that is given more generally).

Fall prevention interventions may comprise single component interventions from one of the above categories alone (e.g. balance training) or involve combinations of two or more component interventions (e.g. balance training and strength/resistance exercises) from the same category (e.g. exercise); or from different categories (e.g. exercise and medication (drug target)). Delivery of interventions with more than one component intervention from different categories can broadly be divided into the following two main groups.

- Multifactorial interventions, where the component interventions are matched to an individual assessment of risk.

- Multiple component interventions, where the same component interventions are provided to all people (Gillespie 2012; Lamb 2005).

Multifactorial interventions are interventions that involve an assessment of an individual to determine the presence of two or more modifiable risk factors for falling, which is then followed by specific interventions targeting those risk factors (Lamb 2011). Importantly, not all people receive the same combination of interventions. For example, based on an individual's risk profile, one person may receive supervised exercise and home-hazard modification whereas another may receive home-hazard modification and medication modification. The manner in which multifactorial interventions are delivered varies. In some instances, the assessment and linked interventions are by the same provider. In other instances, one provider may undertake the assessment, but linked interventions are provided through referral to other providers or other routes.

Multiple component interventions are those where people receive a fixed combination of two or more fall prevention interventions from the different categories shown above (Lamb 2011). For example, all people at risk of falling will receive the same combination of component interventions, such as supervised exercise, education and home-hazard modification. Provision is regardless of their underlying risk factor profile, which is not usually assessed as part of the intervention (Gillespie 2012). Hence there is no formal tailoring to the exact risk-factor profile of an individual.

### How the intervention might work

Fall prevention interventions aim to minimise known modifiable risk factors for falling, and thereby prevent falls and associated injuries (Todd 2004).

The hypothesis underlying multifactorial interventions is that health providers assess a range of modifiable risk factors for falling and, along with the linked interventions that follow, provide a much more tailored and potentially effective intervention. This assumes a cumulative and reasonably linear association between the number of risk factors and the probability of falling (Tinetti 2003). It assumes all risk factors contribute in a similar way and that increasing the numbers of risk factors assessed reduces the chances of falling, but this assumption may not be true (Gates 2008). Gillespie 2012 found some evidence that multifactorial interventions may reduce the rate of falls (i.e. the total number of falls per unit of person-time that falls were monitored), but not the risk of falling (i.e. the number of people who fell once or more). Of note is the wide variation in the risk factors assessed, and both the type and format of matched interventions described in published interventions. Multifactorial interventions are the recommended approach for falls prevention in the UK (NICE 2013) and recommended as a primary treatment strategy in the guideline for prevention of falls published by the American Geriatrics Society, the British Geriatrics Society and the Australian Commission on Safety and Quality in Healthcare (ACSQH 2009; American Geriatrics Society 2011). Implementation of multifactorial interventions is a challenge because of the time involved, skills demand, sometimes the need for co-ordinated efforts for assessment and intervention delivery (involving multiple health professionals), and associated cost implications (Vieira 2016).

Multiple component interventions also aim to reduce several components of fall risk rather than dealing with single risk factors. However, there is no assessment and individual tailoring of the intervention to risk factors. There is some evidence that multiple component interventions may reduce the rate of falls and risk of falling in older people living in the community. However, additional evidence is needed to determine which are the most effective combinations of component interventions (Gillespie 2012). It might be simpler and cheaper not to undertake complex assessments, but to focus on interventions for the most common risk factors and provide these to all, regardless of exact risk status. The other complication is that it is possible that the populations that receive these interventions may be different.

### Why it is important to do this review

There is some evidence for the effectiveness of multifactorial interventions and multiple component interventions in preventing falls in older people living in the community, based on the findings of a Cochrane Review (Gillespie 2012). An updated review of the effects of these interventions was warranted, given the number of new trials published, the increasing number of older people living in the community and the major long-term consequences associated with falls and fall-related injuries (including disability and reduced quality of life) to both the individual and to society. In the UK, the National Health Service (NHS) is estimated to spend around GBP 2.3 billion each year on fall-related injuries in people over the age of 65 (NICE 2013). Evidence is needed on which interventions are most effective in reducing falls and fall-related injuries, the results of which will be of major importance to healthcare professionals, policy-makers, consumers, researchers and others with an interest in this topic. Although not a focus of our review, having a sufficiently effective intervention is also an integral component of cost effectiveness.

## OBJECTIVES

To assess the effects (benefits and harms) of multifactorial interventions and multiple component interventions for preventing falls in older people living in the community.

## METHODS

### Criteria for considering studies for this review

#### Types of studies

We included randomised controlled trials, either individual or cluster-randomised, that evaluated the effects of multifactorial interventions and multiple component interventions on the incidence of falls in older people living in the community. We excluded trials that explicitly use methods of quasi-randomisation (e.g. allocation to groups by alternation or date of birth).

#### Types of participants

We included studies of interventions to prevent falls if they specified an inclusion criterion of participants aged 60 years or over. We also accepted studies that included younger participants if the mean age minus one standard deviation (SD) was more than 60 years. We included studies where most participants recruited were living in the community, either at home or in places of residence that, on the whole, do not provide residential health-related care or rehabilitative services. Studies with mixed populations

(community and higher-dependency places of residence) were eligible for inclusion provided separate data were available for those participants living in the community or the numbers in higher-dependency residences were very few and balanced in the comparison groups. We included studies that recruited participants in hospital if most participants were discharged to the community (where most of the intervention is delivered and falls were recorded).

We excluded studies that tested interventions for preventing falls in people after stroke and with Parkinson's disease, as these topic areas are covered by other Cochrane Reviews (Canning 2015; Verheyden 2013).

### Types of interventions

This Cochrane Review focuses on any multifactorial intervention or multiple component intervention designed to reduce falls in older people (i.e. designed to minimise exposure to, or the effect of, any risk factor for falling). We considered these two groups of interventions separately.

We define a multifactorial intervention as one in which interventions from two or more main categories of intervention can be given to participants, but the interventions are linked to each individual's risk profile (usually assessed using a formal process). Importantly, not all participants in a programme receive the same combination of interventions. We distinguished between multifactorial interventions where treatments were actively provided to address identified risk factors and those where the intervention consisted mainly of referral to other services or the provision of information to increase knowledge (e.g. increase the person's awareness about their risk factors to enable them to take decisions). For example:

- Each individual receives an assessment of known risk factors for falling (fall risk assessment) and then receives an intervention to match their risk profile (i.e. one person may receive supervised exercise and home-hazard modification, whereas another may receive home-hazard modification and medication modification).

We define a multiple component intervention as one in which interventions from two or more main categories of intervention are given to all participants of the falls prevention programme. Combinations of interventions and an assessment of relating to another category (e.g. assessment of environment/dwelling units) are also defined as multiple component interventions. For example, all participants of the fall prevention programme receive the following:

- Supervised exercise and medication (vitamin D and calcium supplementation).
- Supervised exercise and environmental assessment of their home.

We have based these definitions on those developed by the Prevention of Falls Network Europe (ProFaNE) (Lamb 2005).

We included studies where the intervention was compared with 'usual care' (i.e. no change in usual activities), an attention control intervention (i.e. an intervention that is not thought to reduce falls, e.g. general health education or social visits) or exercise as a single active falls-prevention intervention. We analysed studies where the control group was usual care or an attention control intervention separately from those with exercise as an 'active' control.

We chose to include exercise as a separate comparator intervention because systematic reviews of fall prevention interventions have consistently shown exercise to be the intervention that has the largest and most consistent evidence base supporting its use (Gillespie 2012; Sherrington 2016b). Impairments of gait and balance are the most commonly-occurring risk factors for falling (Tinetti 1988), and so exercise is the most logical and effective intervention. As the evidence base for falls prevention evolves to refine and provide evidence about the best interventions, exercise is the natural active comparator to select.

We did not include comparisons of different multifactorial interventions or different multiple component interventions, comparisons of any multifactorial versus multiple component interventions, or comparisons where the control was a single active intervention, apart from exercise.

### Types of outcome measures

We included studies that reported data related to the rate and number of falls during follow-up (fallers). Prospective daily calendars returned monthly for at least one year from randomisation were the preferred method for recording falls (Lamb 2005). However, we also included studies where falls were recorded retrospectively, or not monitored continuously throughout the trial, as this is still common practice and would have resulted in excluding a number of trials. We included the following outcomes in this review.

#### *Primary outcomes*

- Rate of falls (falls per person-years).
- Number of people who have sustained one or more falls (risk of falling).
- Number of people who have sustained recurrent falls (defined as two or more falls in a specified time period) (risk of recurrent falls).

#### *Secondary outcomes*

- Number of people who have sustained one or more fall-related fractures.
- Number of people who experienced a fall that required hospital admission.
- Number of people who experienced a fall that required medical attention (e.g. attended hospital emergency department, required general practitioner (GP) consultation).
- Health-related quality of life (measured using validated scale e.g. EQ-5D or similar).
- Adverse effects of the intervention.

#### Timing of outcome measurement

For studies with less than 12 months of follow-up, we used the longest duration reported. We planned to make assessments at short-term (less than 12 months) and long-term (12 months or longer) follow-up, but because of the limited number of studies for some outcomes we combined both short- and long-term follow-up and reported duration of follow-up for each study in the Characteristics of included studies.

#### Other outcomes

We recorded and reported intervention adherence data, where available, for use in the interpretation of trial and review findings.

We noted when trials had performed an economic evaluation, and reported on the key findings.

### Search methods for identification of studies

#### Electronic searches

Our search extends that performed up to February 2012 in Gillespie 2012. We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (February 2012 to 12 June 2017), the Cochrane Central Register of Controlled Trials (CENTRAL) (2012 Issue 3 to 2017 Issue 6), MEDLINE (including Epub Ahead of Print, In-Process & Other Non-Indexed Citations, MEDLINE Daily and MEDLINE Versions) (January 2012 to 9 June 2017), Embase (January 2012 to 12 June 2017) and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (January 2012 to 12 June 2017), using tailored search strategies.

In MEDLINE, we combined subject-specific search terms with the sensitivity- and precision-maximising version of the Cochrane Highly Sensitive Search Strategy for identifying randomised trials (Lefebvre 2011). The search strategies for all databases are in Appendix 1.

We also searched the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP) for ongoing and recently-completed trials (14 July 2017). There were no language or publication status restrictions.

#### Searching other resources

We checked the references in Gillespie 2012 and other relevant articles. We also identified ongoing and unpublished trials by contacting researchers in the field.

### Data collection and analysis

#### Selection of studies

Pairs of review authors (OA, BC, GB, DB) independently screened all titles and abstracts for potentially eligible studies, for which we obtained full-text reports. The same two review authors independently performed study selection. They resolved any disagreements about the inclusion or exclusion of individual studies by discussion or, if necessary, consulted another review author (SH or SL).

#### Data extraction and management

Pairs of review authors (OA, BC, GB, SH) independently performed data extraction. We piloted the data extraction form using a representative sample of studies in order to identify any missing items or unclear coding instructions. The pairs of review authors resolved any disagreements by discussion or, if they could not achieve consensus, another review author acted as an arbitrator (SL). The review authors were not blinded to names of authors, institutions, journals or outcomes. We used a standardised data extraction form to record the following items:

- General information: review author's name, date of data extraction, study ID, first author of study, author's contact address (if available), citation of paper and trial objectives.
- Trial details: trial design, location, setting, sample size, inclusion and exclusion criteria, comparability of groups, length of follow-up, stratification, stopping rules and funding source.
- 'Risk of bias' assessment: sequence generation, allocation concealment, blinding (participants, personnel, outcome assessors), incomplete outcome data, selective outcome reporting and other bias (recall bias).
- Characteristics of participants: age, gender, ethnicity, the number randomised, analysed, lost to follow-up and dropouts in each arm (with reasons).
- Interventions: experimental and control interventions, timing of intervention, whether studies assessed adherence (compliance) with interventions and associated data, and additional co-interventions.
- Outcomes measured: rate of falls, number of people sustaining one or more falls, number of people sustaining recurrent falls, number of people sustaining one or more fall-related fractures, number of people who experience a fall requiring hospital admission, number of people who experience a fall requiring medical attention, health-related quality of life, and adverse effects of the interventions.
- Other details: economic and health-resource information.

We retrieved data from both full-text and abstract reports of studies. Where these sources did not provide sufficient information, we contacted study authors for additional details.

#### Assessment of risk of bias in included studies

Two review authors (OA and BC) independently assessed the risks of bias of each included study based on recommendations in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a). They resolved any disagreements by consensus or, if they could not achieve consensus, a third review author (SH) acted as arbitrator. We assessed the risk of bias for the following domains: sequence generation (selection bias); allocation concealment (selection bias); blinding of participants and personnel (performance bias); blinding of outcome assessment (detection bias); incomplete outcome data (attrition bias); and selective outcome reporting. In our assessment of detection bias, we assessed separately (a) rate of falls and risk of falling; (b) risk of fractures; and (c) requiring hospital admission/medical attention. We also assessed bias in the recall of falls due to less reliable methods of ascertainment (i.e. where falls were recorded retrospectively, or not monitored continuously throughout the trial) (Hannan 2010). Specifically for trials using cluster randomisation, we considered the risk of additional bias relating to recruitment, baseline imbalance, loss of clusters, incorrect analysis and comparability with individually-randomised trials, as described in Chapter 16 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

We rated risk of bias as either low, high or unclear for each domain. We used the criteria for judging risk of bias in fall-prevention trials based on those described by Gillespie 2012 (see Appendix 2).

#### Measures of treatment effect

We presented the treatment effect for rate of falls, rate of fall-related fractures and rate of hospital admission as rate ratios (RaRs) with 95% confidence intervals (CIs). For the number of fallers, number of recurrent fallers, number sustaining fall-related fractures and number sustaining one or more hospital admission, we reported

risk ratios (RRs) and 95% CIs. For continuous outcomes (health-related quality of life), we presented the mean difference (MD) with 95% CIs where the same outcome measure was used, or standardised mean difference (SMD) with 95% CIs for outcomes measured using different scales. We only used results based on change scores if final values were unavailable.

### *Primary outcomes*

#### Rate of falls

We defined the rate of falls as the total number of falls per unit of person-time that falls were monitored (e.g. falls per person-year). The RaR compares the rate of falls in any two groups during each trial. If appropriate raw data were available, we calculated a RaR (using the total number of falls over the per person-years) and 95% CI using Stata®, and used this in the meta-analysis. We used the reported RaR and 95% CIs if appropriate raw data were not available. If included studies reported both adjusted and unadjusted RaRs, we used the unadjusted estimate unless the adjustment was for clustering.

#### Risk of falling

We defined the risk of falling separately for the number of people who fell once or more (fallers) and the number of people who sustained recurrent falls (defined as two or more falls). The RR compares the risk of falling in any two groups during each trial. We used the reported estimate of risk (RR) and 95% CIs if available. If an included study reported both adjusted and unadjusted estimates we used the unadjusted estimate, unless the adjustment was for clustering. If a study reported an odds ratio (or an effect estimate and 95% CI was not reported) and appropriate data were available, we calculated an RR and 95% CI using Stata 2015.

### *Secondary outcomes*

Where data were available, we reported RRs and 95% CIs for the number of participants who sustained one or more fall-related fractures, one or more hospital admissions and one or more adverse events.

### Unit of analysis issues

For studies that were cluster-randomised (e.g. randomised by medical practice), we performed adjustments for clustering according to guidance provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011b) if this had not been performed correctly in the original study. We used an intraclass correlation coefficient (ICC) of 0.01, as reported by Smeeth 2002. We did not adjust for the possibility of a clustering effect in studies that randomised by household. We anticipated that trials would be unlikely to report details of clustering by household and that the clustering effect by household would be very small (if any).

For studies with multiple intervention groups, we included each pair-wise comparison separately, but with the shared intervention group (typically the control group) divided evenly among the different comparisons. This avoids the loss of valuable information from multiple group studies and avoids problems associated with the same group of participants being included in the analysis twice. We followed guidance provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011d) on dealing with multiple groups from one study.

### Dealing with missing data

We attempted to contact study investigators for any key missing or unclear data or information on their trial. To avoid the risk of overly positive answers, we asked open-ended questions (e.g. "Please describe all measures used") followed up by more focused questions if further clarification was required. For all outcomes, we used the number of participants contributing data in each group if this was known; if this was not reported we used the number randomised in each group as long as there was no significant loss to follow-up. We recorded the reasons for missing data across treatment groups. We conducted sensitivity analyses to explore the effects of missing data (defined as those studies at high risk of bias for incomplete outcome data) on the treatment effect. If a study did not report SDs for continuous outcomes, we calculated these from standard errors, CIs or exact probability (P) values where possible. We did not impute missing SDs.

### Assessment of heterogeneity

The decision about whether or not to combine the results of individual studies was dependent on an assessment of clinical and methodological heterogeneity. Where we performed a meta-analysis, we assessed statistical heterogeneity of treatment effects between trials using the $Chi^2$ test with a significance level at $P < 0.1$ and the $I^2$ statistic. We based our interpretation of the $I^2$ statistic results on that suggested by Higgins 2011c: 0% to 40% might not be important; 30% to 60% may represent moderate heterogeneity; 50% to 90% may represent substantial heterogeneity; and 75% to 100% may represent very substantial ('considerable') heterogeneity.

### Assessment of reporting biases

If there were more than 10 studies included in the meta-analysis, we explored potential publication bias by generating a funnel plot and tested this statistically using a linear regression test. A P value of less than 0.1 could be an indication of a publication bias or small-study effects.

### Data synthesis

We analysed multifactorial interventions and multiple component interventions separately.

- We analysed multifactorial interventions, whereby participants received different combinations of intervention based on an individual assessment of risk, as one group. We analysed studies where the intervention was compared with 'usual care' (i.e. no change in usual activities) or an attention control intervention (i.e. an intervention that is not thought to reduce falls, e.g. social visits) separately from those that were compared with exercise as a single active falls-prevention intervention.
- We subgrouped multiple component interventions by the combination of interventions (i.e. where the same combination of single categories of intervention are delivered to all participants). Although we planned to analyse and report each combination separately, after finding exercise was a key component in 17 of the 18 studies assessing multiple component interventions, we decided to analyse the different combinations of interventions together in the same analysis and present the pooled results for both analyses (versus usual care and versus exercise).

We used the fall prevention intervention classification system (taxonomy) developed by the Prevention of Falls Network Europe (ProFaNE) (Lamb 2011). These categories include: exercises (supervised/unsupervised), medication (drug target), surgery, management of urinary incontinence, fluid or nutrition therapy, vision assessment, psychological interventions, environment/assistive technology, social environment and interventions to increase knowledge. Full details are available in the ProFaNE Taxonomy Manual.

Where appropriate, we had planned to pool results of comparable studies using both fixed-effect and random-effects models. We decided to use the random-effects model for all analyses, based on a careful consideration of the extent of heterogeneity and whether it could be explained, in addition to other factors, such as the number and size of included studies. We used 95% CIs throughout. We considered not pooling data where there was considerable heterogeneity ($I^2$ statistic value of greater than 75%) that could not be explained by the diversity of methodological or clinical features among trials. Had we considered it inappropriate to pool data, we would have presented trial data in the analyses or tables for illustrative purposes and reported these in the text.

When we thought it appropriate, we pooled data using the generic inverse variance method in Review Manager 5 (RevMan) (RevMan 2014). This method enables pooling of the adjusted and unadjusted treatment effect estimates (RaRs or RRs) reported in the individual studies or which can be calculated from data presented in the published article (see Measures of treatment effect). The generic inverse variance option in RevMan requires entering the natural logarithm of the RaR or RR and its standard error for each trial; we calculated these using Stata®.

### Subgroup analysis and investigation of heterogeneity

Where there was sufficient data for primary outcomes, we explored potential sources of heterogeneity by carrying out the following prespecified subgroup analyses:

- Higher versus lower falls risk at enrolment (i.e. comparing trials with participants selected for inclusion based on history of falling or other specific risk factors for falling, versus unselected).
- For the multifactorial interventions, trials that actively provided treatment to address identified risk factors versus those where the intervention consisted mainly of referral to other services or the provision of information to educate older people and their families about falls and potential risk factors.

Where appropriate, we performed the test for subgroup differences available in RevMan (RevMan 2014). We planned to perform a subgroup analysis for multiple interventions which included a vitamin D component, comparing trials that recruited participants with lower baseline vitamin D levels versus those that did not. However, only four (Campbell 2005; Neelemaat 2012; Ng 2015; Uusi-Rasi 2015) of the 15 trials of multiple interventions included a vitamin D component, and none specified the participants baseline vitamin D level.

### Sensitivity analysis

Where there were sufficient data, we assessed the robustness of our findings by conducting sensitivity analyses. We examined the effects of the following:

- Inclusion of trials at high or unclear risk of selection bias from inadequate concealment of allocation.
- Inclusion of trials at high or unclear risk of detection bias from inadequate blinding of outcome assessors.
- Inclusion of trials at high or unclear risk of attrition bias from incomplete outcome data.
- Cluster versus individual randomised trials.

We did not perform sensitivity analyses based on the choice of statistical model for pooling (fixed-effect versus random-effects). While we visually assessed the effect of time of study publication by sorting the studies in meta-analyses into ascending order by year of publication, we did not identify a suitable cut-off year to select a subgroup of more recent trials; *see* Differences between protocol and review.

### *Assessing the quality of the evidence and 'Summary of findings' tables*

We used the GRADE approach to assess the quality of the body of evidence for each primary and secondary outcome listed in the Types of outcome measures section (Schünemann 2011). The quality rating 'high' is reserved for evidence based on randomised controlled trials. We downgraded the quality rating to 'moderate', 'low' or 'very low', depending on the presence and extent of five factors: study limitations, inconsistency of effect, imprecision, indirectness or publication bias. We then prepared a 'Summary of findings' table for each of the main comparisons:

- Multifactorial interventions compared with usual care or attention control
- Multifactorial interventions compared with exercise
- Multiple component interventions compared with usual care or attention control
- Multiple component interventions compared with exercise

# RESULTS

## Description of studies

### Results of the search

We found 6080 articles from the following databases: Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (21 records); CENTRAL (1483), MEDLINE (1343), Embase (2170), CINAHL (777), the WHO ICTRP (286). We also identified 41 studies from Gillespie 2012. After removal of duplicates, we screened 3406 records.

The search identified 427 records for potential inclusion, for which we obtained full reports where possible. After further examination, we included 62 studies (in 137 records) (see Characteristics of included studies), we eliminated 271 records of which we kept 42 studies (in 94 records) as excluded studies (see Characteristics of excluded studies). An additional 16 studies (in 19 records) were ongoing studies (see Characteristics of ongoing studies). No studies await classification. A flow diagram summarising the study selection process is shown in Figure 1.

**Figure 1. Study flow diagram**

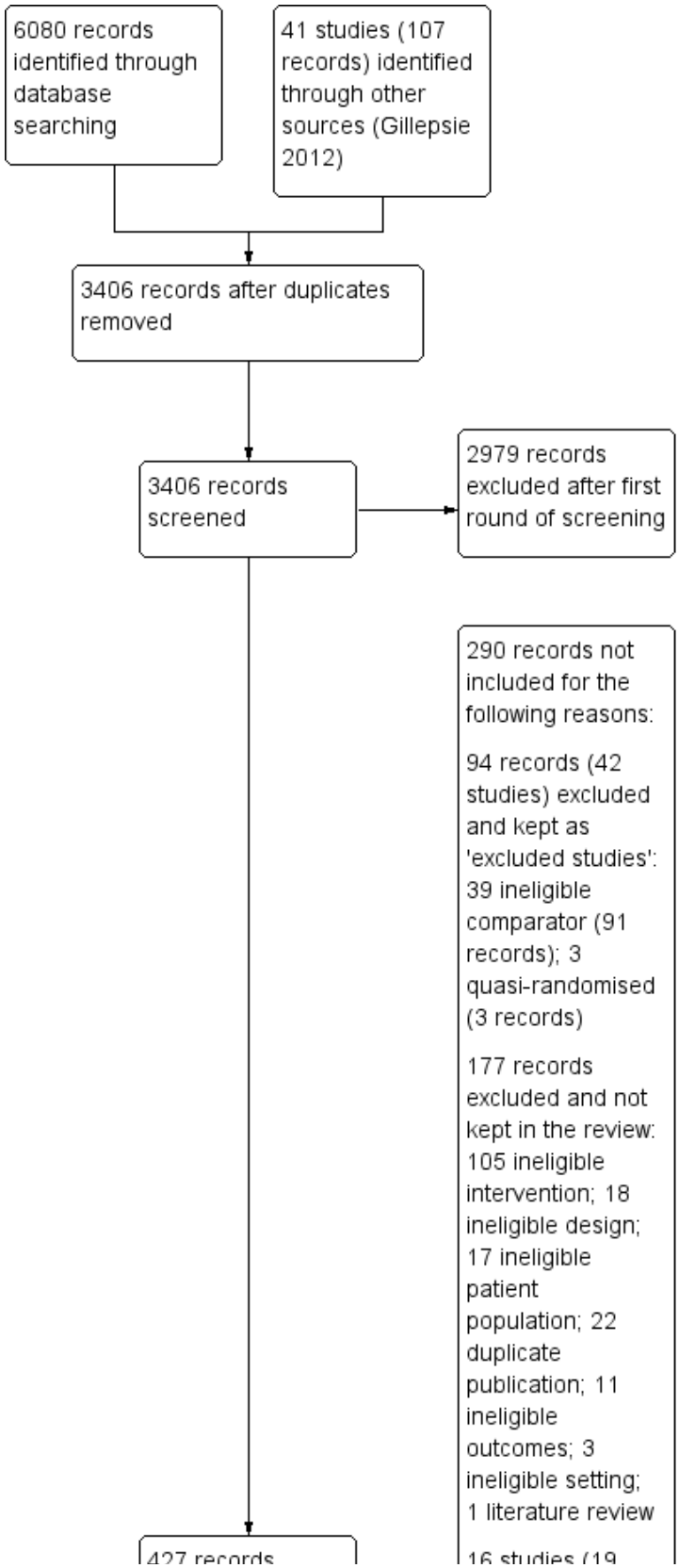
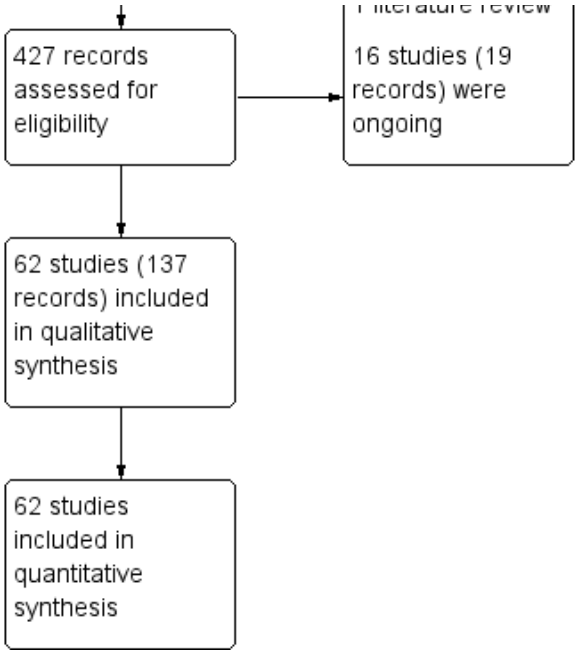


**Figure 1. (Continued)**




### Included studies

We describe all 62 trials in the Characteristics of included studies and summarise them below:

- 44 trials assessed multifactorial interventions.
- 18 trials assessed multiple component interventions.

#### *Multifactorial interventions*

#### Trial design

All 44 trials assessing multifactorial interventions were randomised controlled trials, of which 40 were parallel-group trials and four were cluster-randomised (Coleman 1999; Metzelthin 2013; Spice 2009; Tinetti 1994). Most trials included two arms, four (Carter 1997; Lord 2005; Spice 2009; Wagner 1994) had three arms and one (Markle-Reid 2010) had four arms. Sixteen trials were multicentre trials and 20 were single-centre trials; the number of centres was unclear in the remaining eight trials. The length of follow-up ranged from one month to 48 months. More than half of trials (n = 23/44) reported 12-month follow-up; 10 trials reported less than 12 months and 11 trials reported more than 12 months follow-up. SeeTable 1.

#### Trial setting

The 44 trials were conducted in 16 different countries, the most common being the UK (8 trials), USA (7 trials), the Netherlands (7 trials), Australia (6 trials), and Canada (4 trials), with the remainder being conducted in Denmark (1 trial), Finland (1 trial), France (1 trial), Germany (1 trial), Japan (1 trial), New Zealand (1 trial), Spain (1 trial), Sweden (1 trial), Switzerland (1 trial), Taiwan (2 trials), and Thailand (1 trial); see Table 1.

#### Trial size

The trials included a total of 15,733 participants. The median number of participants randomised in each trial was 303 (interquartile range (IQR) 156 to 489) with a minimum sample size of 23 participants in Beling 2009 and a maximum of 1559 participants in Wagner 1994. The median number of participants analysed in each trial was 230 (IQR 122 to 367) with a minimum of 19 (Beling 2009) and maximum of 1145 participants (Palvanen 2014). The total number of participants analysed was 11,716; however, this tally does not include the 1559 participants of Wagner 1994, as this trial did not report on the number analysed. Fifteen of the 44 trials reported more than 20% lost to follow-up. We report full details in the Characteristics of included studies and summarise these details in Table 1.

#### Participants

The mean age of participants ranged from 72 (Ciaschini 2009; Kingston 2001; Wagner 1994) to 85 years (Imhof 2012; Luck 2013). Some studies only reported the median age, which ranged from 75 (Lightbody 2002) to 83 years (Logan 2010), the age range which was from 75 to 84 years (Markle-Reid 2010; Van Rossum 1993) or the percentage over a certain age range (Carpenter 1990; Carter 1997; Russell 2010; Schrijnemaekers 1995; Vetter 1992).

Most trials included more women than men. The median percentage of women included in the trials was 69% (IQR 65% to 72%), and ranged from 2% in Fabacher 1994 to 100% in Kingston 2001; two trials (Spice 2009; Vetter 1992) did not report on the percentage of women included. Both trials conducted predominantly in men were carried out by the US Department of Veterans Affairs; 98% were men in Fabacher 1994 and 97% in Rubenstein 2007.

Thirty-one trials included study participants judged to be at higher risk of falls at enrolment (i.e. participants were selected for inclusion based on a history of falling or other specific risk factors for falling) and 13 trials included participants not judged to be at higher risk of falls (i.e. participants were not selected for inclusion based on history of falling or other specific risk factors for falling).

We report full details in the Characteristics of included studies and summarise these details in Table 2.

### Interventions

Of the 44 trials assessing multifactorial interventions, 43 trials (Beling 2009; Carpenter 1990; Carter 1997; Ciaschini 2009; Close 1999; Coleman 1999; Davison 2005; De Vries 2010; Elley 2008; Fabacher 1994; Fairhall 2014; Ferrer 2014; Gallagher 1996; Hendriks 2008; Hogan 2001; Huang 2005; Imhof 2012; Jitapunkul 1998; Kingston 2001; Lightbody 2002; Logan 2010; Lord 2005; Luck 2013; Markle-Reid 2010; Metzelthin 2013; Möller 2014; Newbury 2001; Palvanen 2014; Pardessus 2002; Rubenstein 2007; Russell 2010; Schrijnemaekers 1995; Sheffield 2013; Shyu 2010; Spice 2009; Tinetti 1994; Van Haastregt 2000; Van Rossum 1993; Vetter 1992; Vind 2009; Wagner 1994; Whitehead 2003; Zijlstra 2009) were compared with 'usual care' (i.e. no change in usual activities), or an attention control intervention (i.e. an intervention that is not thought to reduce falls, e.g. general health education or social visits). One trial compared a multifactorial intervention with exercise, a single active falls prevention intervention (Ueda 2017).

Twenty trials actively provided treatment to address identified risk factors as part of the intervention, and in 23 trials the intervention consisted mainly of referral to other services or the provision of information to educate older people and their families about falls and potential risk factors. One trial (Lord 2005) was a three-arm trial and included an active intervention, a referral intervention and a control intervention. Twenty-six trials reported assessing adherence (compliance) to the intervention as part of the trial. This was predominantly reported to be assessed by monitoring the intervention delivery by attending treatment sessions and phone contact with participants. However, the extent to which participants within the trials complied with the individual treatment components of the intervention was unclear. We report full details in the Characteristics of included studies, and summarise these details in Table 2.

We summarise details of the key components of each of the multifactorial interventions in Table 3: two or more main categories of intervention could be given to participants, but as the interventions were linked to each individual's risk profile (usually assessed using a formal process), not all participants would have received the same intervention within an individual trial. The most common categories of intervention to be included across individual trials were exercise (n = 37) and environment/assistive technologies (e.g. home-hazard assessment and modifications, referral to occupational therapist) (n = 34). Medication review (n = 28) and psychological interventions (e.g. cognitive behavioural intervention, referral to mental health services) (n = 19) were also common. Poor reporting for some trials meant that it was not always possible to identify key components of the intervention.

### Outcomes

We report full details of outcomes in the Characteristics of included studies and summarise these details in summary Table 4. Not all trials which assessed an outcome reported results in a way which could be included in a meta-analysis.

- 23 trials assessed the rate of falls
- 35 trials assessed the number of people sustaining one or more falls
- 13 trials assessed the number of people sustaining recurrent falls (defined as two or more falls in a specified time period)
- 9 trials assessed the number of people sustaining one or more fall-related fractures
- 17 trials assessed the number of people who experienced a fall that required hospital admission
- 11 trials assessed the number of people who experienced a fall that required medical attention (e.g. attended a hospital emergency department, required general practitioner (GP) consultation)
- 19 trials assessed health-related quality of life measured using a validated scale; the most commonly-used scale was the SF-36
- 3 trials assessed adverse events that may have been as a result of the intervention.

Economic information was recorded in 13 trials (Close 1999; Coleman 1999; De Vries 2010; Fairhall 2014; Hendriks 2008; Imhof 2012; Lightbody 2002; Logan 2010; Metzelthin 2013; Sheffield 2013; Shyu 2010; Tinetti 1994; Van Rossum 1993). Details are reported in the Characteristics of included studies and summarised in Table 5. All 13 trials provided some information on the cost of delivering the intervention or the cost saving in terms of the total healthcare costs. Only two trials reported information on the cost per fall prevented (De Vries 2010; Hendriks 2008) and two trials on the cost per quality-adjusted life year (QALY) gained (De Vries 2010; Logan 2010).

## *Multiple component interventions*

### Trial design

All 18 trials assessing multiple component interventions were randomised controlled trials; 13 were parallel-group trials, four used a factorial design and one was cluster-randomised (Huang 2010). Eight trials had two arms, three (Huang 2011; Waterman 2016; Wilder 2001) had three arms and seven (Campbell 2005; Day 2002; Freiberger 2012; Huang 2010; Ng 2015; Sosnoff 2015; Uusi-Rasi 2015) had four or more arms. Nine trials were multicentre trials, and six were single-centre trials; the number of centres was unclear in the other three trials. The length of follow-up ranged from 3 to 24 months, with four trials reporting 12 months follow-up, nine trials reported less than 12 months and five trials reported more than 12 months follow-up. See Table 6.

### Trial setting

The included trials were conducted in 14 different countries, the most common being Australia (3 trials), the Netherlands (2 trials) and Taiwan (2 trials). The remaining were conducted in Canada (1 trial), Finland (1 trial), Germany (1 trial), Mexico (1 trial), New Zealand (1 trial), Norway (1 trial), Singapore (1 trial), Slovakia (1 trial), Spain (1 trial), UK (1 trial) and USA (1 trial). See Table 6.

### Trial size

The included trials covered a total of 4202 participants. The median number of participants randomised per trial was 179 (IQR 72 to 310), with a minimum sample size of 22 participants (Wesson 2013) and a maximum of 1107 participants (Day 2002). The median number of participants analysed per trial was 157 (IQR 69 to 242) with a minimum of 22 (Wesson 2013) and a maximum of 1090 participants (Day 2002). The total number of participants analysed was 3377, but this tally does not include the 320 participants of Faes 2011 or the 60 participants of Wilder 2001, because neither

trial reported the number of participants in their analyses. Five of the 18 trials reported more than 20% lost to follow-up. We report full details in the Characteristics of included studies and summarise these details in Table 6.

### Participants

The mean age of participants ranged from 62 (Sosnoff 2015) to 84 years (Campbell 2005). Two trials did not report on the mean age of participants (Huang 2010; Wilder 2001). Most trials included more women than men: the median percentage of women included in the trials was 61% (IQR 55% to 71%), with a minimum of 41% in Wesson 2013 and a maximum of 100% women in Olsen 2014 and Uusi-Rasi 2015. Two trials (Neelemaat 2012; Wilder 2001) did not report on the percentage of women included.

Eleven trials included study participants judged to be at higher risk of falls at enrolment (i.e. participants were selected for inclusion based on a history of falling or other specific risk factors for falling) and seven trials included participants not judged at higher risk of falls (i.e. participants were not selected for inclusion based on history of falling or other specific risk factors for falling). We report full details in the Characteristics of included studies and summarise these details in Table 7.

### Interventions

Of the 18 trials assessing multiple component interventions, 17 (Campbell 2005; Clemson 2004; Day 2002; Faes 2011; Freiberger 2012; Hagovska 2016; Huang 2010; Huang 2011; Mendoza-Ruvalcaba 2015; Neelemaat 2012; Ng 2015; Olsen 2014; Serra-Prat 2017; Sosnoff 2015; Waterman 2016; Wesson 2013; Wilder 2001) were compared with 'usual care' (i.e. no change in usual activities), or an attention control intervention (i.e. an intervention that is not thought to reduce falls; e.g. general health education or social visits). Five trials (Day 2002; Huang 2010; Ng 2015; Sosnoff 2015; Uusi-Rasi 2015) compared a multiple component intervention with exercise as a single active falls-prevention intervention.

Seventeen trials included exercise as an intervention in addition to: education (4 trials); home safety (3 trials); nutrition (2 trials); psychological intervention (3 trials); home safety and nutrition (1 trial); home safety and vision assessment (2 trials); or nutrition and psychological intervention (2 trials). The remaining trial assessed a nutrition and psychological intervention (Neelemaat 2012). Most of the multiple component interventions included only two components (12 trials) and no trial included an intervention with more than four components. Most multiple component interventions included exercise and another component, commonly education or home-hazard assessment.

Eleven trials reported assessing adherence (compliance) to the intervention as part of the trial. This was predominantly reported as being assessed by monitoring of the intervention delivery by attending treatment sessions and phone contact with participants. However, the extent to which participants complied with the individual treatment components was unclear.

We report full details in the Characteristics of included studies and summarise these details in Table 7.

### Outcomes

We report full details in the Characteristics of included studies and summarise these details in Table 8. Not all trials which assessed an outcome reported results in a way which could be included in a meta-analysis.

- 8 trials assessed the rate of falls
- 14 trials assessed the number of people sustaining one or more falls
- 4 trials assessed the number of people sustaining recurrent falls (defined as two or more falls in a specified time period)
- 2 trials assessed the number of people sustaining one or more fall-related fractures
- 1 trial assessed the number of people who experienced a fall that required hospital admission
- 1 trial assessed the number of people who experienced a fall that required medical attention (e.g. attended a hospital emergency department, required general practitioner (GP) consultation)
- 7 trials assessed health-related quality of life measured using a validated scale; the most commonly-used scale was the SF-36
- 8 trials assessed adverse events which may have been as a result of the intervention

Economic information was recorded in three trials (Campbell 2005; Uusi-Rasi 2015; Waterman 2016).Details are reported in the Characteristics of included studies and summarised in Table 5. All three trials provided some information on the cost of delivering the intervention, or the cost saving in terms of the total healthcare costs, and reported information on the cost per fall prevented; none reported on the cost per QALY gained.

#### *Ongoing studies*

We identified 16 ongoing trials (see Characteristics of ongoing studies). Of these, one study had not yet started recruiting (ACTRN12607000206426), seven are currently open to recruitment (ACTRN12614000827639; ACTRN12615001326583; Close 2014; Hill 2017; Landi 2017; NCT02631330; Sherrington 2016), one is ongoing but no longer recruiting (NCT02374307), and six have recently been completed but the results not yet published (Barker 2015; Blank 2011; ISRCTN21120199; NCT01552551; NCT01713543; Tan 2014). The recruitment status is unknown for one study (NCT01080196).

Ten trials are evaluating multifactorial interventions (ACTRN12607000206426; Barker 2015; Close 2014; ISRCTN21120199; NCT01080196; NCT01552551; NCT01713543; NCT02631330; Sherrington 2016; Tan 2014).

### Excluded studies

We dropped 271 records from the review, for reasons given below. Of these, we retained 42 studies (included in 94 records) as excluded studies. The excluded studies fell into two categories: ineligible comparator and quasi-randomised.

- 39 (in 91 records) studies assessed the effects of multifactorial or multiple component interventions but included an ineligible comparator (see Characteristics of excluded studies).
- 3 (in 3 records) studies assessed the effects of multifactorial or multiple component interventions but were quasi-randomised trials (see Characteristics of excluded studies).
- 105 records assessed an ineligible intervention.
- 17 records included an ineligible participant population.

- 18 were reports of non-randomised studies.
- 22 records were duplicate publications.
- 11 records did not include our outcomes of interest (i.e. relevant outcomes were not assessed or measured).
- 3 records were conducted in an ineligible setting.
- 1 record was a literature review.

### Risk of bias in included studies

See Figure 2 and Figure 3 for visual representations of the 'Risk of bias' assessments across all included trials and for each individual item in the included trials. See the Characteristics of included studies section 'Risk of bias' table for further information about the bias identified within the individual trial.

**Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.**

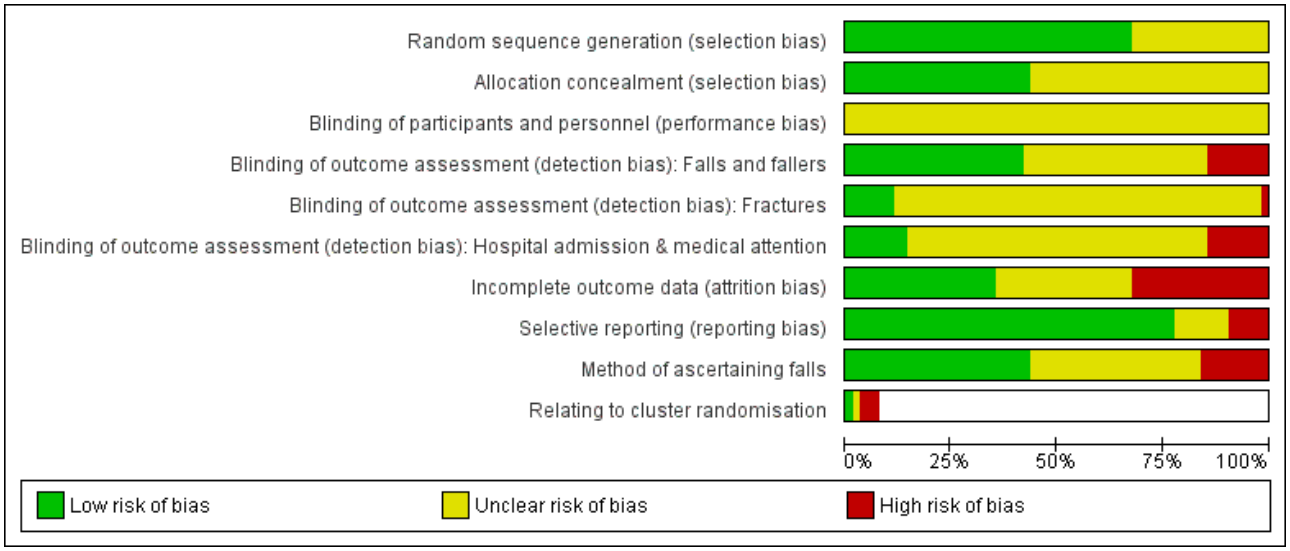


**Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.**

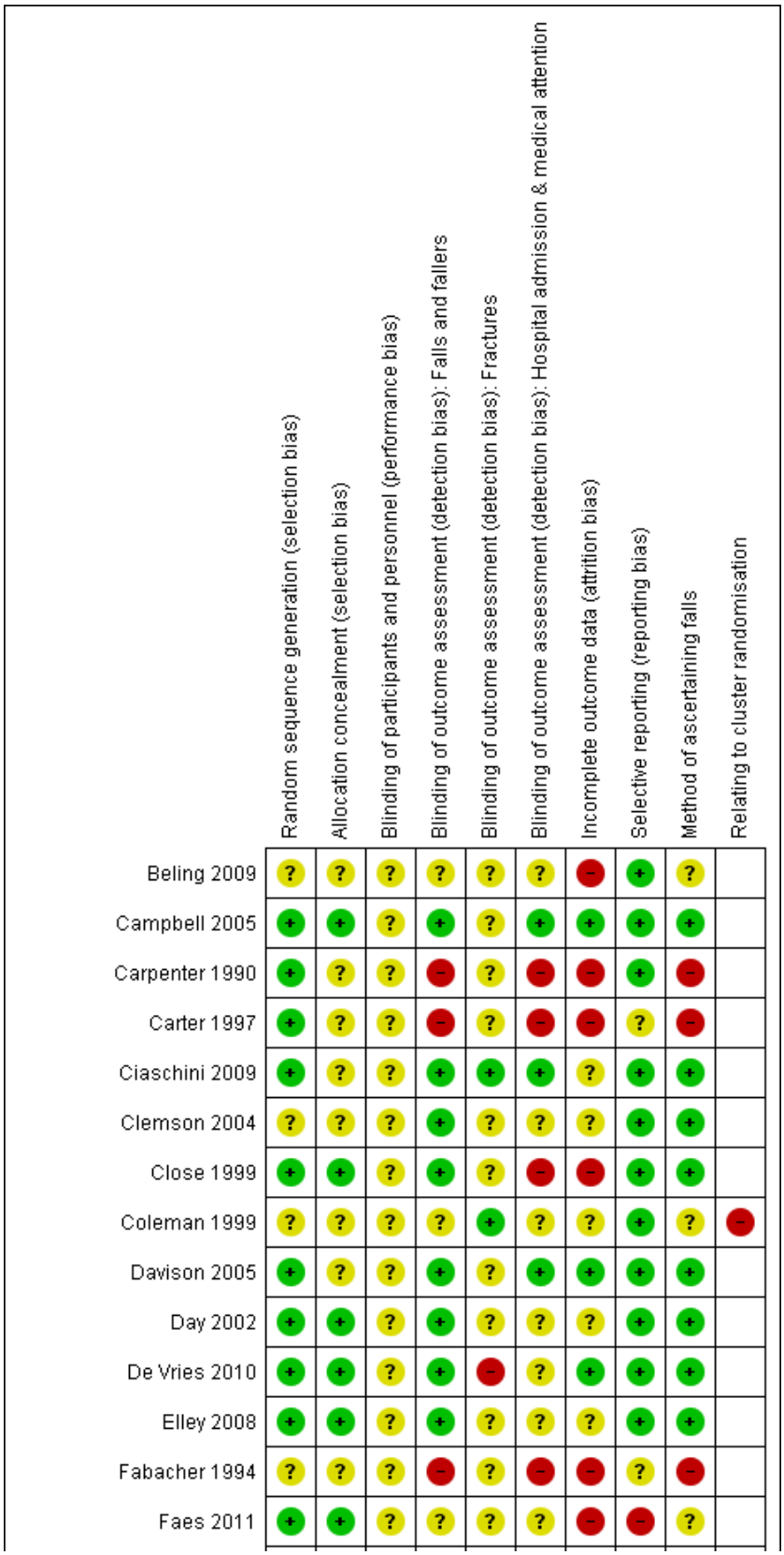


**Figure 3. (Continued)**

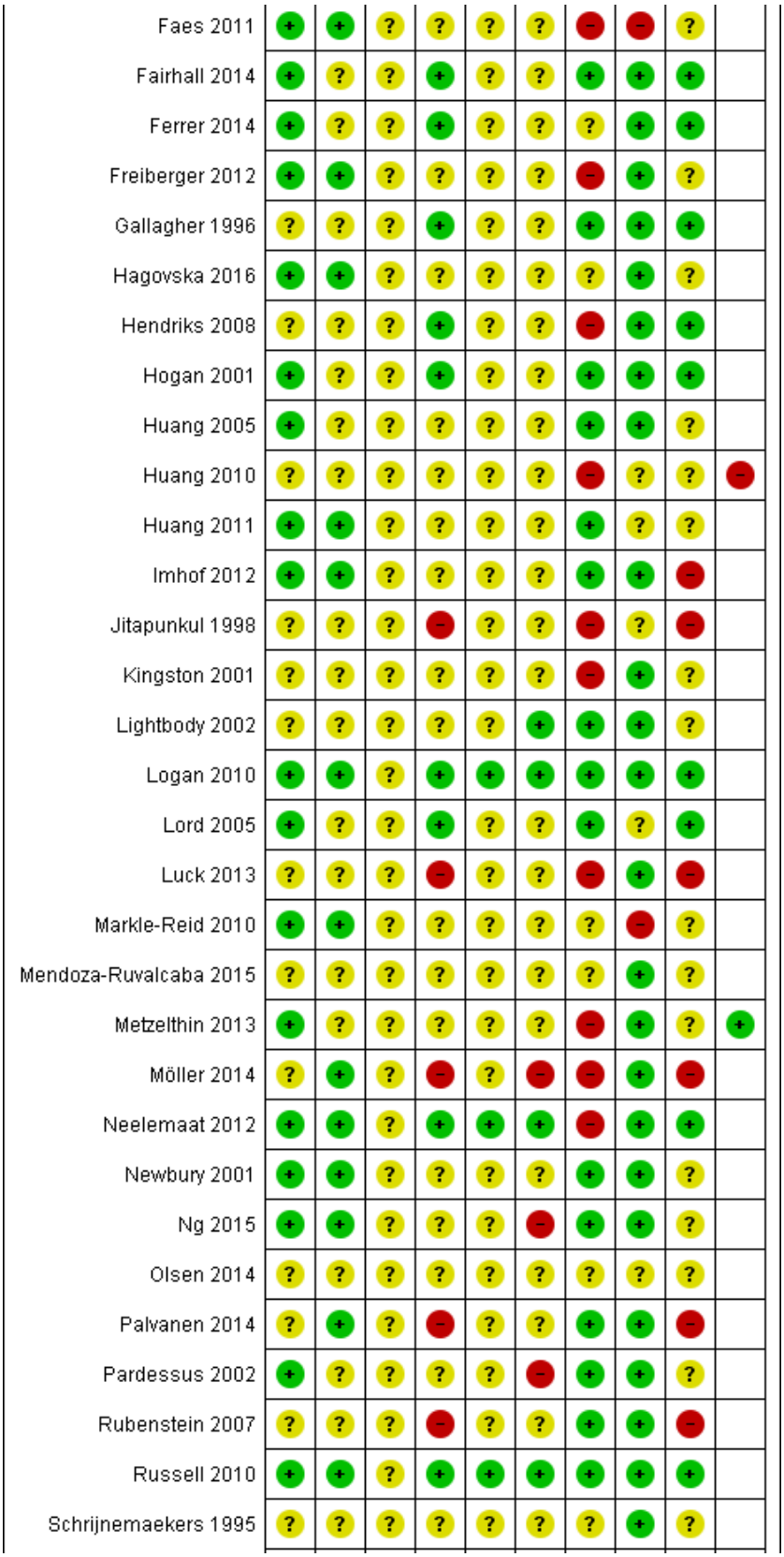
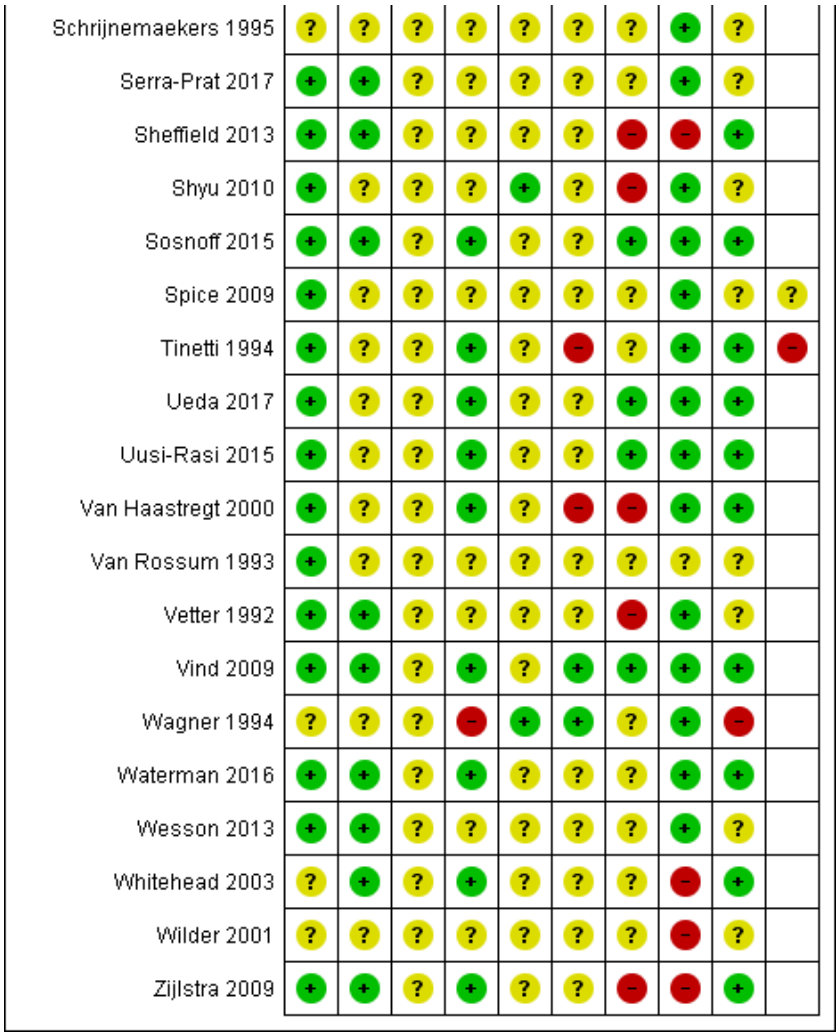


**Figure 3. (Continued)**




### Allocation

Of the 44 trials assessing multifactorial interventions, we assessed the risk of bias in the generation of allocation sequence as low in 66% (n = 29/44) and unclear in the remaining 34% (n = 15/44). We judged the methods of concealment of the allocation prior to group assignment as low risk of bias in 34% (n = 15/44) and unclear in the remaining 66% (n = 29/44).

Of the 18 trials assessing multiple component interventions, we assessed the risk of bias in the generation of allocation sequence as low in 72% (n = 13/18) and unclear in the remaining 28% (n = 5/18). We judged methods of concealment of the allocation prior to group assignment as low risk of bias in 67% (n = 12/18) and unclear in the remaining 33% (n = 6/18).

### Blinding

#### *Blinding of participants and personnel*

Due to the nature of the interventions, it was not possible to blind the participants and personnel to the allocated group. It was unclear whether awareness of the group allocation would be likely to introduce performance bias, and we therefore assessed the risk of bias for non-blinding as unclear for all trials.

#### *Blinding of outcome assessment*

We assessed the risk of bias for blinding of outcome assessment separately for rate of falls and risk of falling, risk of fractures and requiring hospital admission or medical attention.

##### Rate of falls and risk of falling

In trials of multifactorial interventions reporting on the rate or risk of falls, or both, we assessed the risk of detection bias in relation to the methods of ascertainment of the rate or risk of falls to be low in 63% (n = 20/32), unclear in 9% (n = 3/32) and high in the remaining 28% (n = 9/32); this was largely due to problematic methods of recording falls (e.g. phone call at six months or verbally at 12-month follow-up visit). In trials of multiple component interventions reporting on the rate or risk of falls, we assessed the risk of detection bias in relation to the methods of ascertainment of the rate or risk of falls to be low in 50% (n = 7/14), and unclear in the remaining 50% (n = 7/14).

##### Risk of fractures

In trials of multifactorial interventions reporting on the risk of fracture, we judged the risk of detection bias in relation to the method of ascertainment of fractures as low in 60% (n = 6/10),

unclear in 30% (n = 3/10) and high in the remaining 10% (n = 1/10), due to self-report of fractures by participants. In the two trials of multiple component interventions reporting on the risk of fracture, we judged the risk of detection bias in relation to the method of ascertainment of fractures to be low in one trial and unclear in the other.

#### Requiring hospital admission or medical attention

In trials of multifactorial interventions reporting on the risk of hospital admission or requiring medical attention, we judged the risk of detection bias in relation to the method of ascertainment of hospital admission or medical attention to be low in 32% (n = 7/22), unclear in 32% (n = 7/22) and high in the remaining 36% (n = 8/22), due to self-report by participants. In the two trials of multiple component interventions reporting on the risk of hospital admission or requiring medical attention, we judged the risk of detection bias in relation to the method of ascertainment of hospital admission or medical attention to be low in one trial and high in the other.

### Incomplete outcome data

Of the 44 trials assessing multifactorial interventions, we assessed the risk of bias due to attrition bias from incomplete outcome data to be low in 39% (n = 17/44), unclear in 25% (n = 11/44) and high in the remaining 36% (16/44), due to more than 20% of missing outcome data or with either imbalance in numbers or reasons for missing data across intervention groups. Of the 18 trials assessing multiple component interventions, we assessed risk of attrition bias to be low in 28% (n = 5/18), unclear in 50% (n = 9/18) and high in the remaining 22% (4/18).

### Selective reporting

Of the 44 trials assessing multifactorial interventions, we assessed the risk of bias due to selective reporting of outcomes as low in 80% (n = 35/44), unclear in 11% (n = 5/44) and high in the remaining 9% (n = 4/44), due to non-reporting of all prespecified outcome or incomplete reporting of study outcomes. Of the 18 trials assessing multiple component interventions, we assessed the risk of bias due to selective reporting of outcomes as low in 72% (n = 13/18), unclear in 17% (n = 3/18) and high in the remaining 11% (n = 2/18).

### Other potential sources of bias

#### *Bias in the recall of falls due to less reliable methods of ascertainment*

Of the 44 trials assessing multifactorial interventions, we assessed the risk of bias in the recall of falls (i.e. falls were recorded concurrently using methods such as postcards or monthly fall diaries) to be low risk in 45% (n = 20/44). In 23% of trials (n = 10/44) there was potential for a high risk of bias in that ascertainment of falling episodes was by participant recall, at intervals during the study or at its conclusion. In 32% of trials (n = 14/44) the risk of bias was unclear, as retrospective recall was for a short period only, or details of ascertainment were not described. Of the 18 trials assessing multiple component interventions, we assessed the risk of bias in the recall of falls to be low risk in 39% (n = 7/18) and unclear in the remaining 61% (n = 11/18).

#### *Bias specific to cluster-randomised trials*

Of the four cluster-randomised trials that assessed multifactorial interventions, we rated two (Coleman 1999; Tinetti 1994) at high risk of bias because they did not adjust for clustering in their analyses; we rated Spice 2009 at unclear risk of bias because it was unclear how participants were recruited within the clusters of GP practices; and we rated Metzelthin 2013 at low risk of bias. Notably, we assessed all four trials as low risk of bias for baseline imbalance, loss of clusters and comparability with individually-randomised trials.

We judged the sole cluster-randomised trial (Huang 2010) assessing multiple interventions to be at high risk of bias, reflecting baseline imbalance between the intervention groups and lack of adjustment for clustering. Furthermore, we rated comparability with individually-randomised trials as unclear, as there was only one trial for the comparison.

#### *Publication bias*

Where there were more than 10 studies included in the meta-analysis, we explored potential publication bias (P value less than 0.1) by generating a funnel plot, and tested this statistically using a linear regression test for the following comparisons and primary outcomes:

Multifactorial interventions versus usual care or attention control:

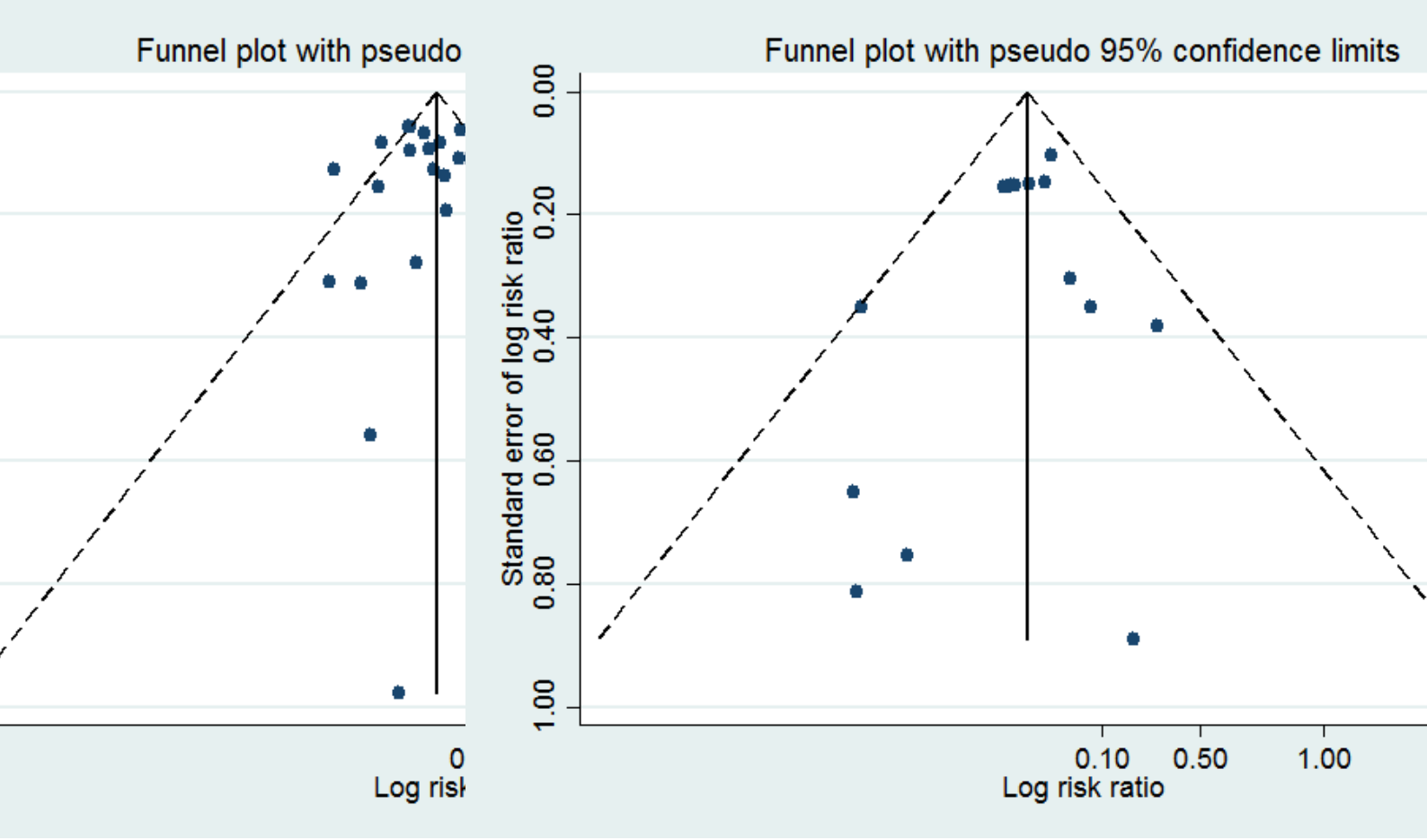
- Rate of falls: Egger's test bias co-efficient: 1.12; 95% CI -1.64 to 3.88; P = 0.405 (funnel plot not shown).

- Number of people who experienced one or more falls: Egger's test bias co-efficient: 0.58, 95% CI -0.66 to 1.82; P = 0.350 (Figure 4).

**Figure 4. Funnel plot of comparison: Multifactorial intervention vs usual care or attention control: risk of falls**

- Number of people who experienced one or more falls: Egger's test bias co-efficient: -0.42, 95% CI -1.40 to 0.56; P = 0.371 (Figure 5).

**Figure 5. Funnel plot of comparison: Multiple interventions vs usual care or attention control: rate of falls**




- Number of people who experienced recurrent falls: Egger's test bias co-efficient: -2.50, 95% CI -6.30 to 1.30; P = 0.174 (funnel plot not shown).

Multiple component interventions versus usual care or attention control:

For all analyses the P value was greater than 0.1, which indicates, although not conclusively, a lack of publication bias for these outcomes.

### Effects of interventions

See: **Summary of findings for the main comparison** Multifactorial interventions compared with usual care or attention control for preventing falls in older people living in the community; **Summary of findings 2** Multifactorial interventions compared with exercise for preventing falls in older people living in the community; **Summary of findings 3** Multiple component interventions compared with usual care or attention control for preventing falls in older people living in the community; **Summary of findings 4** Multiple component interventions compared with exercise for preventing falls in older people living in the community

The raw data available for rate of falls, number of fallers, recurrent fallers, and numbers of people sustaining fractures, being admitted to hospital or requiring medical attention are presented

respectively in Appendix 3; Appendix 4; Appendix 5; Appendix 6; Appendix 7; Appendix 8.

### Multifactorial interventions

#### *Multifactorial interventions versus usual care or attention control*

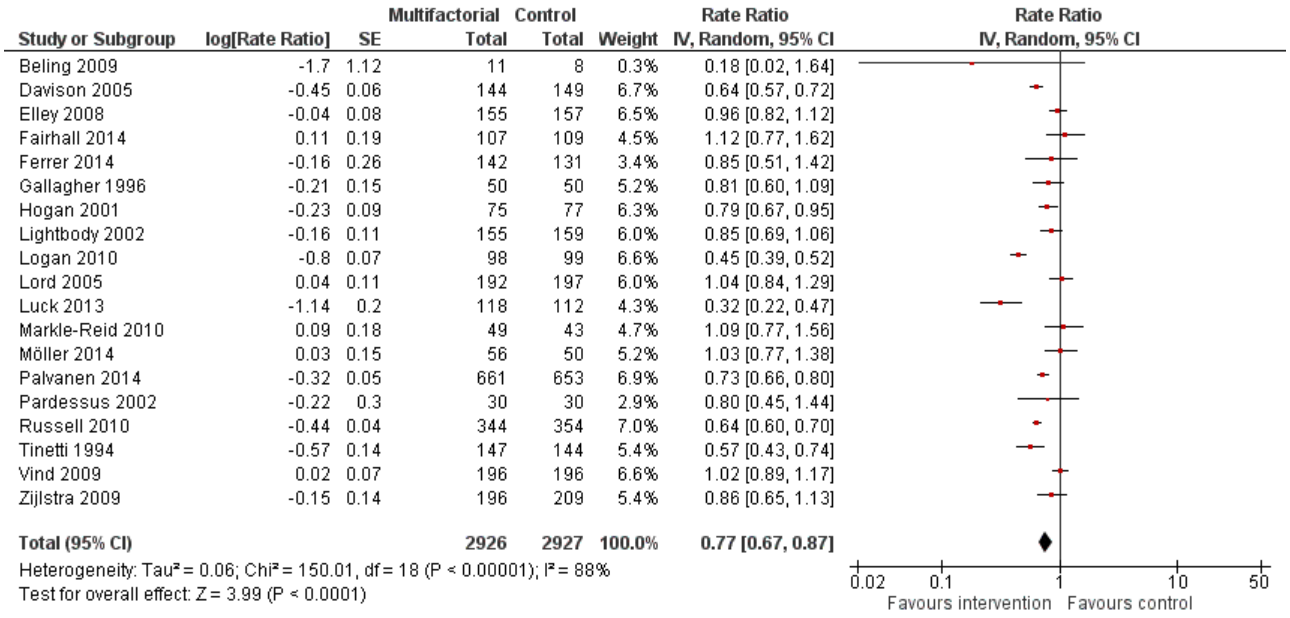
Forty-three trials compared multifactorial interventions with 'usual care' (i.e. no change in usual activities), or an attention control intervention (i.e. an intervention that is not thought to reduce falls; e.g. general health education or social visits).

#### *Primary outcomes*

##### Rate of falls

Of 22 trials that assessed the rate of falls, we could pool data from 19 trials. Multifactorial interventions may reduce the rate of falls compared with those who receive usual care or an attention control: RaR 0.77, 95% CI 0.67 to 0.87; 19 trials; 5853 participants; $I^2$ = 88%; low-quality evidence; Analysis 1.1; Figure 6). There was considerable heterogeneity that could not be explained based on our prespecified sensitivity and subgroup analyses, shown below. However, despite this high level of unexplained heterogeneity, we considered it is still appropriate to pool the data for these trials. Multifactorial interventions are a specific type of intervention, whereby their definition means that the individual components of the intervention will differ (based on an individual's risk profile), both within an individual trial and across trials. Despite the high level of heterogeneity, the direction of the treatment effect was fairly consistent across trials. As such, we believe it is clinically useful to pool the data, but have downgraded our confidence in the results to low, reflecting our uncertainty around the treatment effect.

**Figure 6. Forest plot of comparison: 1 Multifactorial intervention vs usual care or attention control, outcome: 1.1 Rate of falls (falls per person years).**




##### Subgroup analyses

- Subgroup analysis by intensity of intervention (assessed and active intervention versus assessed and referral and/or provision of information) showed no evidence of a difference in treatment effect between subgroups for rate of falls ($Chi^2$ = 0.15, df = 1, P = 0.70, $I^2$ = 0%; Analysis 5.1). Of note is the considerable statistical heterogeneity in both subgroups: active intervention (RaR 0.74, 95% CI 0.58 to 0.95; 11 trials; 2630 participants; $I^2$ = 92%); referral (RaR 0.78, 95% CI 0.69 to 0.88; 8 trials; 3223 participants; $I^2$ = 72%).
- Subgroup analysis by falls risk at baseline showed no evidence of a difference in treatment effect between subgroups for rate of falls ($Chi^2$ = 0.24, df = 1, P = 0.63, $I^2$ = 0%; Analysis 6.1). Of note is the considerable statistical heterogeneity in both subgroups: selected for higher risk of falling (RaR 0.78, 95% CI 0.68 to 0.89; 16 trials; 5112 participants; $I^2$ = 88%); not selected for higher risk of falling (RaR 0.67, 95% CI 0.36 to 1.25; 3 trials; 741 participants; $I^2$ = 92%).

*Sensitivity analyses*

There was no important change to the overall effect estimate when the analysis was restricted to trials with the following characteristics:

- Trials at low risk of selection bias (RaR 0.80, 95% CI 0.66 to 0.98; 8 trials; 3516 participants; $I^2$ = 93%; Analysis 8.1).
- Trials at low risk of detection bias (RaR 0.78, 95% CI 0.66 to 0.91; 12 trials; 3718 participants; $I^2$ = 91%; Analysis 9.1).
- Trials at low risk of attrition bias ( RaR 0.77, 95% CI 0.66 to 0.89; 11 trials; 4125 participants; $I^2$ = 90%; Analysis 10.1).
- Individually randomised trials (excluding cluster trials) (RaR 0.78, 95% CI 0.68 to 0.89; 18 trials; 5562 participants; $I^2$ = 88%; Analysis 11.1).

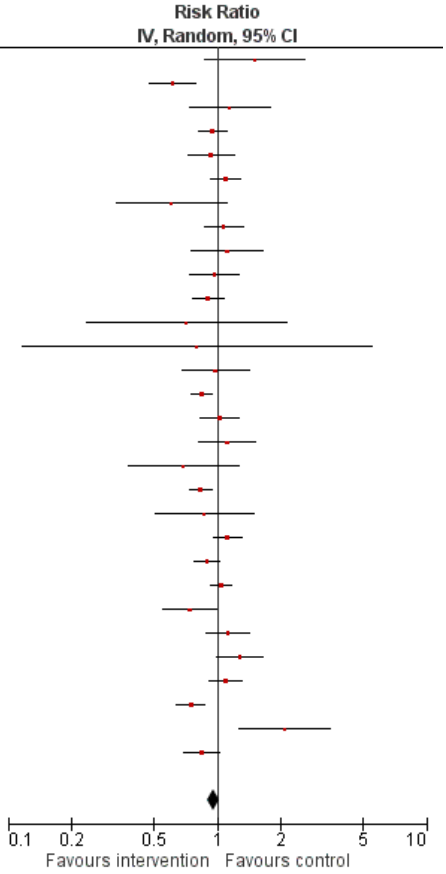
**Number of people who sustained one or more falls**

Of 34 trials that assessed the number of people sustaining one or more falls, we could pool data from 29 trials. There may be little or no difference in the risk of people sustaining one or more falls between recipients of multifactorial interventions compared with those who received usual care or an attention control (RR 0.96, 95% CI 0.90 to 1.03; 29 trials; 9637 participants; $I^2$ = 60%; low-quality evidence; Analysis 1.2; Figure 7). (Spice 2009 contributed data from two different multifactorial interventions: one in primary care and one in secondary care, and so is included in the pooled analysis twice by splitting data from the control group. We used the data from the conservative analysis presented in the main report of this trial, which assumed that all who were lost to follow-up had fallen during follow-up).

**Figure 7. Forest plot of comparison: 1 Multifactorial intervention vs usual care or attention control, outcome: 1.2 Number of people sustaining one or more falls.**

| Study or Subgroup | log[Risk Ratio] | SE | Multifactorial Total | Control Total | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ciaschini 2009 | 0.41 | 0.28 | 101 | 100 | 1.2% | 1.51 [0.87, 2.61] |
| Close 1999 | -0.49 | 0.13 | 184 | 213 | 3.5% | 0.61 [0.47, 0.79] |
| Coleman 1999 | 0.14 | 0.23 | 79 | 63 | 1.7% | 1.15 [0.73, 1.81] |
| Davison 2005 | -0.05 | 0.08 | 144 | 149 | 5.0% | 0.95 [0.81, 1.11] |
| De Vries 2010 | -0.07 | 0.13 | 106 | 111 | 3.5% | 0.93 [0.72, 1.20] |
| Elley 2008 | 0.09 | 0.08 | 155 | 157 | 5.0% | 1.09 [0.94, 1.28] |
| Fabacher 1994 | -0.5 | 0.31 | 100 | 95 | 1.1% | 0.61 [0.33, 1.11] |
| Fairhall 2014 | 0.07 | 0.11 | 119 | 119 | 4.0% | 1.07 [0.86, 1.33] |
| Ferrer 2014 | 0.11 | 0.2 | 142 | 131 | 2.1% | 1.12 [0.75, 1.65] |
| Hendriks 2008 | -0.03 | 0.14 | 124 | 134 | 3.2% | 0.97 [0.74, 1.28] |
| Hogan 2001 | -0.1 | 0.09 | 75 | 77 | 4.7% | 0.90 [0.76, 1.08] |
| Huang 2005 | -0.34 | 0.56 | 63 | 63 | 0.4% | 0.71 [0.24, 2.13] |
| Kingston 2001 | -0.22 | 0.98 | 51 | 41 | 0.1% | 0.80 [0.12, 5.48] |
| Lightbody 2002 | -0.02 | 0.19 | 155 | 159 | 2.2% | 0.98 [0.68, 1.42] |
| Logan 2010 | -0.17 | 0.06 | 102 | 102 | 5.7% | 0.84 [0.75, 0.95] |
| Lord 2005 | 0.03 | 0.11 | 202 | 201 | 4.0% | 1.03 [0.83, 1.28] |
| Möller 2014 | 0.11 | 0.16 | 80 | 73 | 2.8% | 1.12 [0.82, 1.53] |
| Newbury 2001 | -0.37 | 0.31 | 45 | 44 | 1.1% | 0.69 [0.38, 1.27] |
| Palvanen 2014 | -0.18 | 0.06 | 661 | 653 | 5.7% | 0.84 [0.74, 0.94] |
| Pardessus 2002 | -0.14 | 0.28 | 30 | 30 | 1.2% | 0.87 [0.50, 1.50] |
| Russell 2010 | 0.11 | 0.08 | 320 | 330 | 5.0% | 1.12 [0.95, 1.31] |
| Spice 2009 | -0.11 | 0.07 | 164 | 80 | 5.4% | 0.90 [0.78, 1.03] |
| Spice 2009 | 0.04 | 0.06 | 106 | 80 | 5.7% | 1.04 [0.93, 1.17] |
| Tinetti 1994 | -0.3 | 0.15 | 147 | 144 | 3.0% | 0.74 [0.55, 0.99] |
| Van Haastregt 2000 | 0.12 | 0.12 | 120 | 115 | 3.8% | 1.13 [0.89, 1.43] |
| Vetter 1992 | 0.25 | 0.13 | 240 | 210 | 3.5% | 1.28 [1.00, 1.66] |
| Vind 2009 | 0.09 | 0.09 | 196 | 196 | 4.7% | 1.09 [0.92, 1.31] |
| Wagner 1994 (1) | -0.29 | 0.08 | 635 | 607 | 5.0% | 0.75 [0.64, 0.88] |
| Whitehead 2003 | 0.74 | 0.26 | 58 | 65 | 1.4% | 2.10 [1.26, 3.49] |
| Zijlstra 2009 | -0.17 | 0.1 | 188 | 203 | 4.4% | 0.84 [0.69, 1.03] |
| **Total (95% CI)** | | | **4892** | **4745** | **100.0%** | **0.96 [0.90, 1.03]** |

Heterogeneity: Tau² = 0.02; Chi² = 72.98, df = 29 (P < 0.0001); I² = 60%
Test for overall effect: Z = 1.16 (P = 0.24)




Footnotes
(1) Multifactorial arm vs control

**Subgroup analyses**

- Subgroup analysis by intensity of intervention (assessed and active intervention versus assessed and referral and/or provision of information) showed no evidence of a difference in treatment effect between subgroups for number of fallers ($Chi^2$ = 1.10, df = 1, P = 0.29, $I^2$ = 9.5%; Analysis 5.2). Of note is that both groups continued to show similar statistical heterogeneity to the overall analysis: active intervention (RR 0.93, 95% CI 0.86 to 1.01; 13 trials; 3677 participants; $I^2$ = 54%); referral (RR 1.00, 95% CI 0.89 to 1.13; 16 trials; 5960 participants; $I^2$ = 66%).
- Subgroup analysis by falls risk at baseline (selected for higher risk of fallings; not selected) showed no evidence of a difference in treatment effect between subgroups for number of fallers ($Chi^2$ = 0.26, df = 1, P = 0.61, $I^2$ = 0%; Analysis 6.2). Once again, the results in the two groups were statistically heterogeneous: selected for high risk of falls (RR 0.97, 95% CI 0.90 to 1.04; 22 trials; 6975 participants; $I^2$ = 58%); not selected (RR 0.92, 95% CI 0.75 to 1.12; 7 trials; 2662 participants; $I^2$ = 67%).

*Sensitivity analyses*

There was no important change to the overall effect estimate when the analysis was restricted to trials with the following characteristics:

- Trials at low risk of selection bias (RR 0.98, 95% CI 0.86 to 1.10; 12 trials; 4692 participants; $I^2$ = 77%; Analysis 8.2).
- Trials at low risk of detection bias (RR 0.97, 95% CI 0.88 to 1.07; 16 trials; 4380 participants; $I^2$ = 64%; Analysis 9.2).
- Trials at low risk of attrition bias (RR 0.95, 95% CI 0.88 to 1.02; 13 trials; 4452 participants; $I^2$ = 34%; Analysis 10.2).

- Individually-randomised trials (excluding cluster trials) (RR 0.97, 95% CI 0.89 to 1.04; 26 trials; 8774 participants; $I^2$ = 62%; Analysis 11.2).

#### Number of people who sustained recurrent falls

Of 13 trials that assessed the number of people sustaining recurrent falls, we could pool data from 12. There may be a little or no difference in the risk of people sustaining recurrent falls between recipients of multifactorial interventions compared with those who received usual care or an attention control (RR 0.87, 95% CI 0.74 to 1.03; 12 trials; 3368 participants; $I^2$ = 53%; low-quality evidence; Analysis 1.3).

#### Subgroup analyses

- Subgroup analysis by intensity of intervention (assessed and active intervention tested in seven trials (2191 participants) versus assessed and referral and/or provision of information tested in five trials (1177 participants)) showed no evidence of a difference in treatment effect between subgroups for number of recurrent fallers ($Chi^2$ = 0.76, df = 1, P = 0.38, $I^2$ = 0%; Analysis 5.3).
- Subgroup analysis by falls risk at baseline (selected for higher risk of fallings tested in 10 trials (2824 participants); not selected tested in only two trials (544 participants)) did not show evidence of a difference in treatment effect between subgroups ($Chi^2$ = 2.63, df = 1, P = 0.11, $I^2$ = 62%; Analysis 6.3).

*Sensitivity analyses*

There was no important change to the overall effect estimate when the analysis was restricted to trials with the following characteristics:

- Trials at low risk of selection bias (RR 0.85, 95% CI 0.62 to 1.15; 6 trials; 1862 participants; $I^2$ = 76%; Analysis 8.3).
- Trials at low risk of detection bias (RR 0.89, 95% CI 0.73 to 1.08; 10 trials; 3033 participants; $I^2$ = 60%; Analysis 9.3).
- Trials at low risk of attrition bias (RR 0.96, 95% CI 0.81 to 1.13; 5 trials; 1402 participants; $I^2$ = 0%; Analysis 10.3).
- Individually-randomised trials (excluding cluster trials) (no change: RR 0.87, 95% CI 0.74 to 1.03; 12 trials; 3368 participants; $I^2$ = 53%; Analysis 11.3).

### *Secondary outcomes*

#### Number of people who sustained one or more fall-related fractures

We could pool data from all nine trials that assessed the number of people sustaining one or more fall-related fractures. The pooled results showed that multifactorial interventions, compared with usual care or attention control, may reduce but also may make no difference to the risk of people sustaining one or more fall-related fractures (RR 0.73, 95% CI 0.53 to 1.01; 9 trials; 2850 participants; $I^2$ = 0%; low-quality evidence; Analysis 1.4). (Spice 2009 contributed data from two different multifactorial interventions: one in primary care and one in secondary care, and so is included in the pooled analysis twice by splitting data from the control group. The observed fracture data in Spice 2009 are used for this outcome).

*Sensitivity analyses*

The overall effect estimate became more conservative, indicating little or no difference between the two groups, when we restricted the analysis to: trials at low risk of selection bias (RR 0.78, 95% CI 0.49 to 1.23; 4 trials; 1521 participants; $I^2$ = 0%); trials at low risk of attrition bias (RR 0.72, 95% CI 0.48 to 1.08; 6 trials; 1774 participants; $I^2$ = 0%); or individually-randomised trials (excluding cluster trials) (RR 0.75, 95% CI 0.53 to 1.06; 8 trials; 2425 participants; $I^2$ = 0%). When we restricted the analysis to the three trials at low risk of detection bias for fractures, the results became strongly in favour of a multifactorial intervention reducing the risk of fall-related fractures (RR 0.47, 95% CI 0.24 to 0.93; 3 trials; 1055 participants; $I^2$ = 0%). The results of all sensitivity analyses for this comparison are presented in Table 9.

#### Number of people who experienced a fall that required hospital admission

We could pool data from 15 of the 16 trials that assessed the number of people who experienced a fall that required hospital admission. There may be little or no difference in the risk of people who experienced a fall that required hospital admission between recipients of multifactorial interventions compared with those who received usual care or an attention control (RR 1.00, 95% CI 0.92 to 1.07; 15 trials; 5227 participants; $I^2$ = 0%; low-quality evidence; Analysis 1.5). (Spice 2009 contributed data from two different multifactorial interventions: one in primary care and one in secondary care, and so is included in the pooled analysis twice by splitting data from the control group). We downgraded the evidence one level for serious risk of bias and one level for indirectness, given that poor reporting meant that it was not always possible to specifically determine that the cause of hospital admission was always due to fall.

*Sensitivity analyses*

There was no important change to the overall effect estimate when the analysis was restricted to: trials at low risk of selection bias (RR 0.98, 95% CI 0.76 to 1.26; 1 trial; 204 participants); trials at low risk of detection bias (RR 0.94, 95% CI 0.74 to 1.18; 4 trials; 1960 participants; $I^2$ = 0%); trials at low risk of attrition bias (RR 1.03, 95% CI 0.92 to 1.14; 7 trials; 2099 participants; $I^2$ = 7%); or individually-randomised trials (excluding cluster trials) (RR 0.99, 95% CI 0.92 to 1.08; 12 trials; 4433 participants; $I^2$ = 0%) (Table 9).

#### Number of people who experienced a fall that required medical attention

We could pool data from eight of the 11 trials that assessed the number of people who experienced a fall that required medical attention. There may be little or no difference in the risk of people who experienced a fall that required medical attention between recipients of multifactorial interventions compared with those who received usual care or an attention control (RR 0.91, 95% CI 0.75 to 1.10; 8 trials; 3078 participants; $I^2$ = 0%; low-quality evidence; Analysis 1.6).

*Sensitivity analyses*

There was no important change to the overall effect estimate when we restricted the analysis to: trials at low risk of selection bias (RR 1.08, 95% CI 0.74 to 1.58; 2 trials; 545 participants; $I^2$ = 1.0%); trials at low risk of detection bias (RR 0.83, 95% CI 0.65 to 1.07; 3 trials; 1947 participants; $I^2$ = 0%); trials at low risk of attrition bias (RR 0.96, 95% CI 0.71 to 1.31; 3 trials; 868 participants; $I^2$ = 0%); or individually-

randomised trials (excluding cluster trials) (RR 0.93, 95% CI 0.75 to 1.15; 7 trials; 2831 participants; $I^2$ = 6%) (Table 9).

#### Health-related quality of life

We could pool data from 11 of the 19 trials that assessed health-related quality of life. Based on pooled SMD results from the nine trials that reported final scores, multifactorial interventions may slightly improve people's reported health-related quality of life compared with those who received usual care or an attention control (SMD 0.19, 95% CI 0.03 to 0.35; 9 trials; 2373 participants; $I^2$ = 70%; low-quality evidence; Analysis 1.7). However, converting these data to the SF-36 scale (0 worst to 100 best) indicates that this difference may not correspond to a clinically-important difference (e.g. minimal important difference (MID) is typically 3 to 5; Walters 2003). Hence, multifactorial interventions may make little or no difference to health-related quality of life (SF-36: MD 2.47, 95% CI 0.39 to 4.55). One trial (De Vries 2010) found no important between-group difference in EQ-5D change scores (0 to 1 scale; higher scores are better) (MD −0.06, 95% CI −0.10 to −0.02; 1 trial; 212 participants; low-quality evidence). In addition, several trials reported data separately for the different components of health-related quality of life and showed little or no difference in people's mental health-related quality of life (SMD 0.27, 95% CI −0.03 to 0.56; 3 trials; 376 participants; $I^2$ = 50%; Analysis 1.8), or physical health-related quality of life (SMD 0.39, 95% CI 0.00 to 0.79; 3 trials; 376 participants; $I^2$ = 72%; Analysis 1.9), based on data for three trials reporting endpoint scores. There was also no difference in SF-36 physical health-related quality of life (0 to 100; best score) in the one trial (Clemson 2004) reporting change scores (MD 0.74, 95% CI −1.61 to 3.09). Appendix 9 provides summary information for all 19 trials including those which we could not include in the meta-analysis (e.g. because they reported median, IQR or P value), the results of which are similar to the above.

*Sensitivity analyses*

Based on data from trials reporting end point scores, there was no important change to the overall effect estimate when we restricted the analysis to: trials at low risk of selection bias (SMD 0.32, 95% CI 0.08 to 0.55; 2 trials; 554 participants; $I^2$ = 43%); trials at low risk of attrition bias (SMD 0.20, 95% CI 0.00 to 0.41; 6 trials; 1602 participants; $I^2$ = 72%) (Table 9). All trials were individually randomised and at high risk for detection bias.

### Adverse effects of the intervention

Only three trials reported on adverse events that may have been related to the intervention (Fairhall 2014; Tinetti 1994; Zijlstra 2009). Fairhall 2014 reported back pain in two participants (2% of 107), which resolved after modification of the exercise programme, and Tinetti 1994 reported musculoskeletal symptoms in 10 participants (7% of 147), which were "self-limited" and again probably related to the exercise programme. Zijlstra 2009 reported there had been no adverse events.

#### *Multifactorial interventions versus exercise*

One trial (Ueda 2017) compared a multifactorial intervention (tailored education programme using home floor plans in Japan) with exercise as a single active falls prevention intervention.

##### *Primary outcomes*

###### Rate of falls

Ueda 2017 provided very low-quality evidence of little or no difference in the rate of falls between multifactorial intervention and exercise (RR 0.13, 95% CI 0.01 to 2.46; 1 trial; 51 participants) Analysis 2.1.

### Number of people who sustained one or more falls

Ueda 2017 provided very low-quality evidence of little or no difference in the risk of falling between multifactorial intervention and exercise (RR 0.26, 95% CI 0.01 to 5.52; 1 trial; 51 participants) Analysis 2.2.

### Number of people who sustained recurrent falls

Ueda 2017 did not report on the risk of recurrent falls.

##### *Secondary outcomes*

Ueda 2017 did not report on any of the secondary outcomes: number of people who have sustained one or more fall-related fractures; number of people who experienced a fall that required hospital admission; number of people who experienced a fall that required medical attention; health-related quality of life; or adverse events.

### Multiple component interventions

#### *Multiple component interventions versus usual care or attention control*

Seventeen trials compared multiple component interventions with 'usual care' (i.e. no change in usual activities), or an attention control intervention (i.e. an intervention that is not thought to reduce falls, e.g. general health education or social visits). Exercise was one of the component interventions in 16 of the 17 trials.

##### *Primary outcomes*

###### Rate of falls

We could pool data from six of the eight trials that assessed the rate of falls. Multiple component interventions probably reduce the rate of falls compared with those who receive usual care or an attention control (RaR 0.74, 95% CI 0.60 to 0.91; 6 trials; 1085 participants; $I^2$ = 45%; moderate-quality evidence; Analysis 3.1). (Campbell 2005 contributed data from two different multiple component interventions and so is included in the pooled analysis twice, by splitting data from the control group). The overall effect remained the same when excluding Neelemaat 2012, the one trials that did not include exercise as a component of the intervention (RaR 0.79, 95% CI 0.67 to 0.92; 6 trials; 934 participants; $I^2$ = 5%); however, the amount of heterogeneity between trials was reduced.

*Subgroup analysis*

When we subgrouped trials by falls risk at baseline, the statistically-significant test for subgroup differences ($Chi^2$ = 6.56, df = 1, P = 0.01, $I^2$ = 84.8%; Analysis 7.1) indicated a larger protective effect of multiple component interventions where participants were not selected for higher risk of falls (RaR 0.39, 95% CI 0.23 to 0.66; 2 trials; 267 participants; $I^2$ = 0%) compared with when they were (RaR 0.79, 95% CI 0.68 to 0.93; 4 trials; 818 participants; $I^2$ = 7%). However, it

is important to note that there were only two trials in the smaller subgroup.

*Sensitivity analyses*

There was no important change to the overall effect estimate when we restricted the analysis to trials with the following characteristics:

- Trials at low risk of selection bias (RaR 0.68, 95% CI 0.51 to 0.92; 4 trials; 584 participants; $I^2$ = 47%; Analysis 12.1).
- Trials at low risk of detection bias (RaR 0.75, 95% CI 0.60 to 0.93; 5 trials; 969 participants; $I^2$ = 50%; Analysis 13.1).
- Trials at low risk of attrition bias (RaR 0.79, 95% CI 0.66 to 0.96; 3 trials; 596 participants; $I^2$ = 10%; Analysis 14.1).
- Individually-randomised trials (excluding cluster trials) (no change: RaR 0.74, 95% CI 0.60 to 0.91; 6 trials; 1085 participants; $I^2$ = 45%; Analysis 15.1).

#### Number of people who sustained one or more falls

We could pool data from 11 of the 14 trials that assessed the number of people sustaining one or more falls. Multiple component interventions probably reduce the risk of sustaining one or more falls compared to those who receive usual care or an attention control (RR 0.82, 95% CI 0.74 to 0.90; 11 trials; 1980 participants; $I^2$ = 0%; moderate-quality evidence; Analysis 3.2). (Campbell 2005 and Day 2002 contributed data from different multiple component interventions and so are included in the pooled analysis more than once, by splitting data from the control group). The overall effect remained the same when we excluded data from the two trials (Day 2002; Neelemaat 2012) which did not include exercise as a component of the intervention (RR 0.82, 95% CI 0.74 to 0.91; 9 trials; 1599 participants; $I^2$ = 0%).

#### Subgroup analysis

Subgroup analysis by falls risk at baseline (selected for higher risk of falls tested in 7 trials (872 participants); not selected tested in 4 trials (1108 participants)) showed no evidence of a difference in treatment effect between subgroups for rate of falls ($Chi^2$ = 1.14, df = 1, P = 0.29, $I^2$ = 12.5%; Analysis 7.2).

#### Sensitivity analyses

There was no important change to the overall effect estimate when we restricted the analysis to trials with the following characteristics:

- Trials at low risk of selection bias (RR 0.78, 95% CI 0.70 to 0.88; 8 trials; 1478 participants; $I^2$ = 0%; Analysis 12.2).
- Trials at low risk of detection bias (RR 0.81, 95% CI 0.73 to 0.89; 5 trials; 1518 participants; $I^2$ = 0%; Analysis 13.2).
- Trials at low risk of attrition bias (RR 0.75, 95% CI 0.62 to 0.92; 3 trials; 506 participants; $I^2$ = 0%; Analysis 14.2).
- Individually-randomised trials (excluding cluster trials) (RR 0.81, 95% CI 0.74 to 0.90; 10 trials; 1877 participants; $I^2$ = 0%; Analysis 15.2).

#### Number of people who sustained recurrent falls

We could pool data from all four trials that assessed the number of people sustaining recurrent falls. Multiple component interventions may reduce but may also slightly increase the risk of people sustaining recurrent falls compared with those who received usual care or an attention control (RR 0.81, 95% CI 0.63 to 1.05; 4 trials; 662 participants; $I^2$ = 0%; low-quality evidence; Analysis 3.3). (Campbell 2005 contributed data from two different multiple component interventions and so is included in the pooled analysis twice, by splitting data from the control group). Subgroup analysis by baseline risk of falls was not possible because all four trials included participants selected at higher risk of falls (Analysis 7.3).

#### Sensitivity analyses

There was no important change to the overall effect estimate when we restricted the analysis to trials with the following characteristics:

- Trials at low risk of selection bias (RR 0.90, 95% CI 0.62 to 1.30; 3 trials; 352 participants; $I^2$ = 1%; Analysis 12.3).
- Trials at low risk of detection bias (RR 0.79, 95% CI 0.61 to 1.02; 3 trials; 629 participants; $I^2$ = 0%; Analysis 13.3).
- Trials at low risk of attrition bias (RR 0.84, 95% CI 0.57 to 1.23; 1 trial; 291 participants; Analysis 14.3).
- Individually-randomised trials (excluding cluster trials) (No change: RR 0.81, 95% CI 0.63 to 1.05; 4 trials; 662 participants; $I^2$ = 0%; Analysis 15.3).

### *Secondary outcomes*

#### Number of people who sustained one or more fall-related fractures

We could pool data from both trials that assessed the number of people sustaining one or more fall-related fractures. Given the very few fracture events (one in each trial), we are uncertain of the effects of multiple component interventions on the risk of people sustaining one or more fall-related fractures compared with those who received usual care or an attention control (RR 0.50, 95% CI 0.05 to 5.32; 2 trials; 232 participants; $I^2$ = 0%; very low-quality evidence; Analysis 3.4).

#### Sensitivity analyses

There was no important change to the overall effect estimate when we restricted the analysis to:

- Trials at low risk of selection bias (RR 0.50, 95% CI 0.05 to 5.32; 2 trials; 232 participants; $I^2$ = 0%).
- Trials at low risk of detection bias (RR 0.50, 95% CI 0.02 to 1.73; 1 trial; 210 participants).
- Individually-randomised trials (excluding cluster trials) (RR 0.50, 95% CI 0.05 to 5.32; 2 trials; 232 participants; $I^2$ = 0%).

Both trials were at unclear or high risk of attrition bias. The results of all sensitivity analyses are presented in Table 10.

#### Number of people who experienced a fall that required hospital admission

Only Ng 2015 assessed the number of people who required a hospital admission, some of which may have been fall-related. Given the few events, we are uncertain of the effects of multiple component interventions on the risk of experiencing a fall that required hospital admission (RR 3.06, 95% CI 0.65 to 14.42; 1 trial; 99 participants; very low-quality evidence; Analysis 3.5). Ng 2015 included participants selected for higher risk of falls.

#### Number of people who experienced a fall that required medical attention

One trial assessed the number of people who experienced a fall that required medical attention (Campbell 2005); this trial contributed data from two different multiple interventions and so is included in the pooled analysis twice, by splitting data from the control group. Multiple component interventions may have little or no difference in the risk of people who experienced a fall that required medical attention compared to those who received usual care or an attention control (RR 0.95, 95% CI 0.67 to 1.35; 1 trial; 291 participants; low-quality evidence; Analysis 3.6). Campbell 2005 included participants selected for higher risk of falls.

#### Health-related quality of life

We could pool data for six of the seven trials that assessed health-related quality of life. Multiple component interventions may slightly improve people's reported health-related quality of life compared with those who received usual care or an attention control (SMD 0.77, 95% CI 0.16 to 1.39; 4 trials reporting final scores; 391 participants; $I^2$ = 88%; low-quality evidence; Analysis 3.7). When converted to the SF-36 scale (0 worst to 100 best), the result indicates that this may include a clinically-important difference (MD 9.12, 95% CI 1.89 to 16.46). One small trial reported change scores using EQ-5D VAS 0 - 100 in favour (MD −19.73, 95% CI −30.94 to −8.52; 1 trial; 33 participants; very low-quality evidence). Several trials reported separate final-score data for different components of health-related quality of life scores. These showed that multiple component interventions may slightly improve people's mental health-related quality of life (SMD 0.69, 95% CI 0.26 to 1.11; 2 trials; 92 participants; $I^2$ = 0%; Analysis 3.8), but not physical health-related quality of life (SMD 0.12, 95% CI −0.53 to 0.77; 2 trials; 92 participants; $I^2$ = 54%; Analysis 3.9). There was no difference in mental (MD −0.53, 95% CI −2.93 to 1.87; 1 trial; 258 participants) or physical health-related quality of life (MD 0.70, 95% CI −1.43 to 2.83; 1 trial; 258 participants) in the one trial reporting change scores. Appendix 10 provides summary information for all seven trials.

#### Sensitivity analyses

There was no important change to the overall effect estimate when we restricted the analysis to:

- Trials at low risk of selection bias (SMD 0.84, 95% CI 0.02 to 1.67; 3 trials; 327 participants; $I^2$ = 92%).
- One trial at low risk of attrition bias (SMD 1.15, 95% CI 0.75 to 1.54; 1 trial; 116 participants).
- Individually-randomised trials (excluding cluster trials) (SMD 0.77, 95% CI 0.16 to 1.39; 4 trials; 391 participants; $I^2$ = 88%) (Table 10).
- All trials were at high risk for detection bias.

### Adverse effects of the intervention

Seven trials reported on adverse events that may have been related to the intervention. One trial (Ng 2015) reported resolvable joint pain in two participants undergoing exercise (2% of 97; it is unclear whether this included the multiple component group) and one trial (Wesson 2013) reported minor complaints in four participants (36% of 11) relating to stiffness, dizziness and mild joint pain. Five trials reported no adverse events (Campbell 2005; Freiberger 2012; Olsen 2014; Serra-Prat 2017; Waterman 2016).

### *Multiple component interventions versus exercise*

Five trials compared multiple component interventions (Day 2002; Huang 2010; Ng 2015; Sosnoff 2015; Uusi-Rasi 2015) with exercise as a single active falls-prevention intervention.

#### *Primary outcomes*

#### Rate of falls

Of the two trials assessing the rate of falls, we could analyse data for one trial (Uusi-Rasi 2015), which found there was little or no difference in the rate of falls between a multiple component intervention versus exercise (RaR 0.92, 95% CI 0.77 to 1.10; 1 trial; 191 participants; low quality evidence; Analysis 4.1).

#### Number of people who sustained one or more falls

We could pool data from three of the four trials that assessed the number of people sustaining one or more falls. There may be little or no difference in the risk of sustaining one or more falls between multiple component interventions versus exercise (RR 0.93, 95% CI 0.78 to 1.10; 3 trials; 863 participants; low-quality evidence; Analysis 4.2). (Day 2002 contributed data from four different multiple component interventions and so is included in the pooled analysis four times, by splitting data from the exercise group).

#### Number of people who sustained recurrent falls

No trials comparing multiple component interventions versus exercise reported on the risk of recurrent falls.

#### *Secondary outcomes*

No trials comparing multiple component interventions versus exercise reported on the number of people who sustained one or more fall-related fractures; the number of people who experienced a fall that required medical attention; or health-related quality of life.

#### Number of people who experienced a fall that required hospital admission

Only Ng 2015 assessed the number of people who required a hospital admission, some of which may have been fall-related. This found very low-quality evidence, which means we are uncertain of whether there is any difference in the risk for people who experienced a fall that required hospital admission between a multiple component intervention versus exercise (RR 1.95, 95% CI 0.52 to 7.41; 1 trial; 97 participants; Analysis 4.3).

#### Adverse events

Two trials reported on adverse events that may be related to the intervention: Ng 2015 reported joint pain in two participants (2% of 97) and Uusi-Rasi 2015 reported no adverse events.

## DISCUSSION

### Summary of main results

#### Multifactorial interventions

Forty-four trials assessed the effects of multifactorial interventions (where the different components of the intervention are linked to each individual's risk profile) for preventing falls in older people living in the community. Of these, 43 trials compared a

multifactorial intervention with usual care or attention control, and one compared a multifactorial intervention with exercise as a single intervention. The trials included a range of multifactorial interventions, most involving assessment by registered medical or health professionals, but not all trials used this method. Commonly-used component interventions included exercise, applied in 37 trials; environment/assistive technologies, applied in 34 trials; medication review, applied in 28 trials; and psychological interventions, applied in 19 trials. In 21 trials, the intervention was designed to actively provide treatment to address identified risk factors as opposed to where the intervention consisted mainly of referral to other services or the provision of information on falls prevention.

#### *Multifactorial interventions versus usual care or attention control*

We summarise the evidence for this comparison, tested by 43 trials, in Summary of findings for the main comparison. Results show that multifactorial interventions may reduce the rate of falls compared with those who receive usual care or an attention control (Analysis 1.1). There was considerable heterogeneity that could not be explained based on our prespecified sensitivity and subgroup analyses, but we nonetheless pooled data because the nature of a multifactorial intervention means that, even within a single trial, different participants will receive different combinations of treatment based on their risk profile and so we would expect a certain amount of heterogeneity. There may be little or no difference between recipients of multifactorial interventions compared with those who received usual care or an attention control and the risk of people sustaining one or more falls; sustaining recurrent falls; experiencing a fall that required hospital admission or experiencing a fall that required medical attention. There is low-quality evidence that multifactorial interventions may reduce the risk of sustaining one or more fall-related fractures, although it also supports a conclusion of little or no difference in effect. Multifactorial interventions may slightly improve a person's health-related quality of life, but the effect size may be too small to be noticeable. Of the three trials reporting on adverse events potentially relating to the interventions, one trial reported back pain in two participants, one reported musculoskeletal symptoms in 10 participants, and the third trial stated that no adverse events had been reported. All 12 adverse events were self-limiting.

#### *Multifactorial interventions versus exercise*

The evidence for this comparison, which is summarised in Summary of findings 2, was from one small trial that tested a multifactorial intervention, centred on Japanese home floor plans, in recently-discharged orthopaedic patients. Very low-quality evidence means that we are uncertain of the effects on the rate of falls or the risk of people sustaining falls of multifactorial interventions versus exercise as a single intervention. Other outcomes were not reported.

### Multiple component interventions

Eighteen trials assessed the effects of multiple component interventions (where two or more main categories of intervention are given to all participants) for preventing falls in older people living in the community. Seventeen were compared with usual care or attention control, and five were compared with exercise as a single intervention. Exercise was an almost universal component of multiple interventions in 17 of the 18 trials and statistical heterogeneity was generally low. Given these, we made the post hoc decision to present the results for the pooled analyses in addition to subgrouping trials by the different combination of interventions. This enabled us to examine the effect of using different combinations of treatment compared with usual care or exercise alone. Popular combinations of interventions were exercise with home safety (5 of 18) and exercise with education (4 of 18). Eleven of the 18 trials included participants at higher risk of falls at baseline.

#### *Multiple component interventions versus usual care or attention control*

We summarise the evidence for this comparison in Summary of findings 3. There is moderate-quality evidence that multiple component interventions probably reduce the rate of falls and the risk of sustaining one or more falls compared with usual care or an attention control. There is low-quality evidence that multiple component interventions may reduce the risk of people sustaining recurrent falls, but the 95% confidence interval also included the possibility of no difference or a slight increase in this risk. Very low-quality evidence means that we are uncertain of the effects of multiple component interventions compared with usual care or an attention control on the risk of fall-related fractures or of experiencing a fall that required hospital admission. There was low-quality evidence that there may be little or no difference between multiple component interventions and usual care or an attention control and the risk of people experiencing a fall that required medical attention. There is some low-quality evidence that multiple component interventions may slightly improve a person's health-related quality of life, but the limited available evidence for this outcome was also heterogeneous. Seven trials reported on adverse events. Of the seven trials reporting on adverse events potentially relating to the interventions, one trial reported resolvable joint pain in two participants and one trial reported four participants with minor complaints relating to stiffness, dizziness and mild joint pain; the remaining five trials reported no adverse events.

#### *Multiple component interventions versus exercise*

We summarise the evidence for this comparison, tested in five trials, in Summary of findings 4. Compared with exercise as a single intervention, multiple component interventions may have little or no difference in the rate of falls (one trial) or on the risk of sustaining one or more falls (three trials). We are uncertain whether there is a difference between the two interventions for the risk of experiencing a fall that required hospital admission (one trial). None of the five trials reported on the risk of recurrent falls, fall-related fractures, falls requiring medical attention, or health-related quality of life. Two trials reported on adverse events. One trial reported joint pain (in two participants) as an adverse event which may have been related to the intervention; the remaining trial stated that no adverse events were reported.

## Overall completeness and applicability of evidence

This review provides the most up-to-date evidence for the effects of multifactorial and multiple component intervention for the prevention of falls in older people living in the community, compared with either usual care (or attention control) or exercise as a single intervention.

### Participants

We included 44 trials assessing the effects of multifactorial interventions with a total of 15,733 participants. Most trials were moderately small (median = 303 participants; IQR 156 to 489), with a mean age of participants ranging from 72 to a maximum of 85 years. Trials were performed over 20 years from 1992 to 2014. Only one of the 44 trials included participants from a low- or middle-income country (Thailand), suggesting the findings of this review may not be applicable to those settings. In addition, most trials made a purposeful attempt to select samples who were at higher risk of falls, with 31 of the 44 trials including participants at higher risk of falls at baseline. The age range of participants and the rate of falls in the control arm also indicate that trials of multifactorial interventions may have selected populations who were experiencing more falls.

The total number of participants included in the 18 trials of multiple component interventions was smaller (total = 4202), as was the size of the individual trials (median = 179; IQR 72 to 310). The mean age range of participants included in the trials was 62 to 84 years, suggesting that, for a few trials at least, the average age of participants included in the multiple component intervention trials was slightly less than for trials of multifactorial interventions. Trials were also performed more recently, from 2001 to 2017. Again, only one of the 18 trials included participants from a low- or middle-income country (Mexico), suggesting the findings of this review may not be applicable to those settings.

Most trials specifically excluded older people who were cognitively impaired, indicating that the results of this review may not be applicable to this important group of people at risk of falls. We excluded trials recruiting people with Parkinson's disease and post-stroke, as we consider the results of interventions for those neurological conditions are not necessarily applicable to older people as a whole; these topic areas are covered by other Cochrane Reviews (Canning 2015; Verheyden 2013).

### Interventions

Evidence is limited for the effects of multifactorial interventions compared with those who receive usual care or an attention control, showing that they may reduce the rate of falls but may have little or no effect on other fall-related outcomes. This is despite multifactorial interventions being the recommended approach for falls prevention in the UK (NICE 2013), and recommended as a primary treatment strategy in guidelines for prevention of falls published by the American Geriatrics Society, British Geriatrics Society and Australian Commission on Safety and Quality in Healthcare (ACSQH 2009; American Geriatrics Society 2011).

Evidence for the effects of multiple component interventions compared with those who receive usual care or an attention control show that they probably reduce the rate of falls and the risk of sustaining one or more falls. The multiple component interventions included in this review were heterogeneous. Often, only a single trial examined the effectiveness of each combination of components; however, exercise was a key component in all but one of the 18 multiple component interventions. In this review, we did not investigate which combinations of multiple component interventions were most effective, but we conclude that providing two or more interventions may be more effective in comparison with usual care in reducing the rate and risk of falls, and noting that most combinations included an exercise programme.

The included trials were conducted in over 20 countries, using a variety of different healthcare models. The extent to which the effectiveness of some interventions may be sensitive to differences between healthcare systems and structures at a local and national level is unclear. For example, Hendriks 2008 reported the results of a study which aimed to reproduce in The Netherlands the successful multifactorial intervention reported by Close 1999 from the UK. Major differences in the health systems in The Netherlands may be one reason why Hendriks 2008 found no difference in the number of people sustaining one or more falls, whereas the study by Close 1999 did.

We decide a priori to only include trials where the intervention was compared with usual care (i.e. no change in usual activities), an attention control (i.e. an intervention that is not thought to reduce falls such as general health information or social visits) or exercise as a single intervention. When defining usual care (i.e. no change in usual activities) we used the definition of usual care as defined by the trial as meaning no active treatment (i.e. no intervention). Several large trials excluded from this review included a falls prevention leaflet as the comparator intervention (Bruce 2016; Conroy 2010; Perula 2012; Salminen 2009; Shumway-Cook 2007). The inclusion of trials with a structured advice leaflet for the prevention of falls as the comparator intervention could potentially reduce the effectiveness of a multifactorial and multiple component intervention, although this would need to be proved empirically and warrants further investigation.

### Outcomes

We sought data on the rate of falls, the number of people sustaining one or more falls, recurrent falls, fall-related fractures, hospital admission following a fall, medical attention, health-related quality of life and adverse events. Data for adverse events were sparse and are discussed separately. For multifactorial interventions compared with control, there was low quality of evidence for both primary and secondary outcomes (between 8 and 29 trials per outcome). However, the evidence was more limited for multiple component interventions versus control; for example, just two trials provided data on fall-related fractures, and single trials provided data on medical attention and hospital admission. The evidence was also limited for the effects of multifactorial (one trial) or multiple component interventions (five trials) compared with exercise as a single intervention.

Prospective daily calendars returned monthly for at least one year from randomisation were the preferred method for recording falls (Lamb 2005). However, we also included studies where falls were recorded retrospectively, or not monitored continuously throughout the trial, as this is still common practice and increases the applicability of our findings and avoids potential bias, as it would have resulted in the exclusion of a number of trials.

There was limited evidence available on adverse events occurring as a result of the interventions tested in this review; while some trials did report on whether adverse events occurred, it was not always clear whether this was specifically due to the intervention. Trials which did report information on adverse events were more likely to have been published more recently. Inspection of the reasons for loss to follow-up did not reveal withdrawal explicitly due to adverse events; however, reasons for loss to follow-up were not reported consistently across studies. While we did not specifically assess this in our review, it is noteworthy that none of

the trials assessed mortality due to falls as an outcome measure. Over half of the trials reported death as a reason for loss to follow-up. In some trials, mortality was the main reason for loss to follow-up; for example, in Carpenter 1990 (120 deaths, 22% of 539 participants, occurred over the three-year follow-up) and in Vetter 1992 (194 deaths, 29% of 674 participants, occurred over the four-year follow-up).

### Quality of the evidence

We have summarised the GRADE quality of evidence in Summary of findings for the main comparison (Multifactorial interventions versus control), Summary of findings 3 (Multiple interventions versus control), Summary of findings 2 (Multifactorial interventions versus exercise) and Summary of findings 4 (Multiple interventions versus exercise).

Overall the quality of the evidence ranged from moderate to very low. We downgraded all outcomes by one level for risk of bias, as more than one trial was at unclear or high risk of bias in all domains. We also downgraded one level for inconsistency where heterogeneity was a significant problem, such as for 'Rate of falls' for the comparison of multifactorial interventions versus control, which could not be explained by prespecified subgroup and sensitivity analyses. We downgraded one level for indirectness for fall-related hospital admission for the first comparison because poor reporting meant that it was not always possible to specifically determine that the cause of hospital admission was always due to a fall.

We also downgraded the level of evidence for imprecision by one or two levels due to the wide confidence intervals, often reflecting the small number of trials, participants and sometimes events for some outcomes such as fall-related fractures.

### Potential biases in the review process

We are not aware of any obvious biases within the review process. We conducted a comprehensive search, which was not restricted by language or by full-text publication, to optimise the chances of identifying all relevant trials. Two review authors who were blinded to each other's results performed screening and data extraction in duplicate to minimise bias. A limitation of this review is that for some outcomes the original authors published results in a format that did not allow for inclusion in meta-analysis and therefore could not contribute data for these outcomes; this was particularly the case when analysing the rate of falls and health-related quality of life. Additionally, several subgroup analyses have limited power due to the small number of studies within subgroups. We were therefore cautious in our interpretation of subgroup analyses where there was a limited number of studies within a subgroup.

### Agreements and disagreements with other studies or reviews

This review provides updated evidence for two of the intervention categories (multifactorial and multiple component interventions) covered in the Cochrane Review of *Interventions for preventing falls in older people living in the community,* published in 2012 (Gillespie 2012). We have excluded several trials included in Gillespie 2012 from this review because the comparator was either a different multifactorial intervention or different multiple component intervention, or because the comparator was a single active intervention (apart from exercise) or included a falls prevention leaflet. Updated evidence for the category of 'Exercise interventions' is being covered in Sherrington 2016a.

Our review adds to this existing body of evidence and supports the findings of Gillespie 2012, where multifactorial interventions were found to reduce the rate of falls (RaR 0.76, 95% CI 0.67 to 0.86; 19 trials; 9503 participants) but not the risk of falling (RR 0.93, 95% CI 0.86 to 1.02; 34 trials; 13,617 participants) or the risk of fall-related fractures. However, as in our review, there was significant unexplained statistical heterogeneity in the rate of falls, thus weakening our confidence in the observed treatment effect. In Gillespie 2012, exercise, whether group- or home-based, saw the greatest reduction in the rate of falls, risk of falling and the risk of fall-related fracture. This is supported by a recent review using network meta-analysis by Tricco 2017 of 54 trials (41,596 participants), across a range of acute and community settings, showing that exercise alone or exercise combined with various combinations of interventions was associated with lower risk of injurious falls compared with usual care.

A Cochrane Review of interventions for preventing falls in older people in care facilities and hospitals (Cameron 2012) found evidence that, as in our review, multifactorial interventions also reduced the rate of falls (RaR 0.69, 95% CI 0.49 to 0.96; 4 trials; 6478 participants) in older people in hospitals but not the risk of falling. However, there was no difference in the rate of falls and risk of falling between multifactorial interventions and control in older people living in care facilities, or comparing exercise interventions to a control intervention.

Gillespie 2012 did not pool the results of individual trials comparing different multiple component interventions and also included other fall prevention interventions as a comparator. In our review, we decided a priori to limit the choice of comparator to either usual care (or attention control) or to exercise as a single intervention, in order to be able to compare outcomes more consistently across trials. Goodwin 2014 carried out a systematic review of trials evaluating the effects of multiple component interventions in adults aged over 60 years, with any medical condition or in any setting. As in our review, they found that multiple component interventions reduced the rate of falls (RaR 0.80, 95% CI 0.72 to 0.89) and the risk of falling (RR 0.85, 95% CI 0.80 to 0.91) compared with those who received a control intervention, suggesting that offering multiple component treatments, regardless of risk profile, could be considered an option for service delivery.

## AUTHORS' CONCLUSIONS

### Implications for practice

Despite their appeal as a strategy to prevent falls in older people living in the community, the findings from our review show that while multifactorial interventions may reduce the rate of falls compared with those who receive usual care or an attention control, there may be little or no difference in other fall-related outcomes. An exception may be that these interventions reduce the risk of fall-related fractures, but the low-quality evidence also supports a conclusion of little or no difference in effect. There was very limited evidence available on adverse events occurring as a result of the intervention; all 12 reported musculoskeletal events resolved.

Very low-quality evidence from one small trial means that we are uncertain of the effects on rate of falls or the risk of people sustaining falls of multifactorial interventions versus exercise as a single intervention. Other fall-related outcomes were not assessed.

Multiple component interventions, where exercise was a key component, probably reduce the rate of falls and the risk of sustaining one or more falls and may reduce the risk of recurrent falls. Such interventions may make little or no difference to the number of people requiring medical attention but may slightly improve quality of life. There was insufficient evidence to determine the effects on fall-related fracture or hospital admission. There was limited evidence available on adverse events occurring as a result of the intervention; all six adverse events were minor.

The few trials comparing multiple component interventions with exercise as a single intervention provided low-quality evidence that there may be little or no difference between the interventions in the rate of falls or the risk of sustaining one or more falls. The very low-quality evidence from one small trial means that we are uncertain of the relative effects on hospital admission. The two reported adverse events were minor. Other fall-related outcomes were not reported.

### Implications for research

Exercise is one of the most common elements of both multifactorial and multiple component interventions and is an effective single intervention. Future research should build on this and establish a better picture of the added benefit of including co-interventions alongside exercise. Many of the types of intervention added to exercise as part of a multifactorial or multiple component interventions are expensive and the additional benefits are unclear. The addition of health economic data would help aid decision-making and provide a greater understanding of the broader impacts of these and other similar interventions.

Given that exercise is an effective and well-established intervention in community-dwelling populations, we believe this should be considered as the comparator intervention for new research, as opposed to usual care (i.e. no change in usual activities) or an attention control (e.g. social visits) comparator, as was the case for most of the trials included in this review. Measuring adherence to interventions is also important. Only half of the trials included in this review reported that they assessed adherence to the intervention, and the extent to which participants within the trials complied with the individual treatment components was unclear. We would recommend that future trials look at ways to maximise adherence and measure its impact on the trial findings. Another potential area for research is to develop interventions for those who are either unable or unwilling to engage with exercise or to adhere in the longer term.

The underlying quality of the research evidence also remains a concern. Nearly all the trials in this review depended on the participants or observers reporting falls either prospectively in diaries, or through recollection. The obvious drawback is that participants, care providers and/or carers cannot be blinded from the treatment received.The degree to which knowledge of the treatment as opposed to treatment received influences reporting of falls is not known. Wearable sensors are evolving and will soon offer the possibility for monitoring falls independently of self-report. This is an important aspect of methodology that should be pursued in future trials. In this review, few trials reported outcomes that can be independently verified, for example, falls resulting in fracture or hospital admission. As the event rates are much lower for these outcomes (Campbell 1990; Tinetti 1988), trials which use injurious or fracture falls need to be substantially larger than those reported to date (Bruce 2016; Bhasin 2018). We suggest that robust data on a larger number of people offers better value for money in terms of research investment.

Use of core data sets has improved over the last decade after the ProFANE consensus (Copsey 2016). We encourage trialists to adopt the consensus and to use a unified approach to defining and reporting outcomes. There is a paucity of data on health-related quality of life and future trials should include this. The types of interventions being tested potentially have much broader effects than a reduction in falls. For example, improving mobility without changing falls, improving depression and pain, better management of chronic disease. Measurement of health-related quality of life would capture these potential benefits.

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* Indicates the major publication for the study

# CHARACTERISTICS OF STUDIES

## Characteristics of included studies *[ordered by study ID]*

### Beling 2009

| | |
|---|---|
| Methods | Study Design: RCT (parallel design) |
| | Number of study arms: 2 |
| | Study centres: Single centre |
| | Length of follow-up: 3 months |

**Beling 2009** *(Continued)*

| | |
|---|---|
| Participants | Setting: United States of America<br>Number randomised: 23<br><br>Number analysed: 19<br><br>Number lost to follow-up: 4<br><br>Sample: Volunteers were recruited through press releases, newspaper advertisements and university website.<br><br>Age (years): mean 80 (SD 5.7)<br><br>Sex: 42% women<br><br>Ethnicity : 78% white, 15.8% Hispanic, 5.3% Asian<br><br>Inclusion criteria: ≥ 65 years; community-dwelling; English-speaking; minimal vision and hearing deficit; access to transportation; consenting; with physician approval to participate; MMSE ≥ 24/30; 3 metre TUG test ≥ 13.5 sec and/or to have ≥ 2 falls in past year and/or 1 injurious fall in the past year<br>Exclusion criteria: cardiac conditions; musculoskeletal and/or neurological impairment that could result in falls, e.g. stroke, Parkinson's disease, lower extremity joint replacement, fracture in last year |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. The Matter of Balance programme: 12-week small-group-based balance programme and falls home-based risk assessment (n = 12)<br><br>2. Control: Usual care (n = 11)<br><br>Who delivered the intervention: Physical therapists, teams of physical therapy students enrolled in the last semester of their curriculum<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls |
| Notes | Source of Funding: Supported by a grant from Unihealth Foundation<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Twelve subjects were randomly assigned to the experimental group and 11 subjects were assigned to the control group." |
| Allocation concealment (selection bias) | Unclear risk | Quote: "randomly assigned" but no further information on allocation schedule. Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Quote "relied on each participant's self-reported fall history over time". Insufficient information to permit judgement. |

**Beling 2009** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not Applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not Applicable |
| Incomplete outcome data (attrition bias) All outcomes | High risk | Less than 20% missing outcome data with imbalanced losses groups<br>1. The Matter of Balance programme: randomised n = 12, analysed n = 11 (1 participant dropped out due to unrelated hospitalisation and deteriorating health)<br>2. Usual care: randomised n = 11, analysed n = 8 (3 participants excluded from analysis: 1 demonstrated prolonged latencies of motor responses during the Motor Control Test, 1 refused further participation because of unrelated health problems, and 1 enrolled in a Tai Chi course during the study to improve balance) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Data gathering was prospective, and study relied on each participant's self-reported fall history over time. Insufficient information to permit judgement |

**Campbell 2005**

| | |
|---|---|
| Methods | Study design: RCT (2 x 2 factorial design)<br>Number of study arms: 4<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: New Zealand<br>Number randomised: 391<br>Number analysed: 360<br>Number lost to follow-up: 30<br>Sample: Men and women with severe visual impairment (visual acuity 6/24 or worse) identified in blind register, university and hospital outpatient clinics, and private ophthalmology practice<br>Age (years): Mean 83.6 (SD 4.8), range 75 to 96<br>Sex: 68% women<br>Ethnicity: Not reported<br>Inclusion criteria: Vision worse than 6/24 in better eye; age ≥ 75 years<br>Exclusion criteria: Unable to walk around at home |
| Interventions | Type of intervention: Multiple intervention<br>1. Home safety programme (n = 100)<br>2. Otago Exercise Programme plus vitamin D supplements (n = 97)<br>3. Home safety programme plus Otago Exercise Programme plus vitamin D supplements (n = 98)<br>4. Social visits (n = 96) |

**Campbell 2005** *(Continued)*

| | |
|---|---|
| | Who delivered intervention: Occupational therapists and physiotherapists<br><br>Compliance assessed: Yes, OTs evaluated adherence to home-safety programme during phone interviews, exercise compliance assessed using participant-completed monthly postcard reminders, physiotherapy compliance assessed by twice-yearly monitoring |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining one or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Number of people who experienced a fall that required medical attention<br><br>5. Adverse events of the intervention |
| Notes | Source of funding: Health Research Council of New Zealand<br><br>Conflicts of interest: None<br><br>Economic information:The programme cost NZD 64,337 to deliver to the 198 participants in the 2 centres, or NZD 325 (SD NZD 292) per person.<br><br>Otago Exercise Programme manual can be obtained from: www.cdc.gov/HomeandRecreationalSafety/Falls/compendium/1.2_otago.html.<br><br>Adverse events: "No significant adverse events were reported during the study" |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Computer-generated random numbers |
| Allocation concealment (selection bias) | Low risk | Schedule held by independent person at separate site, telephone access |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded monthly by patients returning postcard calenders |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Requiring medical attention confirmed by GP and hospital records |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br><br>1. Otago Exercise Programme plus vitamin D supplements: randomised n = 97, analysed n = 90 (2 died, 2 withdrew, 3 unspecified) |

**Campbell 2005** *(Continued)*

| | | |
|---|---|---|
| | | 2. Home-safety programme plus Otago Exercise Programme plus vitamin D supplements: randomised n = 98, analysed n = 87 (4 died, 6 withdrew, 1 unspecified)<br>3. Social visits: randomised n = 96, analysed n = 87 (7 died, 2 withdrew) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported. |
| Method of ascertaining falls | Low risk | Falls recorded monthly by patients returning postcard calenders |

**Carpenter 1990**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 36 months |
| Participants | Setting: United Kingdom<br>Number randomised: 539<br>Number analysed: 367<br>Number lost to follow-up: 172<br>Sample: women and men recruited from patient lists of 2 general medical practices<br>Age (years): ≥ 75 years<br>Sex: 65% women<br>Ethnicity: Not reported<br>Inclusion criteria: aged ≥ 75; living in Andover town, including the surrounding house estates<br>Exclusion criteria: living in residential care; living in surrounding villages |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Visit by trained volunteers for dependency surveillance using Winchester disability rating scale. The intervention was stratified by degree of disability on the entry evaluation. For those with no disability, the visit was every 6 months; for those with disability, 3 months. Scores compared with previous assessment and referral to GP if score increased by 5 or more. (n = 272)<br>2. Control: no disability surveillance between initial and final evaluation (n = 267)<br>Who delivered the intervention: Unskilled volunteers and general practitioners<br>Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls<br>2. Number of people who experienced a fall that required hospital admission |
| Notes | Source of funding: Wessex Regional Health Authority<br>Conflicts of interest: None<br>Economic information: Quote "The running costs of the project were low, the only expenses incurred were costs of printing questionnaires, salary, and travel expenses for half term research assistant and purchase of statistical software for the data analysis". |

**Carpenter 1990** *(Continued)*

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomised by random-number tables |
| Allocation concealment (selection bias) | Unclear risk | No information on allocation schedule. Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Retrospectively by interview |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Self-report by participants |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, losses balanced across groups with similar reasons for loss to follow-up<br>1. Home visits for dependency surveillance: randomised n = 272, analysed n = 181 (66 died, 14 withdrew from project, 11 moved out of area)<br>2. No disability surveillance: randomised n = 267, analysed n = 186 (54 died, 11 withdrew from project, 11 moved out of area, 2 changed doctors to a different practice, 3 moved into long-term nursing care) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | High risk | Falls were reported by participants retrospectively by interview at the end of the study |

**Carter 1997**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 3<br>Study centre: unclear<br>Length of follow-up: 12 months |
| Participants | Setting: Australia<br>Number randomised: 657<br>Number analysed: 457 |

**Carter 1997** *(Continued)*

| | |
|---|---|
| | Number lost to follow-up: 200<br><br>Sample: All full-time general practitioners in the Lower Hunter Region of NSW, Australia were approached and asked to generate lists of their patients who fulfilled eligibility<br><br>Age (years) 80 years+: Mean 34%<br><br>Sex: 66% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Aged 70 years and over, ability to speak and understand English, living independently at home, in hostel or retirement village, not suffering from psychiatric disturbance<br>Exclusion criteria: Those who were listed as living outside the region, those with no phone |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Brief feedback on home safety plus pamphlets on home safety and medication use: Standardised checklist to assess all rooms in the house for hazards, summary list of hazards, pamphlet on home safety, pamphlet on the wise use of medicines for older people (n = 220)<br>2. Action plan for home safety plus medication review: House check with more comprehensive feedback including how it could be fixed Could arrange local service club to do the work. Pamphlet on safety (n = 205)<br><br>3. Control: No intervention (n = 232)<br><br>Who delivered the intervention: Trained project officer<br><br>Compliance assessed: Yes, approximately 3 months after, participants were sent the letter recommending medication review, a member of the research team rang them and asked if they had been to their doctor for medication review and if their medication use had altered as a result. |
| Outcomes | 1) Number of people sustaining one or more falls<br><br>2) Number of people sustaining recurrent falls<br><br>3) Number of people requiring medical attention (e.g. attendance at emergency department, requiring GP consultation) |
| Notes | Source of funding: Australian Rotary Health Research Fund<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Subjects were randomised to one of the three groups using a random generator in SAS software". |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and provider not blinded to allocation group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias) | High risk | Falls were self-reported and participants were unblinded |

**Carter 1997** *(Continued)*

| | | |
|---|---|---|
| Falls and fallers | | |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Falls were self-reported and participants were unblinded |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, losses were unbalanced across groups with no reasons given for loss to follow-up.<br>1. Brief feedback on home safety plus pamphlets on home safety: randomised n = 220, analysed n = 163 (57, no reasons)<br>2. Action plan for home safety plus medication review: randomised n = 205, analysed n = 133 (72, no reasons)<br>3. Control: no intervention: randomised n = 232, analysed n = 161 (71, no reasons ) |
| Selective reporting (reporting bias) | Unclear risk | Unpublished study |
| Method of ascertaining falls | High risk | Falls were recorded retrospectively |

**Ciaschini 2009**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Canada<br>Number randomised: 201<br>Number analysed: 176<br>Number lost to follow-up: 25<br>Sample: Community-dwelling people at risk of a fall-related fracture<br>Age (years): mean 72 (SD 8.4), range 65 - 79<br>Sex: 94% women<br>Ethnicity: 11 of aboriginal origin: 5.5%<br>Inclusion criteria: Community-dwelling; age > 55 years old; able to consent; at risk of fracture (non-pathological fracture in past year with T-score < 2.0; attended ED with a fall, self-referred, or referred by health professional and at high risk of falls (TUG test > 14 sec)<br>Exclusion criteria: If already receiving therapy for osteoporosis as per Osteoporosis Canada guidelines |
| Interventions | Type of intervention: Multifactorial intervention |

**Ciaschini 2009** *(Continued)*

| | |
|---|---|
| | 1. Multifactorial falls risk assessment by nurse + counselling and referral for PT and OT and interventions, plus recommendations for osteoporosis therapy targeting physicians and their patients (n = 101)<br>2. Control: usual care until 6 months, then same as intervention group (n = 100)<br><br>Who delivered the intervention: Research nurse, physiotherapist, occupational therapist<br><br>Compliance assessed: Yes. Adherance of participants to intervention was assessed as changes to medication were reviewed at 6 months |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people of sustaining 1 or more fall-related fractures<br><br>3. Number of people who experienced a fall that required hospital admissions |
| Notes | Source of funding: Financial support for the completion of the study was given by Merck Frosst Canada Ltd, Sanofi-Aventis Pharma Inc., Proctor & Gamble Pharmaceuticals Canada Inc., Eli Lilly Canada Inc., and the Greenshield Foundation. Equipment (e.g. office space, computers, telephones) was contributed in-kind by the Group Health Centre, Algoma Public Health, Sault Area Hospital, AlgomaCommunity Care AccessCentre, and the Slips, Trips and Falls Committee of Sault Ste. Marie Safe Communities Partnership, all located in Sault Ste.Marie, Ontario, Canada.<br><br>Conflicts of interest: None<br><br>Economic information: Not reported<br><br>12-month study but 6-month data used in review analysis as control group participants were offered the intervention after 6 months |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Eligible patients were randomized using a computer generated randomization scheme under supervision of the study biostatistician, into an immediate intervention protocol (IP) group or to a delayed intervention protocol (DP) group". |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement (see above) |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Quote: "The patients, treating physicians and outcomes collectors could not be blinded to the intervention status." but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls and fall-related injuries were obtained from electronic medical records as well as patient diaries |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Falls and fall-related injuries were obtained from electronic medical records as well as patient diaries |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Measurement of outcomes was obtained through patient records (electronic medical records) |
| Incomplete outcome data (attrition bias) | Unclear risk | Less than 20% missing outcome data, intervention arm records a higher loss to follow-up than control. Similar reasons for missing data in both arms |

**Ciaschini 2009** *(Continued)*

| | | |
|---|---|---|
| All outcomes | | 1. Multifactorial assessment: referral and counselling: randomised n = 101, analysed n = 85 (1 withdrew, 6 died, 9 other reasons)<br>2. Control: usual care until 6 months, then same as intervention group: randomised n = 100, analysed n = 91 (4 died, 5 other reasons) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Falls and fall-related injuries were obtained from electronic medical records as well as patient diaries |

**Clemson 2004**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 14 months |
| Participants | Setting: Australia<br>Number randomised: 310<br>Number analysed: 285<br>Number lost to follow-up: 25<br>Sample: Volunteer community-dwelling men and women recruited by various strategies<br>Age (years): mean 78 (SD 5)<br>Sex: 74% women<br>Ethnicity: Not reported<br>Inclusion criteria: aged ≥ 70; community-dwelling; fallen in past year or felt themselves to be at risk of falling<br>Exclusion criteria: dementia (> 3 errors on Short Portable Mental Status Questionnaire); home-bound; unable to independently leave home; unable to speak English |
| Interventions | Type of intervention: Multiple intervention<br>1. Stepping On programme. Multifaceted small-group learning environment to encourage self-efficacy, behaviour change, and reduce falls using decision-making theory and a variety of learning strategies. 2 hours a week for 7 weeks; taught exercises and practised in classes OT home visit within 6 weeks of final programme session; booster session 3 months after final session. (n = 157)<br>2. Social visits from student OT with no discussion of falls or fall prevention (n = 153)<br>Who delivered intervention: OTs experienced in group work with 12 years experience in geriatrics<br>Compliance assessed: Yes, through home visit by research assistant |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls<br>3. Number of people sustaining recurrent falls<br>4. Health-related quality of life (SF-36 0 - 100, mental and physical subscales: change score) |
| Notes | Source of funding: National Health and Medical Research Council, Australia |

**Clemson 2004** *(Continued)*

| | |
|---|---|
| | Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Randomised by researcher not involved in subject screening or assessment". Method not described |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blinded to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded monthly by participants returning postcard calenders |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, losses balanced across group but reasons not given<br>1. Step On Programme: randomised n = 157, analysed n = 147<br>2. Social visits: randomised n = 153, analysed n = 138<br>(7 died, 6 withdrew, 5 lost contact, 6 nursing home, 1 cognitive decline) |
| Selective reporting (reporting bias) | Low risk | All pre-specified outcomes reported |
| Method of ascertaining falls | Low risk | Falls recorded monthly by patients returning postcard calenders |

**Close 1999**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centre: Unclear<br>Length of follow-up: 12 months |
| Participants | Setting: United Kingdom |

**Close 1999** *(Continued)*

| | |
|---|---|
| | Number randomised: 397<br><br>Number analysed: 304<br><br>Number lost to follow-up: 93<br><br>Sample: Community-dwelling individuals presenting at A&E after a fall. Admitted patients not recruited until discharge<br><br>Age (years): Mean 78.2 (SD 7.5)<br><br>Sex: 68% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: aged ≥ 65; lived in the community; history of falling<br>Exclusion criteria: cognitive impairment (AMT < 7) and no regular carer (for informed consent reasons); speaking little or no English; not living locally |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Medical and occupational therapy assessments and interventions: Medical assessment to identify primary cause of fall and other risk factors present (general examination and visual acuity, balance, cognition, affect, medications). Intervention and referral as required. Home visit by OT (functional assessment and environmental hazards). Advice, equipment, and referrals as required. (n = 184)<br>2. Control: usual care only (n = 213)<br><br>Who delivered the intervention: Physician and OT<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Health-related quality of life (Barthel Index 0 - 20: endpoint score) |
| Notes | Source of funding: South Thames NHS Research and Development project grant.<br><br>Conflicts of interest: None<br><br>Economic information: Cost analysis reported in Close 2000 |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomised by random-numbers table |
| Allocation concealment (selection bias) | Low risk | List held independently of the investigators |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias) | Low risk | Quote "Each participant was given a “falls diary” with 12 monthly sheets to assist with the recall of further falls". |

**Close 1999** *(Continued)*
Falls and fallers

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Quote: "follow-up was done by postal questionnaire, which was sent to all participants every 4 months for 1 year after the fall. Information about subsequent falls, fall-related injury, and details of doctor and hospital visits or admissions and degree of function were requested". |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, losses balanced across groups with similar reasons for missing data.<br>1. Medical and occupational therapy assessments and interventions: randomised n = 184, analysed n = 141 (18 moved to institutional care, 19 died, 6 otherwise lost to follow-up)<br>2. Control usual care: randomised n = 213, analysed n = 163 (18 moved to institutional care, 27 died, 5 otherwise lost to follow-up) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes reported |
| Method of ascertaining falls | Low risk | Self-reports by study participants through “falls diary” |

**Coleman 1999**

| | |
|---|---|
| Methods | Study design: Cluster-RCT (by physician practice)<br>Number of study arms: 2<br>Number of clusters: 9<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: United States of America<br>Number randomised: 169<br>Number analysed: 142<br>Number lost to follow-up: 27<br>Sample: Community-dwelling men and women in 9 physician practices in an ambulatory clinic<br>Age (years): mean 77<br>Sex: 49% women<br>Ethnicity: Not reported<br>Inclusion criteria: Community-dwelling adults aged ≥ 65; high risk of being hospitalised or of developing functional decline<br>Exclusion criteria: Living in nursing home; terminal illness; moderate to severe dementia or "too ill" (physician's judgement) |
| Interventions | Type of intervention: Multifactorial intervention |

**Coleman 1999** *(Continued)*

| | |
|---|---|
| | 1. Half-day Chronic Care Clinics every 3 to 4 months in 5 practices focusing on planning chronic disease management (physician and nurse); reducing polypharmacy and high-risk medications (pharmacist); patient self-management/support group (n = 73)<br>2. Control: usual care (n = 96)<br><br>Who delivered intervention: Multidisciplinary team<br><br>Compliance assessed: Semi-structured interventions with physicians' perceived ability to provide comprehensive primary care to their frail older patients |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people who experienced a fall that required hospital admission<br><br>3. Health-related quality of life (measured using SF 36 - physical function score) |
| Notes | Source of funding: Robert Wood Foundation Chronic Care Initiative<br><br>Conflicts of interest: Not reported<br><br>Economic information: Cost analysis reported as Multifactorial intervention USD 9535 a year and Usual care USD 10,116 a year |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "randomized using simple randomization" |
| Allocation concealment (selection bias) | Unclear risk | Insuffient information |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Participant self-reported fall information. No further information given |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Participant self-reported information |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, unbalanced losses across groups with similar reasons for missing data<br><br>1. Multifactorial intervention: randomised n = 96, analysed n = 79 (7 refusal, 3 lost to follow-up, 5 died, 2 other)<br><br>2. Usual care: randomised n = 73, analysed n = 63 (2 refusal, 2 lost to follow-up, 5 died, 1 other) |

**Coleman 1999** *(Continued)*

| | | |
|---|---|---|
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Participant self-reported fall information |
| Relating to cluster randomisation | High risk | Recruitment bias: participants were recruited and randomised based on risk score for all participants at the same time (low risk)<br>Baseline imbalance: baseline similar between intervention arms (low risk)<br>Loss of clusters: no clusters lost from the trial (low risk)<br>Incorrect analysis: the trial did not adjust for clustering (high risk)<br>Comparability: results comparable with individually-randomised trials (low risk) |

**Davison 2005**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Unclear<br>Length of follow-up: 12 months |
| Participants | Setting: United Kingdom<br>Number randomised: 313<br>Number analysed: 282<br>Number lost to follow-up: 31<br>Sample: People presenting at A&E with a fall or fall-related injury<br>Age (years): mean 77 (SD 7)<br>Sex: 72% women<br>Ethnicity: Not reported<br>Inclusion criteria: age > 65 years, presenting at A&E with a fall or fall-related injury; history of at least 1 additional fall in previous year; community-dwelling<br>Exclusion criteria: cognitively impaired (MMSE < 24); > 1 previous episode of syncope; immobile; live > 15 miles away from A&E; registered blind; aphasic; clear medical explanation for their fall, e.g. acute myocardial infarction, stroke, epilepsy; enrolled in another study |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multifactorial post-fall assessment and intervention: Hospital-based medical assessment and intervention: fall history and examination including medications, vision, cardiovascular assessment, laboratory blood tests, ECG. Home-based physiotherapist assessment and intervention: gait, balance, assistive devices, footwear. Home-based OT home-hazard assessment and interventions. (n = 159)<br>2. Control: usual care (n = 154)<br>Who delivered the intervention: Not reported<br>Compliance assessed: Yes. It was recorded whether participants followed certain recommendations |

**Davison 2005** *(Continued)*

| | |
|---|---|
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls<br>3. Number of people sustaining 1 or more fall-related fractures<br>4. Number of people who experienced a fall that required hospital admissions<br>5. Number of people who experienced a fall that requires medical attention (e.g. attendance at emergency, requiring GP consultation) |
| Notes | Source of Funding: Wellcome Trust and Northern and Yorkshire NHS Executive<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomised by computer-generated block randomisation |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Quote: "Fall data were collected prospectively by fall diaries, with four weekly cards per diary, returned every 4 weeks over 12 months. There was telephone prompting to maximise compliance. Subjects were asked to detail the frequency and circumstances of each fall" |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Insufficient information to permit judgement |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Quote: "Hospital and A&E attendances were recorded prospectively,prompted by diary reports, and hospital records were checked retrospectively at 1 year for all participants. For each episode, an independent reviewer determined whether attendances were fall-related" |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Multifactorial post-fall assessment and intervention: randomised n = 159, analysed n = 141 (1 withdrew and died, 2 died, 15 withdrew)<br>2. Usual care: randomised n = 154, analysed n = 141 (1 withdrew and died, 4 died, 8 withdrew) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Quote: "Fall data were collected prospectively by fall diaries, with four weekly cards per diary, returned every 4 weeks over 12 months. There was tele- |

**Davison 2005** *(Continued)*

| | |
|---|---|
| | phone prompting to maximise compliance. Subjects were asked to detail the frequency and circumstances of each fall" |

**Day 2002**

| | |
|---|---|
| Methods | Study design: RCT (2 x 2 factorial design)<br><br>Number of study arms: 8<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 18 months |
| Participants | Setting: Australia<br>Number randomised: 1107<br><br>Number analysed: 1090<br><br>Number lost to follow-up: 17<br>Sample: Community-dwelling men and women identified from electoral roll<br>Age (years): mean 76.1 (SD 5.0)<br>Sex: 60% women<br><br>Ethnicity: Mainly Australian-born<br><br>Inclusion criteria: Aged ≥ 70; community-dwelling and able to make modifications; expected to remain in area for 2 years (except for short absences); have approval of family physician<br>Exclusion criteria: Undertaken regular to moderate exercise with a balance component in previous 2 months; unable to walk 10 to 20 metres without rest or 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 |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Exercise: 1-hour class a week for 15 weeks, plus daily home exercises. Designed by physiotherapist to improve flexibility, leg strength, and balance (or less demanding routine depending on participant's capability) (n = 135)<br>2. Home hazard management: home assessed by "trained assessor", hazards removed or modified by participants or City of Whitehorse's home maintenance programme. Staff visited home, provided quote for work including free labour and materials up to AUD 100 (n = 136)<br>3. Vision improvement: assessed at baseline using dual visual acuity chart. Referred to usual eye care provider, general practitioner, or local optometrist if not already receiving treatment for identified impairment (n = 139)<br>4. (1) + (2) (n = 135)<br>5. (1) + (3) (n = 136)<br>6. (3) + (2) (n = 137)<br>7. (1) + (2) + (3) (n = 135)<br><br>8. No intervention. Received brochure on eye care for over 40-year olds (n = 137)<br><br>Who delivered interventions: Multidisciplinary team<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls |
| Notes | Source of funding: National Health and Medical Research Council, Australia |

**Day 2002** *(Continued)*

| | |
|---|---|
| | Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomised by "adaptive biased coin" technique, to ensure balanced group numbers |
| Allocation concealment (selection bias) | Low risk | Computer-generated by an independent third party contacted by telephone |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded monthly by participants returning postcard calenders |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, but distribution across groups and reasons not reported, randomised n = 1107, analysed n = 1090 |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Falls recorded monthly by participants returning postcard calenders |

**De Vries 2010**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br><br>Number of study arms: 2<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 12 months |
| Participants | Setting: The Netherlands<br><br>Number randomised: 217<br>Number analysed: 187<br><br>Number lost to follow-up: 30 |

**De Vries 2010** *(Continued)*

| | |
|---|---|
| | Sample: People consulting ED or family physician after a fall<br><br>Age (years): Mean 79.8 (SD 7.35)<br><br>Sex: 71% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Aged ≥ 65 years; living independently or in assisted living facility; living near University Medical Center; history of falling in previous 3 months<br>Exclusion criteria: Unable to sign informed consent or provide a fall history; cognitive impairment (MMSE < 24); fall due to traffic or occupational accident; living in nursing home; acute pathology requiring long-term rehabilitation, e.g. stroke |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multidisciplinary intervention: Multidisciplinary assessment in geriatric outpatient clinic and individually-tailored treatment in collaboration with participant's GP, e.g. withdrawal of psychotropic drugs, balance and strength exercises, home-hazard reduction, referral to specialists (n = 106)<br>2. Control: usual care (n = 111)<br><br>Who delivered the intervention: Geriatrician, physical therapist, occupational therapist, opthalmologist, family physician, cardiologist<br><br>Compliance assessed: Yes, during the second home visit in the intervention group, adherence to the treatment regimen was evaluated by recommendation given. Questionnaires at 3 and 6 months and interview also provided adherence data. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people sustaining recurrent falls<br><br>3. Number of people sustaining 1 or more fall-related fractures<br><br>4. Health-related quality of life (EQ-5D 0 - 1: change score for overall QoL; SF-36 physical subscale 0 - 100: change score for physical QoL) |
| Notes | Source of funding: Not reported<br><br>Conflicts of interest: Not reported<br><br>Economic information: The total mean costs were EUR 7740 (SD 9129) in the intervention group and EUR 6838 (SD 8623) in the usual care group. The intervention and usual care groups did not differ in total costs (EUR 902, 95% CI −1534 to 3357). Also, the mean healthcare costs and the mean participant and family costs did not differ significantly between the groups<br><br>The percentage of fallers was 4.0% lower in the intervention group as compared with the usual care group and the costs were EUR 902 higher, resulting in an ICER of 226. In other words, the costs per percentage decrease in fallers are EUR 226. Since the percentage of recurrent fallers was higher in the intervention than in the usual care group, the ICER for recurrent falling was negative (ICER −280).<br><br>This indicates that if EUR 10,000 were invested, the probability that the intervention would reduce the percentage of fallers by 1% was 0.80. Likewise, if EUR 300,000 were invested, the probability that the intervention would improve the quality of life (utility) by one point was only about 0.30. Since the costs were higher and effects were smaller for the outcome recurrent fallers, the intervention was not cost-effective at any given ceiling ratio. |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**De Vries 2010** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "computer-generated random sequence" |
| Allocation concealment (selection bias) | Low risk | Quote: "…opaque envelopes are numbered and filled with group names. When a participant is designated to the high-risk group, the interviewer, who is unaware of the content, opens the envelope with the lowest number." (from protocol paper) |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Quote: "Participants, intervention caregivers, and interviewers could not be blinded to group assignment." but impact of non-blinding unclear. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded weekly by participants by the use of a falls calender |
| Blinding of outcome assessment (detection bias)<br>Fractures | High risk | Quote: "By their response to a questionnaire sent 1.5 years after the first home visit, participants were asked to indicate whether they had sustained a fracture since the first home visit". |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups.<br>1.Multidisciplinary intervention: randomised n = 106, analysed n = 93 (1 died, 11 no reasons given, 1 objected to procedure)<br>2.Usual care: randomised n = 111, analysed n = 94 (7 died, 9 no reasons given, 1 did not expect to benefit) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Falls recorded weekly by participants by the use of a falls calender |

**Elley 2008**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: New Zealand<br>Number randomised: 312<br>Number analysed: 280<br>Number lost to follow-up: 32<br>Sample: Patients from 19 primary care practices |

**Elley 2008** *(Continued)*

| | |
|---|---|
| | Age (years): Mean 80.8 (SD 5)<br><br>Sex: 69% women<br><br>Ethnicity: 9 participants identified themselves as either Maori or Pacific.<br>Inclusion criteria: Aged ≥ 75 (> 50 years for Maori and Pacific people), fallen in last year, living independently<br>Exclusion criteria: Unable to understand study information and consent processes, unstable or progressive medical condition, severe physical disability, dementia (< 7 on AMT Score) |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Intervention: Community-based nurse assessment of falls and fracture risk factors, home hazards, referral to appropriate community interventions, and strength and balance exercise programme (n = 155)<br>2. Control: usual care and social visits (n = 157)<br><br>Who delivered the intervention: Nurse, family physician, OT, optometrist, physiotherapist, podiatrist, physiotherapist, physical therapist, continence nurse<br><br>Compliance assessed: Yes, the intervention assessment was usually undertaken at 1 visit. The nurse telephoned 2 - 4 weeks later to ensure referral consultations had taken place. |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Health-related quality of life |
| Notes | Source of funding: The New Zealand ACC, the New Zealand Lotteries Commission, the Wellington Medical Research Foundation, the University of Otago, and the Hutt Valley District Health Board<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "computer randomisation" |
| Allocation concealment (selection bias) | Low risk | Quote: "independent researcher at a distant site" |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were recorded daily by participants and posted monthly to the research team. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |

**Elley 2008** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | Less than 20% missing outcome data with unbalanced losses across groups. Overall, similar reasons for missing data in both arms.<br>1. Intervention group: randomised n = 155, analysed n = 135 (4 unwell or cognitive decline, 5 admitted to rest home or hospital, 2 moved away, 2 declined, 7 died)<br>2. Usual care and social visits: randomised n = 157, analysed n = 145 (5 admitted to rest home or hospital, 1 unwell or cognitive decline, 1 moved away, 1 declined, 4 died) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Falls were recorded daily by participants and posted monthly to the research team. |

**Fabacher 1994**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: United States of America<br>Number randomised: 254<br>Number analysed: 195<br>Number lost to follow-up: 59<br>Sample: Men and women aged > 70 years and eligible for veterans medical care. Identified from voter registration lists and membership lists of service organisations<br>Age (years): Mean 73<br>Sex: 2% women<br>Ethnicity: Participants were predominantly white men (98%)<br>Inclusion criteria: Aged ≥ 70; not receiving health care at Veterans Administration Medical Centre<br>Exclusion criteria: Known terminal disease, dementia |
| Interventions | Type of intervention: Multifactorial intervention<br>1. HAPSA: Home visit by health professional to screen for medical, functional, and psychosocial problems, followed by a letter for participants to show to their personal physician. Targeted recommendations for individual disease states, preventive health practices (n = 131)<br>2. Control: follow-up telephone calls for outcome data only (n = 123)<br>Who delivered the intervention: Physician assistant, nurses, trained volunteers<br>Compliance assessed: Yes, information on compliance with recommendations was obtained from participants during the follow-up visits. |

**Fabacher 1994** *(Continued)*

| | |
|---|---|
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Number of people who experienced a fall that required hospital admissions |
| Notes | Source of funding: Disabled American Veterans Charities of Greater Los Angeles and the Disability American Veterans California Rehabilitation Foundation Inc.<br>Conflicts of interest: Not reported<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "randomly assigned ... using randomly generated assignment cards in sealed envelopes". Judged to be unclear. |
| Allocation concealment (selection bias) | Unclear risk | Quote: "randomly assigned ... using randomly generated assignment cards in sealed envelopes". Judged to be unclear. |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Falls data collected by self-reports at 12 month follow-up interview |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Falls data collected by self-reports at 12 month follow-up interview |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data with losses balanced across both groups.<br>1. HAPSA: randomised n = 131, analysed n = 100 (13 refused initial assessment, 5 refused follow-up visits, 3 moved, 4 died, 6 logistic reasons)<br>2. Control: randomised n = 123, analysed n= 95 (15 refused follow-up visits, 9 moved, 4 died) |
| Selective reporting (reporting bias) | Unclear risk | Fall rates reported to be similar across groups but numerical values were not given. |
| Method of ascertaining falls | High risk | Falls were self-reported at 12-month follow-up interview |

**Faes 2011**

| | |
|---|---|
| Methods | Study design: Parallel RCT |

**Faes 2011** *(Continued)*

| | |
|---|---|
| | Number of study arms: 2<br><br>Study centres: Multiple centres<br><br>Length of follow-up: Trial terminated due to "Extremely difficult recruitment" |
| Participants | Settting: The Netherlands<br><br>Number randomised: Not reported - target sample 160 people plus their carer (N = 320)<br><br>Number analysed: Not reported<br><br>NUmber lost to follow-up: Not reported<br><br>Sample: Patients recruited from 3 geriatric outpatient clinics<br><br>Age (years): mean 78.3 (SD 7)<br><br>Sex: 70% women<br><br>Inclusion criteria: Fallen in previous 6 months; able to walk 15 metres independently (with or without walking aid); had a primary informal caregiver; community-dwelling; life expectancy > 1 year; frail (≥ 2 frailty indicators)<br><br>Exclusion criteria: Awaiting nursing home admission; MMSE < 15 |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Psychological teaching and training + physical training in small groups. 10 x 2-hour sessions twice a week + booster session 6 weeks later. Caregivers trained in autonomy-boosting strategies, and being co-therapist at home<br><br>2. Control: usual care<br><br>Who delivered intervention: Not reported<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people sustaining recurrent falls<br><br>3. Health-related quality of life (EQ-5D VAS 0 - 100: change score) |
| Notes | Source of funding: The Netherlands Organisation for Health Research and Development (920-03-457) and the NUTS-Ohra Fund (0601-60) and a career development sponsorship acquired from the Radboud University Nijmegen Medical Centre, The Netherlands<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Treatment allocation…was based on a minimization algorithm that balanced for the minimization factors" |
| Allocation concealment (selection bias) | Low risk | Quote: "allocation, carried out by an independent statistician" |

**Faes 2011** *(Continued)*

| | | |
|---|---|---|
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Insufficent information to provide judgement |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | The trial was terminated due to "Extremely difficult recruitment". No data are provided on the number of participants analysed |
| Selective reporting (reporting bias) | High risk | The trial was terminated due to "Extremely difficult recruitment". No data are provided on the number of participants analysed |
| Method of ascertaining falls | Unclear risk | Insufficent information to provide judgement |

**Fairhall 2014**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Australia<br>Number randomised: 241<br>Number analysed: 216<br>Number lost to follow-up: 25<br>Sample: Potential participants were identified from older people being discharged from the Division of Rehabilitation and Aged care services at Hornsby Ku-ring-gai Health Service, Sydney, Australia<br>Age (years): Mean 83.3 (SD 5.9)<br>Sex: 67% women<br>Ethnicity: Not reported<br>Inclusion criteria: 70 years or older, frail (met specified cut-offs for 3 or more of the CHS frailty criteria : slow gait, weak grip, exhaustion, low energy expenditure, and weight loss), did not live in a residential aged care facility, had a MMSE score > 18 and life expectancy of at least 12 months (a modified Implicit illness Severity Scale score ≤ 3) |

**Fairhall 2014** *(Continued)*

| | |
|---|---|
| | Exclusion criteria: Lives in residential aged care facility |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial intervention: An individualised home-exercise programme prescribed in 10 home visits from a physiotherapist and interdisciplinary management of medical, psychological and social problems (n = 120)<br><br>2. Control: usual care (n = 121)<br><br>Who delivered the intervention: Physiotherapists, geriatrician, rehabilitation physician, dietician, nurses, OTs.<br><br>Compliance assessed: Yes, adherence to home-exercise sessions |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Number of people sustaining 1 or more fall-related fracture<br><br>5. Health-related quality of life<br><br>6. Adverse effects of the intervention |
| Notes | Source of Funding: Supported by Australian National Health and Medical Research Council Health Services Research Grant<br><br>Conflicts of interest: None<br><br>Economic information: Not reported<br><br>Adverse events: “Two intervention group participants experienced back pain consistent with the study definition of an adverse event: a medical event or injury that restricted activities of daily living for more than 2 days or resulted in medical attention [26]. Both participants recommenced exercise following modification of the exercise program.” |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "The group allocation schedule was generated and managed by an investigator independent of participant recruitment using a computer generated random number schedule with varying block sizes." |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blinded to allocated group but impact on blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were monitored prospectively using monthly calender with follow-up telephone call |
| Blinding of outcome assessment (detection bias) | Unclear risk | Not reported |

**Fairhall 2014** *(Continued)*

| | | |
|---|---|---|
| Fractures | | |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Less than 20% missing outcome data, losses are balanced across groups with similar reasons for missing data<br>1. Multifactorial intervention: randomised n = 120 , analysed n = 107 (12 died unrelated to trial protocol, 1 withdrew)<br>2. Usual care: randomised n= 121, analysed n = 109 (10 died unrelated to trial protocol, 2 withdrew) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed were reported |
| Method of ascertaining falls | Low risk | Falls data were collected by monthly calenders and telephone calls. |

**Ferrer 2014**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Barcelona, Spain<br>Number randomised: 328<br>Number analysed: 273<br>Number lost to follow-up: 55<br>Sample: All community-dwelling individuals born in 1924, and registered at 1 of the 7 healthcare centres in Baix Llobregrat, Barcelona.<br>Age (years): Mean 81<br>Sex: 61.6% female<br>Ethnicity: Not reported<br>Inclusion criteria: Age of 85<br>Exclusion criteria: Being institutionalised |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multifactorial intervention: Specific algorithm identifying 9 areas of potentially modifiable risk factors for falls, including psychotropic and cardiovascular use, auditory acuity, visual acuity, balance and gait disorders, cognitive impairment, risk of malnutrition, disability, social risk and home safety (n = 164)<br>2. Control: Usual care (n = 164) |

**Ferrer 2014** *(Continued)*

| | |
|---|---|
| | Who delivered the intervention: Physician, opthalmologist, physical therapist, physiotherapist, dietician, healthcare professional with specialised training in geriatrics<br><br>Compliance assessed: Yes, adherence to recommendations was monitored by quarterly visits or telephone calls made by the therapist during the first and second years. |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls |
| Notes | Source of Funding: Fond de Investigation Sanitaria-Institute de Salud Carlos III Spain<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "After the baseline questionnaire had been questionnaire had been administered, the subjects were randomised to an intervention or control group using a computer-generated randomization table". |
| Allocation concealment (selection bias) | Unclear risk | No mention of allocation concealment |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blinded to allocated group but impact on blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were monitored prospectively using a monthly calender with a 3-monthly follow-up telephone call |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, unbalanced losses across groups with similar reasons for missing data<br><br>1. Multifactorial intervention: randomised n = 164, analysed n = 142 (9 died, 3 moved, 3 nursing home, 7 other)<br><br>2. Usual care: randomised n = 164, analysed n = 131 (8 died, 7 moved, 7 nursing home, 11 other) |
| Selective reporting (reporting bias) | Low risk | All outcomes stated in the Methods were reported |

**Ferrer 2014** *(Continued)*

| | | |
|---|---|---|
| Method of ascertaining falls | Low risk | Fall data were collected by monthly self-reports and telephone calls every 3 months. |

**Freiberger 2012**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 4<br>Study centre: Single centre<br>Length of follow-up: 24 months |
| Participants | Setting: Germany<br>Number randomised: 280<br>Number analysed: 201<br>Number lost to follow-up: 79<br>Sample: Recruited from health insurance company membership database<br>Age (years): Mean 76.1 (SD 4.1)<br>Sex: 44% women<br>Ethnicity: Not reported<br>Inclusion criteria: Community-dwelling adults; aged 70 to 90; fallen in the past 6 months or reported fear of falling<br>Exclusion criteria: Unable to walk independently; cognitive impairment (< 25 on the DSST) |
| Interventions | Type of intervention: Multiple intervention<br>1. "Strength and balance group": strength and balance exercises only (n = 63)<br>2. "Fitness group": strength and balance plus endurance training (n = 64)<br>3. "Multifaceted group": strength and balance plus fall-risk education (n = 73)<br>4. Control group: No intervention (n = 80)<br>Who delivered the intervention: Falls-prevention instructors<br>Compliance assessed: Yes, session observations and monthly supervision meetings |
| Outcomes | 1. Rate of falls<br>2. Adverse events of the intervention |
| Notes | Source of funding: Robert Bosch Foundation and Siemens Health Insurance<br>Conflicts of interest: None<br>Economic information: Not reported<br>Adverse events: “No significant adverse events were reported during the study” |
| ***Risk of bias*** | |

**Freiberger 2012** *(Continued)*

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "A third party not involved in the study applied a computerised random-number generator". |
| Allocation concealment (selection bias) | Low risk | Quote: "All randomisations were concealed". "A third party not involved in the study applied a computerised random-number generator". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Quote: "Data on falls were collected prospectively using a monthly fall calendar between months 12 and 24; fall sheets were mailed in at the end of the month. Up to five follow-up telephone calls were made in the event of no response after each month. If falls were reported, details were collected during a structured telephone interview". |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% loss to follow-up, losses unbalanced across groups. No reasons included for missing data<br>1. Multifaceted group: randomised n = 73, analysed n = 58<br>2. Strength and Balance intervention: randomised n = 63, analysed n = 49<br>3. Fitness intervention: randomised n = 64, analysed n = 48<br>4. Control (no intervention): randomised n = 80, analysed n = 52 |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Quote: "Data on falls were collected prospectively using a monthly fall calendar between months 12 and 24; fall sheets were mailed in at the end of the month. Up to five follow-up telephone calls were made in the event of no response after each month. If falls were reported, details were collected during a structured telephone interview". |

**Gallagher 1996**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Unclear<br>Length of follow-up: 6 months |

**Gallagher 1996** *(Continued)*

| | |
|---|---|
| Participants | Setting: Canada<br>Number randomised: 100<br><br>Number analysed: 100<br><br>Number lost to follow-up: 0<br>Sample: Community-dwelling volunteers<br>Age (years): Mean 74.6<br><br>Sex: 80% women<br><br>Ethnicity: 92% of participants were white<br>Inclusion criteria: Aged ≥ 60; fallen in previous 3 months<br>Exclusion criteria: None described |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Falls-reduction programme: 2 risk-assessment interviews of 45 minutes each. 1 counselling interview of 60 minutes showing video and booklet and results of risk assessment (n = 50)<br>2. Control: baseline interview and follow-up only. No intervention (n = 50)<br><br>Who delivered the intervention: Trained nurses were interviewers<br><br>Compliance assessed: Yes, checklist of recommendations re-checked at 6 months follow-up |
| Outcomes | 1. Rate of falls<br><br>2. Health-related quality of life (SF-36 0 - 100: endpoint score) |
| Notes | Source of funding: Not reported<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Method of randomisation not described |
| Allocation concealment (selection bias) | Unclear risk | Method of randomisation not described |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were monitored prospectively using a 2-week calender with a follow-up telephone call to ascertain details. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) | Unclear risk | Not applicable |

**Gallagher 1996** *(Continued)*

| | | |
|---|---|---|
| Hospital admission & medical attention | | |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Less than 20% missing outcome data, as no one dropped out of study<br>1. Falls reduction programme: randomised n = 50, analysed n = 50<br>2. Baseline interview and follow-up only: randomised n = 50, analysed n = 50 |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported. |
| Method of ascertaining falls | Low risk | Falls were monitored prospectively using a 2-week calender with a follow-up telephone call to ascertain details. |

**Hagovska 2016**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 2½ months |
| Participants | Setting: Slovak Republic<br>Number randomised: 80<br>Number analysed: 78<br>Number lost to follow-up: 2<br>Sample: Elderly patients from the region were referred for diagnosis treatment by psychiatrist/psychologist<br>Age (years): Mean 67.07<br>Sex: 48.5% women<br>Ethnicity: Not reported<br>Inclusion criteria: Mild cognitive impairment, encompassing subjective mild decrease in memory and attention domains, Age 65 - 75<br>Exclusion criteria: Moderate and severe cognitive deficits of MMSE, major depressive and anxiety disorder, cancer, significant visual and auditory damage, prior history of neurological disease or brain injury, psychiatric disorders |
| Interventions | Type of intervention: Multiple intervention<br>1. Multiple intervention: Cogniplus programme and balance training (n = 40)<br>2. Control: usual care (n = 40)<br>Who delivered the intervention: psychiatrist, psychologist<br>Compliance assessed: Not reported |
| Outcomes | 1. Health-related quality of life (Quality of life assessment 0 - 10: endpoint score) |
| Notes | Source of Funding: No funding |

**Hagovska 2016** *(Continued)*

| | |
|---|---|
| | Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "The project's data analyst generated a random sequence of numbers to arbitrarily select probands for the experimental group and control using Excel 2010". |
| Allocation concealment (selection bias) | Low risk | Quote: "These numbers were put in a subsequently sealed envelope. The project manager opened the envelope and informed participating persons of their assignment to either groups". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Quote: "patients were not told what kind of intervention they would undergo, training staff was not blinded". |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, losses are unbalanced across groups<br>1. Cogniplus programme + balance training: randomised n = 40, analysed n = 40<br>2. Usual care: randomised n = 40, analysed n = 38 (2 did not complete training, respiratory disease) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the abstract were reported |
| Method of ascertaining falls | Unclear risk | Not applicable |

**Hendriks 2008**

| | |
|---|---|
| Methods | Study design: RCT with economic evaluation (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |

**Hendriks 2008** *(Continued)*

| | |
|---|---|
| Participants | Setting: The Netherlands<br>Number randomised: 333<br><br>Number analysed: 258<br><br>Number lost to follow-up: 75<br><br>Sample: People who have visited an ED or a GP because of a fall<br><br>Age (years): Mean 74.8 (SD 6.4)<br><br>Sex: 68% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: ≥ 65 years; community-dwelling; history of a fall requiring visit to ED or GP; living in Maastricht area<br>Exclusion criteria: Not able to speak or understand Dutch; unable to complete questionnaires or interviews by telephone; cognitive impairment (< 4 on AMT4); long-term admission to hospital or other institution (> 4 weeks from date of inclusion); permanently bedridden; fully dependent on a wheelchair |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial intervention: Detailed assessment by geriatrician, rehabilitation physician, geriatric nurse; recommendations and indications for referral sent to participants' GPs. GPs could then take action if they agreed with the recommendations and/or referrals. Home assessment by OT; recommendations sent to participants and their GPs, and direct referral to social or community services for provision of technical aids and adaptations or additional support (n = 166)<br>2. Control: Usual care (n = 167)<br><br>Who delivered the intervention: GP, OT, geriatrician, geriatric nurse, rehabilitation physician.<br><br>Compliance assessed: Yes, structured recording forms after each assessment, structured face-to-face interviews and plenary group discussion with practitioners |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people sustaining recurrent falls<br><br>3. Number of people who experienced a fall that required medical attention<br><br>4. Health-related quality of life (EQ-5D utilities, range unclear: endpoint score) |
| Notes | Source of funding: The Netherlands Organisation for Health Research and Development Grants<br><br>Conflicts of interest: None<br><br>Economic information: Multifactorial intervention cost: EUR 4857; Control cost: EUR 4991 |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Randomisation was achieved by means of computerised alternative allocation and performed by an external agency". |
| Allocation concealment (selection bias) | Unclear risk | Quote: "Randomisation was achieved by means of computerised alternative allocation and performed by an external agency". |
| Blinding of participants and personnel (performance bias) | Unclear risk | Participants and personnel not blind to allocation group but effect of non-blinding unclear |

**Hendriks 2008** *(Continued)*

| | | |
|---|---|---|
| All outcomes | | |
| Blinding of outcome assessment (detection bias) Falls and fallers | Low risk | Quote: "Falls were recorded continuously by means of a falls calendar for 12 months after baseline". |
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Quote: "Falls were recorded continuously by means of a falls calendar for 12 months after baseline". |
| Incomplete outcome data (attrition bias) All outcomes | High risk | More than 20% missing outcome data, losses are unbalanced across groups with similar reasons for missing data<br>1. Multifactorial intervention: randomised n = 166, analysed n = 124 (16 health problems, 14 refused to participate, 5 died, 7 dropped out for other reasons)<br>2. Usual care: randomised n = 167, analysed n = 134 (21 health problems, 10 refused to participate, 1 died, 1 dropped out for other reasons) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Quote: "Falls were recorded continuously by means of a falls calendar for 12 months after baseline". |

**Hogan 2001**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Unclear<br>Length of follow-up: 24 months |
| Participants | Setting: Canada<br>Number randomised: 163<br>Number analysed: 139<br>Number lost to follow-up: 24<br>Sample: High-risk community-dwelling men and women<br>Age (years): Mean 77.6 (SD 6.8)<br>Sex: 72% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 65; fallen in previous 3 months; community-dwelling; ambulatory (with or without aid); mentally intact (able to give consent)<br>Exclusion criteria: Qualifying fall resulted in lower extremity fracture, resulted from vigorous or high-risk activities, because of syncope or acute stroke, or while undergoing active treatment in hospital |
| Interventions | Type of intervention: Multifactorial intervention |

**Hogan 2001** *(Continued)*

| | |
|---|---|
| | 1. Multifactorial intervention: 1 in-home assessment by a geriatric specialist (doctor, nurse, physiotherapist, or OT) lasting 1 to 2 hours. Intrinsic and environmental risk factors assessed. Multidisciplinary case conference (20 minutes). Recommendations sent to participants and participants' doctor for implementation. Participants referred to exercise class if problems with balance or gait and not already attending an exercise programme. Given instructions about exercises to do at home (n = 79)<br>2. Control: usual care: 1 home visit by recreational therapist (n = 84)<br><br>Who delivered intervention: Geriatrician, OT, physiotherapist, recreational therapist, physician, research assistant<br><br>Compliance assessed: Yes, assessors documented adherence to recommendations. Adherence was categorised as none, partial, or complete |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Number of people who experience 1 or more fall-related fractures<br><br>5. Number of people who experienced a fall that required hospital admission<br><br>6. Number of people who experienced a fall that required medical attention |
| Notes | Source of funding: Health Services Research and Innovation Fund of the Alberta Heritage Foundation for Medical Research<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Computer-generated. Stratified by number of falls in previous year: 1 or > 1 |
| Allocation concealment (selection bias) | Unclear risk | Sequence concealed in locked cabinet prior to randomisation |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Participants were asked to record the date of any falls on a calender which was to be returned monthly in a stamped addressed envelope. A research assistant also visited participants at 3 and 6 months after randomisation, and called them 12 months after randomisation. At these times, the research assistant asked about any more falls since the last contact. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | A research assistant also visited participants at 3 and 6 months after randomisation, and called them 12 months after randomisation. At these times, the research assistant asked about more falls-related information since the last contact. |
| Blinding of outcome assessment (detection bias) | Unclear risk | Quote: "Data concerning hospital and emergency department use were obtained from the Calgary Regional Health Authority for all subjects for the 6 months before and the 12 months after study entry. ICD-9 codes for classify- |

**Hogan 2001** *(Continued)*

| | | |
|---|---|---|
| Hospital admission & medical attention | | ing external causes of injury (i.e. E codes) for selected accidental falls (E880, E884.2, E885, E886.9, E887, E888) were used to identify fall-related use of hospital services". It does not specify blinding of research assistant. |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Multifactorial intervention: randomised n = 79, analysed n = 66 (2 died, 8 withdrew consent/non adherence to protocol, 2 admitted to an institution, 1 moved away)<br>2. Usual care: randomised n = 84, analysed n = 73 (5 died, 4 withdrew consent/non adherence to protocol, 1 admitted to an institution, 1 moved away) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Participants were asked to record the date of any falls on a calender which was to be returned monthly in a stamped addressed envelope. A research assistant also visited participants at 3 and 6 months after randomisation, and called them 12 months after randomisation. At these times, the research assistant asked about any more falls since the last contact. |

**Huang 2005**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 3 months |
| Participants | Setting:Taiwan<br>Number randomised: 141<br>Number analysed: 126<br>Number lost to follow-up: 15<br>Sample: People in hospital with a fall-related hip fracture. Most were community-dwelling as stated "the majority of older people with hip fracture who are discharged from hospital are at home..." Intervention included a home visit. 91% living with family<br>Age (years): Mean 77 (SD 7.6)<br>Sex: 69% women<br>Ethnicity: Not reported<br>Inclusion criteria: In hospital with fall-related hip fracture; aged ≥ 65; discharged within medical centre catchment area<br>Exclusion criteria: Cognitively impaired; too ill (comorbidities, unable to communicate or in intensive care unit) |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multifactorial intervention: Discharge planning intervention by masters-level gerontological nurse, from hospital admission until 3 months after discharge (first visit within 48 hours of admission, seen every 48 hours while in hospital, 1 home visit 3 to 7 days after discharge, available by phone 8am - 8pm 7 days/wk, phoned participant or care-giver once a week). Nurse created individualised discharge plan and facilitated set-up of home-care services etc. Participants provided with brochures on self-care for |

**Huang 2005** *(Continued)*

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|---|---|
| | hip fracture patients and fall prevention (environmental safety and medication issues). Nurse provided direct care and education on correct use of assistive devices, assessed rehabilitation needs, and collaborated with physicians to modify therapies (n = 70)<br>2. Control: usual discharge planning also by nurses, but not specialists. No brochures, written discharge summaries, home visits, or phone calls (n = 71)<br><br>Who delivered the intervention: Masters-level gerontological nurse<br><br>Compliance assessed: No |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people who experienced a fall that required hospital admission<br><br>3. Health-related quality of life (SF-36 0 - 100, overall, mental and physical subscales: endpoint score) |
| Notes | Source of funding: Funded by the National Science Council, Taiwan and Chung Gung University<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomly assigned using a computer-generated table |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | The discharge planning in the intervention group was conducted by a full-time geriatric nurse. Discharge planning in the control group was conducted by general nurses. Impact of non-blinding of participants and personnel unclear. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Participants kept a falls diary but it was unclear if diary was checked every month or at the end of the month or at the end of the 3-month intervention period. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% of missing outcome data,losses balanced across groups with similar reasons for missing data.<br><br>1. Discharge planning intervention: randomised n = 63, analysed n = 56 (7 left the study before discharge due to refusal of participation or changes in health status)<br><br>2. Usual discharge planning: randomised n = 63, analysed n = 55 (left the study before discharge due to refusal of participation or changes in health status) |

**Huang 2005** *(Continued)*

| | | |
|---|---|---|
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Participants kept a falls diary but it was unclear if diary was checked every month or at the end of the month or at end of the 3-month intervention period. |

**Huang 2010**

| | |
|---|---|
| Methods | Study design: Cluster RCT<br>Number of study arms: 4<br>Number of clusters: 4 villages<br>Study centres: Multiple centres<br>Length of follow-up: 18 months |
| Participants | Setting: Taiwan<br>Number of participants: 261<br>Number analysed: 163<br>Number lost to follow-up: 98<br>Sample: People registered as living in 4 randomly-selected villages<br>Age (years): Mean 71.5 (SD 0.64)<br>Sex: 48% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged > 65 years; living in a non-organised community of Taiwan<br>Exclusion criteria: Immobile; living outside registered living area |
| Interventions | Type of intervention: Multiple intervention<br>1. Education: 5 group teaching sessions over 5 months (medications, nutrition, environment (inside and outside), footwear) plus discussion (n = 61)<br>2. Tai Chi Chuan: 13 simple movements, 40 minutes, 3 a week for 20 weeks (n = 65)<br>3. Tai Chi Chuan + education (n = 85)<br>4. Control (n = 50)<br>Who delivered intervention: Coaches, community nurses<br>Compliance assessed: No |
| Outcomes | 1. Number of people sustaining 1 or more falls |
| Notes | Source of funding: National Science Council, Taiwan<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Huang 2010** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "The three intervention groups and one control group were then assigned randomly to one each of the four selected villages." |
| Allocation concealment (selection bias) | Unclear risk | Insufficent information to make a judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact on non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | No information provided on how falls were recorded |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, due to participants moving, hospitalisation or they had died<br>1. Education: randomised n = 61, analysed n = 29<br>2. Tai Chi Chuan: randomised n = 65, analysed n = 31<br>3. Tai Chi Chuan + education: randomised n = 85, analysed n = 56<br>4. Control: randomised: randomised n = 50, analysed n = 47 |
| Selective reporting (reporting bias) | Unclear risk | Insufficent information to make a judgement |
| Method of ascertaining falls | Unclear risk | No information provided on how falls were recorded |
| Relating to cluster randomisation | High risk | Recruitment bias: villages were randomised prior to screening, however, all eligible participants within a cluster were invited to participate (low risk)<br>Baseline imbalance: baseline imbalance between intervention arms (high risk)<br>Loss of clusters: no clusters lost from the trial (low risk)<br>Incorrect analysis: the trial did not adjust for clustering (high risk)<br>Comparability: only 1 trial for this comparison (unclear risk) |

**Huang 2011**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 3<br>Study centres: unclear |

**Huang 2011** *(Continued)*

| | |
|---|---|
| | Length of follow-up: 5 months |
| Participants | Setting: Taiwan<br>Number randomised: 186<br><br>Number analysed: 176<br><br>Number lost to follow-up: 10<br>Sample: Randomly-selected sample of registered households in Yi-Lan county<br>Age (years): Not reported<br><br>Sex: 59% women<br><br>Ethnicity: Taiwanese<br>Inclusion criteria: Aged ≥ 60; community-dwelling; able to communicate in Mandarin or Taiwanese<br>Exclusion criteria: Cognitively impaired; artificial leg or leg brace; unstable health problems or terminally ill |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Cognitive behavioural intervention: 60 to 90 minutes once a week for 8 weeks, in groups of 8 to 12. Promoting view that fall risk and fear of falling is controllable (n = 62)<br><br>2. Cognitive behavioural intervention + intense Tai Chi: as above plus Tai Chi 60 minutes, 5 times a week for 8 weeks, in groups of 10 to 16 (n = 62)<br><br>3. Control: no intervention (n = 62)<br><br>Who delivered intervention: 2 professional Tai Chi instructors and nurse with CB experience<br><br>Compliance assessed: No |
| Outcomes | 1. Rate of falls<br><br>2. Number of people who experienced 1 or more falls<br><br>3. Health-related quality of life (WHOQOL-BREF 16 - 80: endpoint score) |
| Notes | Source of funding: National Science Council, Taiwan<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "The first author used a computer-developed random table to randomly assign patients to three intervention groups … " |
| Allocation concealment (selection bias) | Low risk | Quote: "Allocation was concealed from the recruiting RA" |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Insufficent information to make a judgement |

**Huang 2011** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Cognitive behavioural intervention: randomised n = 62, analysed n = 60 (2 did not complete intervention)<br>2. Cognitive behavioural intervention + intense Tai Chi: randomised n = 62, analysed n = 60 (2 did not complete intervention)<br>3. Control: no intervention: randomised n = 62, analysed n = 56 (6 did not complete intervention) |
| Selective reporting (reporting bias) | Unclear risk | Insufficent information to make a judgement |
| Method of ascertaining falls | Unclear risk | No information provided on how falls were recorded |

**Imhof 2012**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 9 months |
| Participants | Setting: Switzerland<br>Number randomised: 461<br>Number analysed: 413<br>Number lost to follow-up: 48<br>Sample: Various health organisations such as local hospitals, home care organisations and church social services, and by community nurses and family physicians extended the invitation to 1182 participants<br>Age (years): Mean 85<br>Sex: 73%<br>Ethnicity: All white<br>Inclusion criteria: Community-dwelling individuals<br>Exclusion criteria: Individuals aged 80 years or older |
| Interventions | Type of intervention: Multifactorial intervention |

**Imhof 2012** *(Continued)*

| | |
|---|---|
| | 1. Usual care and advanced practice nurse home consultation programme: individualised interventions, 4 home visits, 3 follow-up telephone calls (n = 231)<br><br>2. Control: standard care (n = 230)<br><br>Who delivered the intervention: Community health nurses, physicians, physiotherapists, OTs<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people who experienced 1 or more falls<br><br>2. Number of people who experienced a fall that required hospital admission<br><br>3. Health-related quality of life |
| Notes | Source of Funding: Age Foundation Zurich, Ebnet foundation Teufen, Heinrich and Ema Walder Foundation Zurich and City of Winterthur<br><br>Conflicts of interest: Conflict of interest acknowledged as study was funded by Age foundation Zurich, Ebnet foundation Teufen, Heinrich and Ema Walder Foundation Zurich and City of Winterthur.<br><br>Economic information: Intervention cost is approximately USD 1250 per participant |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "After the second assessment visit, participants were randomly assigned to the intervention or control group using a computer generated list of random numbers with a one to one sequence". |
| Allocation concealment (selection bias) | Low risk | Quote: " A person who was not involved in the recruitment of study participants or data collection prepared sealed envelopes with group assignment. The APN opened the envelope at the end of the visit, and the participant was informed about group allocation". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Particants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Quote: "Particpants were asked have you had a fall and been in hospital in the last 3 months" |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, balanced losses across groups with similar reasons for missing data<br><br>1. Usual care and advanced practice nurse home consultation programme: randomised n = 231, analysed n = 207, (12 withdrew participation, 4 admitted to long-term care, 8 died) |

**Imhof 2012** *(Continued)*

| | | |
|---|---|---|
| | | 2. Standard care: randomised n = 230, analysed n = 206, (10 withdrew participation, 7 admitted into long-term care, 7 died ) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the Methods were reported |
| Method of ascertaining falls | High risk | Retrospective by 3-month period |

**Jitapunkul 1998**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Unclear<br>Length of follow-up: 36 months |
| Participants | Setting: Thailand<br>Number randomised: 160<br>Number analysed: 116<br>Number lost to follow-up: 44<br>Sample: People recruited from a sample for a previous study in Thai elderly persons<br>Age (years): Mean 75.6 (SD 5.8)<br>Sex: 65% women<br>Ethnicity: Thai<br>Inclusion criteria: Aged ≥ 70; living at home<br>Exclusion criteria: None stated |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Home visit group: Home visit from non-professional personnel with structured questionnaire. 3-monthly visits for 3 years. Referred to nurse/geriatrician (community-based) if Barthel ADL index and/or Chula ADL index declined ≥ 2 points, or ≥ 1 fall in previous 3 months. Nurse/geriatrician would visit, assess, educate, prescribe drugs/aids, provide rehabilitation programme, make referrals (n = 80)<br>2. Control: no intervention. Visit at the end of 3 years (n = 80)<br>Who delivered the intervention: Non-professional personnel, nurses, geriatrician<br>Compliance assessed: No |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Number of people who experienced a fall that required hospital admission<br>3. Number of people who experienced a fall that required medical attention<br>4. Health-related quality of life (Barthel Index 0 - 20: endpoint score) |
| Notes | Source of funding: The Rachada-Piseksompoj China Medical Board Research Funds<br>Conflicts of interest: Not reported |

**Jitapunkul 1998** *(Continued)*

| | |
|---|---|
| | Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "... divided into case group (n = 80) and control group (n = 80) at random." Insufficient information to permit judgement |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Self-reports by study participants and visits by non-professional personnel once every 3 months |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Insufficient information to permit judgement |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Home visit group: randomised n = 80, analysed n = 57 (10 moved elsewhere, 13 died)<br>2. Control: randomised n = 80, analysed n = 59 (8 moved elsewhere, 13 died) |
| Selective reporting (reporting bias) | Unclear risk | Insufficient information to permit judgement |
| Method of ascertaining falls | High risk | Self-reports by study participants and visits by non-professional personnel once every 3 months |

**Kingston 2001**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 3 months |
| Participants | Setting: United Kingdom<br>Number randomised: 109<br>Number analysed: 92 |

**Kingston 2001** *(Continued)*

| | |
|---|---|
| | Number lost to follow-up: 17<br>Sample: Community-dwelling women attending A&E with a fall<br>Age (years): Mean 71.9<br><br>Sex: 100% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Female; aged 65 to 79; history of a fall; discharged directly to own home<br>Exclusion criteria: Admitted from A&E to hospital or any form of institutional care |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1.Health Visitor intervention: Rapid Health Visitor intervention within 5 working days of index fall: pain control and medication, how to get up after a fall, education about risk factors (environmental and drugs, alcohol etc), advice on diet and exercise to strengthen muscles and joints. (n = 60)<br>2. Control: usual post-fall treatment, i.e. letter to GP from A&E detailing the clinical event, any interventions carried out in hospital and recommendations about follow-up (n = 49)<br><br>Who delivered intervention: Health visitor, physician<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Health-related quality of life |
| Notes | Source of funding: Not reported<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "randomly allocated" |
| Allocation concealment (selection bias) | Unclear risk | Quote: "randomly allocated". Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Insufficient information to permit judgement |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |

**Kingston 2001** *(Continued)*

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, unbalanced losses across groups with unspecified reasons for missing data<br><br>1. Health Visitor intervention: randomised n = 60, analysed n = 51 (unspecified reasons for lost to follow-up)<br><br>2. Usual post-fall treatment : randomised n = 49, analysed n = 41 (unspecified reasons for lost to follow-up) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Insufficient information to permit judgement |

**Lightbody 2002**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br><br>Number of study arms: 2<br><br>Study centres: Single centre<br><br>Length of follow-up: 6 months |
| Participants | Setting: United Kingdom<br><br>Number randomised: 348<br><br>Number analysed: 314<br><br>Number lost to follow-up: 34<br>Subjects: Consecutive patients attending A&E with a fall<br>Age (years): Median (IQR) 75 (70 to 81)<br><br>Sex: 74% women<br><br>Ethnicity: Not reported, but all participants resided in Liverpool, U.K<br>Inclusion criteria: Aged > 65, patients attending A&E with a fall<br>Exclusion criteria: Admitted to hospital as result of index fall, living in institutional care, refused or unable to consent, lived out of the area |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial assessment: Multifactorial assessment by falls nurse at 1 home visit (medication, ECG, blood pressure, cognition, visual acuity, hearing, vestibular dysfunction, balance, mobility, feet and footwear, environmental assessment). Referral for specialist assessment or further action (relatives, community therapy services, social services, primary care team. No referrals to day hospital or hospital outpatients). Advice and education about home safety and simple modifications, e.g. mat removal (n = 171)<br>2. Control: usual care (n = 177)<br><br>Who delivered intervention: Therapists, clinicians, nurse, relatives, community therapy services, social services, primary care team<br><br>Compliance assessed: No |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls |

**Lightbody 2002** *(Continued)*

| | |
|---|---|
| | 3. Health-related quality of life (Barthel Index 0 - 20: endpoint score) |
| Notes | Source of funding: North West Region NHS Executive and supported by Liverpool and Wirral Research and Development Liason Group<br><br>Conflicts of interest: Not reported<br><br>Economic information: Cost savings of GBP 11,719 in intervention group and GBP 37,951 in control group was reported in the cost evaluation of falls-related bed days. |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Patients were block-randomized consecutively to groups". Insufficient information to permit judgement |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Falls detection was by daily falls diary, and retrospective questionnaire at 6 months |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | GP records were reviewed and hospital databases interrogated for attendances and admissions |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br><br>1. Multifactorial assessment: randomised n = 171, analysed n = 155 ( 2 withdrew, 11 died, 3 lost to follow-up)<br><br>2. Usual care: randomised n = 177, analysed n = 159 ( 10 withdrew, 7 died, 1 lost to follow-up). |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Falls detection was by daily falls diary, and retrospective questionnaire at 6 months |

**Logan 2010**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br><br>Number of study arms: 2 |

**Logan 2010** *(Continued)*

| | |
|---|---|
| | Study centres: Unclear<br><br>Length of follow-up: 12 months |
| Participants | Setting: United Kingdom<br>Number randomised: 204<br><br>Number analysed: 157<br><br>Number lost to follow-up: 47<br>Sample: People living in the 4 primary care trust areas<br><br>Age (years): Median (IQR) 83 (77 to 86)<br><br>Sex: 65% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 60; living at home or in a care home (participants were predominantly community-dwelling - only 5% in care home or hospital); called for an ambulance after a fall and not taken to hospital, or taken to hospital but not admitted<br>Exclusion criteria: Receiving a falls prevention services (in geriatric day hospitals or hospital outpatient departments) |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Individualised Multifactorial Intervention Programme: Referred to multidisciplinary falls-prevention service for assessment and interventions. Tailored interventions including balance training, muscle strengthening, reduction of environmental hazards, education about how to get off the floor, and provision of equipment. If medical assessment required for medication check or visual problems, referred to GP in first instance and then to the community geriatrician if necessary (n = 102)<br>2. Control: No intervention by falls-prevention service (n = 102)<br><br>Who delivered the intervention: Physiotherapists, OTs, social care workers, nurses, doctors.<br><br>Compliance assessed: No |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining 1 or more fall-related fractures<br><br>4. Number of people who experienced a fall that required hospital admission<br><br>5. Health-related quality of life (Barthel Index 0 - 20: endpoint score) |
| Notes | Source of funding: Postdoctoral training scholarship awarded to principal investigator from the UK NHS National Institute of Health Research<br><br>Conflicts of interest: None<br><br>Economic information: Reported in a separate publication (Sach 2012). The mean total NHS and personal social service cost per participant (mean and SD) during the 12-month follow-up period (excluding participant and carer costs) was Intervention: GBP 15,266 (SD GBP 13,504); Control: GBP 16,818 (SD GBP 14,210) giving an MD of GBP −1551 (95% CI: GBP −5932 to GBP 2829). Total costs Intervention: GBP 19,032.9 (17,055.79); Control: GBP 19,129.83 (14,930.35); MD −96.92 (95% CI −5140.92 to 4947.07). |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Logan 2010** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Nottingham Clinical Trials Unit produced a computer generated randomisation scheme with stratification by primary care trust" |
| Allocation concealment (selection bias) | Low risk | Quote: "The allocation sequence was concealed until allocation. After written consent had been obtained, PAL accessed the randomisation sequence through the internet and assigned the participants to their group." |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Quote: "It was not possible to blind the participants and treating therapists to allocation group as they would be aware of receiving or giving falls rehabilitation." Impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Quote: "Data on falls were recorded monthly using a diary" |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Additional outcome measures in this study included falls-related fractures over 12 months which were determined by a researcher blind to allocation by checking the Nottingham University Hospital computer system |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Requiring hospitalisation and medical attention was determined by a researcher blind to allocation by checking the Nottingham University Hospital computer system. The East Midlands Ambulance Service computer system was also checked to determine the number of emergency ambulance calls received for falls over 12 months and the number of such participants taken to an accident and emergency |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br><br>1. Individualised Multifactorial Intervention Programme: randomised n = 102, analysed n= 82 (4 withdrew, 16 died)<br><br>2. No intervention: randomised n= 102, analysed n= 75 ( 8 withdrew, 19 died) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Quote: "Data on falls were recorded monthly using a diary" |

**Lord 2005**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br><br>Number of study arms: 3<br><br>Study centres: Single centre<br><br>Length of follow-up: 12 months |
| Participants | Setting: Australia<br>Number randomised: 620<br><br>Number analysed: 578<br><br>Number lost to follow-up: 42 |

**Lord 2005** *(Continued)*

| | |
|---|---|
| | Sample: Health insurance membership database<br>Age (years): Mean 80.4 (SD 4.5)<br><br>Sex: 66% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Low score on PPA test; community-dwelling; ≥ 75 years<br>Exclusion criteria: Minimal English language skills; blind; Parkinson's disease; cognitive impairment |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Extensive intervention: Individualised exercise intervention (2 a week for 12 months), visual intervention, peripheral sensation counselling intervention (n = 210)<br>2. Minimal intervention. Participants received a report outlining their falls risk, a profile of their test results, and specific recommendations on preventing falls based on their test performances (n = 206)<br>3. Control: no intervention (received minimal intervention after 12-month follow-up) (n = 204)<br><br>Who delivered the intervention: Eye specialist, fitness instructors and primary care physicians<br><br>Compliance assessed: Yes, self-reported participant compliance at 6 months. |
| Outcomes | 1. Rate of falls<br>2. Number of people who sustained 1 or more falls<br><br>3. Number of people who sustained recurrent falls |
| Notes | Source of funding: The National Health and Medical Research Council (POPI Partnership in Injury and Project Grants), MBF Australia, and the Vincent Fairfax Family Foundation<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "randomised in matched blocks N = 20 ... using concealed allocation (drawing lots)". |
| Allocation concealment (selection bias) | Unclear risk | Quote: "concealed allocation" |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Blinding of participants and treatment personnel not mentioned in report, but unlikely. Insufficient evidence to make judgement on impact of lack of blinding |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were monitored for 1 year using monthly fall calendars. When a fall occurred, specific details about fall injuries were obtained from telephone interviews. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |

**Lord 2005** *(Continued)*

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br><br>1. Extensive intervention group: randomised n = 210, analysed n = 192 (4 dropped out due to ill health, 1 died, 1 moved residence, 12 withdrew consent)<br><br>2. Minimal intervention group: randomised n = 206, analysed n= 189 (1 dropped out due to ill health, 1 moved residence, 15 withdrew consent)<br><br>3. Control: randomised n = 204, analysed n = 197 (1 dropped out due to ill health, 3 died, 3 withdrew consent) |
| Selective reporting (reporting bias) | Unclear risk | Methods state that a short-Form 12 Health Status Questionnaire was used to provide validated assessments of physical and mental health but not reported in Results |
| Method of ascertaining falls | Low risk | Falls were monitored for 1 year using monthly fall calendars. When a fall occurred, specific details about fall injuries were obtained from telephone interviews. |

**Luck 2013**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br><br>Number of study arms: 2<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 18 months |
| Participants | Setting: Germany<br>Number randomised: 305<br><br>Number analysed: 230<br><br>Number lost to follow-up: 75<br><br>Sample: Participants were recruited from healthcare settings (general practices, general hospitals) and by mail (general population with addresses provided by local registration)<br><br>Age (years): 85.3<br><br>Sex: 68.5%<br><br>Ethnicity : Not reported<br><br>Inclusion criteria: Living at home, aged 80 years or older, functional impairment in at least 3 activities of daily living<br>Exclusion criteria: People with insufficient knowledge of German language, cognitive impairment, an inability to give informed consent, a level of care higher than 1 ( according to German long-term care insurance) |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial intervention: Multidimensional geriatric assessment, case review (individualised intervention and recommendation), home counselling visit, booster session, falls prevention (n = 150)<br><br>2. Control: No preventive home visits (n = 155)<br><br>Who delivered the intervention: Multidisciplinary team (nurse, scientist, psychologist, geronto-psychiatrist), nutritionist, social worker |

**Luck 2013** *(Continued)*

| | |
|---|---|
| | Compliance assessed: Yes, obstacles and facilitators to adherence were assessed at booster sessions, recommendations were re-emphasised and further assistance was provided. |
| Outcomes | 1. Rate of falls |
| Notes | Source of funding: Supported by grants from the German Federal Ministry of Education and Research (01GT0601,01GT0604) as part of the German Nursing Research Network<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Participants were randomised to an intervention group or to a control group using balanced blockwise randomization stratified by center". Insufficent information but likely to be computer-generated |
| Allocation concealment (selection bias) | Unclear risk | Insufficent information |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Falls were assessed retrospectively by asking questions, no use of diary or postcards |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, unbalanced losses across groups with no reasons for missing data<br><br>1. Multifactorial intervention: randomised n = 150 analysed n = 118, (32, no reasons)<br><br>2. No preventive home visits: randomised n = 155, analysed n = 112, (43, no reasons) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the Methods section were reported |
| Method of ascertaining falls | High risk | Falls were assessed retrospectively by asking questions, without use of diary or postcards. |

**Markle-Reid 2010**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br><br>Number of study arms: 4<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 6 months |
| Participants | Setting: Canada<br>Number randomised: 109<br><br>Number analysed: 92<br><br>Number lost to follow-up: 17<br><br>Sample: Adults newly-referred to, and eligible for, home support services<br><br>Age: Range 75 to 84<br><br>Sex: 72% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 75; community-dwelling (not in nursing home or long-term care facility); "at risk of falls" (fallen in past 12 month, fear of falling, unsteady on feet)<br>Exclusion criteria: Not mentally competent; not competent in English or with a translator available |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial and Interdisciplinary Team Approach: Standard home services + home visits by health professionals (n = 54)<br>2. Control usual care: standard home services (n = 55)<br><br>Who delivered intervention: Community care access centre (CCAC) case manager, registered nurse, OT, physiotherapist, registered dietician<br><br>Compliance assessed: Yes, monitoring and evaluating the plan of care on an ongoing basis through in-home assessments with clients |
| Outcomes | 1. Rate of falls<br><br>2. Health-related quality of life (SF-36 0 - 100, mental and physical subscales: endpoint score) |
| Notes | Source of funding: Canadian Patient Safety Institute (CPSI), Community Care Access Centre of Halton, McMaster University System-Linked Research Unit on Health and Social Services Utilization, and Ontario Ministry of Health and Long-Term Care, Community Care Access Centre of Halton, Hamilton Niagara<br>Haldimand Brant Community Care Access Centre, Mississauga Halton Community Care Access Centre, Halton Region Health Department, Community Rehab, Ellen Williams, Brant Arts Dispensary, and Dr. Heather H. Keller, Department of Family Relations and Applied Human Nutrition, Macdonald Institute, University of Guelph<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "randomly generated numbers constructed by a biostatistician who was not involved in the recruitment process" |

**Markle-Reid 2010** *(Continued)*

| | | |
|---|---|---|
| Allocation concealment (selection bias) | Low risk | Quote: "Randomization was achieved using consecutively numbered, sealed, opaque envelopes containing randomly generated numbers constructed by a biostatistician who was not involved in the recruitment process." |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data,unbalanced losses across groups with similar reasons for missing data<br>1. Multifactorial and Interdisciplinary Team Approach: randomised n = 54, analysed n = 49, (3 died, 2 refused treatment)<br>2. Usual care: randomised n = 55, analysed n = 43, (4 died, 8 refused treatment) |
| Selective reporting (reporting bias) | High risk | Different outcomes stated in clinical trials register compared to full-text publication |
| Method of ascertaining falls | Unclear risk | Not applicable |

**Mendoza-Ruvalcaba 2015**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 6 months |
| Participants | Setting: Mexico<br>Number randomised: 72<br>Number analysed: 64<br>Number lost to follow-up: 8<br>Sample: From senior centre<br>Age (years): 70.6<br>Sex: 89% women |

**Mendoza-Ruvalcaba 2015** *(Continued)*

| | |
|---|---|
| | Ethnicity : Not reported<br><br>Inclusion criteria: Age 60 years or older, availability to attend sessions at least twice a week, willingness to participate in the programme, and being literate<br>Exclusion criteria: Depressive symptomatology measured by the Spanish version of the Geriatric Depression Scale and cognitive impairment determined by the Mini-Mental State Examination. |
| Interventions | Type of intervention: Multiple intervention<br><br>1. I am active programme: reality orientation, physical activity, nutritional education, cognitive exercises (n = 36)<br>2. Waitlist: (n = 36)<br><br>Who delivered the intervention: Trainer<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Health-related quality of life (Spanish version of Quality of Life Index 0 - 30, overall, psychological, and health and functionality subscales: endpoint score) |
| Notes | Source of funding: Not reported<br><br>Conflicts of interest: None<br><br>Economic information: It was found that participants in the programme showed improvements after the intervention (post-test) in social and economic status (P < 0.05, d = 0.59), with medium effect sizes of d = 0.59, respectively, which declined at follow-up to small effect sizes (d = 0.27). |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Insufficient information |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact on blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, unbalanced losses across groups with no reasons for missing data<br><br>1. I am active programme: randomised n = 36, analysed n = 31, (5 missing, no reasons) |

**Mendoza-Ruvalcaba 2015** *(Continued)*

| | | |
|---|---|---|
| | | 2. Waitlist: randomised n = 36, analysed n = 33, (3 missing, no reasons) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in Methods are reported in Results |
| Method of ascertaining falls | Unclear risk | Not applicable |

**Metzelthin 2013**

| | |
|---|---|
| Methods | Study Design: Cluster RCT<br>Number of study arms: 2<br>Number of clusters: 12<br>Study centres: Multiple centres<br>Length of follow-up: 24 months |
| Participants | Setting: The Netherlands<br>Number randomised: 346<br>Number analysed: 270<br>Number lost to follow-up: 76<br>Sample: They invited all general practices in the region of Sittard, The Netherlands and its surrounding area that had no current active and systematic policy for the detection and follow-up of frail older people to take part in the study<br>Age (years): Mean 77.2 (S.D, 5.1)<br>Sex: 58% women<br>Ethnicity : Not reported<br>Inclusion criteria: Community-dwelling frail older patients (70 years or older)<br>Exclusion criteria: Terminally ill, confined to bed, had severe cognitive or psychological impairments, unable to communicate in Dutch |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Prevention of care approach: Frailty screening, assessment, analysis and preliminary treatment plan, agreement on treatment plan, executing treatment plan, evaluation and follow-up (n = 193)<br>2. Control: usual care (n = 153)<br>Who delivered the intervention: Practice nurses, general practitioner, occupational therapist, physical therapist, pharmacist geriatrician<br>Compliance assessed: Not reported |
| Outcomes | 1. Health-related quality of life |
| Notes | Source of Funding: Funded by the Dutch National care for the elderly programme by The Netherlands Organisation for Health Research and Development<br>Conflicts of interest: Not reported |

**Metzelthin 2013** *(Continued)*

| | |
|---|---|
| | Economic information: mean total healthcare costs Intervention group: GBP 26,503; Control: GBP 20,550 |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "stratified the practices in pairs and used a computer generated randomisation list to randomise into intervention or control". |
| Allocation concealment (selection bias) | Unclear risk | Insufficent information |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data,unbalanced losses across groups with similar reasons for missing data<br>1. Prevention of care approach: randomised n = 193, analysed n = 143, (15 died, 8 admitted, 12 health problems, 8 lost interest, 7 other reasons)<br>2. Usual care: randomised n = 153 , analysed n = 127(10 died, 5 admitted, 4 health problems, 6 lost interest, 1 other reasons) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the abstract were reported |
| Method of ascertaining falls | Unclear risk | Not applicable |
| Relating to cluster randomisation | Low risk | Recruitment bias: GP practices were randomised prior to screening, but all eligible participants within a cluster were invited to participate (low risk)<br>Baseline imbalance: baseline similar between intervention arms (low risk)<br>Loss of clusters: no clusters lost from the trial (low risk)<br>Incorrect analysis: the trial adjusted for clustering (low risk)<br>Comparability: results comparable with individually-randomised trials (low risk) |

**Möller 2014**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br><br>Number of study arms: 2<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 12 months |
| Participants | Setting: Sweden<br>Number randomised: 153<br><br>Number analysed: 106<br><br>Number lost to follow-up: 47<br><br>Sample: The sample was recruited through the municipal home care organization (n = 13), from 3 care centres in the municipality (n = 117), 3 clinics at a nearby University hospital (n = 20), or by own referral (n = 3).<br><br>Age (years): Mean 81.5 (S.D, 6.4)<br><br>Sex: 67% women<br><br>Ethnicity : Not reported<br><br>Inclusion criteria: Aged 65 years or older, resident in the study municipality, need of help with at least 2 activities of daily living, admitted to hospital at least twice or have had at least 4 outpatient contacts during the previous 12 months. The participants had to be able to communicate verbally and to have no cognitive impairments (i.e. a score of ≥ 25 in MMSE)<br>Exclusion criteria: None |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Home-based case management intervention: Falls risk assessment, tailored exercise programme, referral to physical therapist, home safety assessment with corrections (n = 80)<br><br>2. Control: Usual care (n = 73)<br><br>Who delivered the intervention: Nurses, physiotherapists<br><br>Compliance assessed: No |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people sustaining recurrent falls<br><br>4. Number of people requiring medical attention (e.g. attendance at emergency department, requiring GP consultation) |
| Notes | Source of Funding: Faculty of Medicine at Lund University, the Swedish Institute for Health Sciences, Region Skane, the Governmental Funding of Clinical Research within the NHS (ALF), the Swedish Research Council, the Greta and Johan Kock Foundation, and the Magnus Bergval Foundation.<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|

**Möller 2014** *(Continued)*

| | | |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Not reported |
| Allocation concealment (selection bias) | Low risk | Sealed envelopes |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Falls were self-reported in the last 3 months |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Medical attention self-report |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, balanced losses across groups with similar reasons for missing data.<br>1. Home-based case management intervention: randomised n = 80, analysed n = 56, (9 died, 15 declined to participate)<br>2. Usual care: randomised n = 73 , analysed n = 50 (3 died, 18 declined to participate, 2 lost to follow-up) |
| Selective reporting (reporting bias) | Low risk | All in Methods section reported in Results |
| Method of ascertaining falls | High risk | Retrospective self-report in the last 3 months |

**Neelemaat 2012**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 3 months |
| Participants | Setting: The Netherlands<br>Number randomised: 210<br>Number analysed: 150<br>Number lost to follow-up: 60<br>Sample: Malnourished older adults newly admitted to an acute hospital (general internal medicine, rheumatology, gastroenterology, dermatology, nephrology, orthopaedics, traumatology, or vascular |

**Neelemaat 2012** *(Continued)*

| | |
|---|---|
| | surgery) and discharged into the community (not all community-dwelling, but 88% were prior to admission)<br><br>Age (years): Mean 74.5 (SD 9.5)<br><br>Sex: Not reported<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Aged ≥ 60; expected length of hospital stay > 2 days; malnourished (BMI ≤ 20.0 kg/m$^2$, 5% or more self-reported unintentional weight loss in the previous month, or 10% or more self-reported unintentional weight loss in the previous 6 months)<br><br>Exclusion criteria: Dementia |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Nutritional intervention (energy- and protein-enriched diet, oral nutritional supplements, calcium-vitamin D supplement, telephone counselling by a dietitian (n = 105)<br>2. Control: usual care (n = 105)<br><br>Who delivered the intervention: Dietician<br><br>Compliance assessed: Yes. "The dietitian contacted participants by telephone". |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people who experienced 1 or more fall-related fractures |
| Notes | Source of funding: The Netherlands Organisation for Health Research and Development (ZonMw)<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| **Bias** | **Authors' judgement** | **Support for judgement** |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "A computerized random number generator was used to assign participants in blocks of 10 to the control or intervention group". |
| Allocation concealment (selection bias) | Low risk | Quote: " the primary investigator (FN) opened a consecutively numbered opaque envelope containing the participant's group assignment". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Quote: "Participants recorded their falls weekly, and were asked to return their first diary by mail 6 weeks after discharge from hospital. In a few cases, sending back the diary was not possible, and the information on falls was obtained over the telephone". |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Not applicable |

**Neelemaat 2012** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Low risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | High risk | More than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Nutritional intervention: randomised n = 105, analysed n = 75 (16 withdrew, 14 died during the study)<br>2. Usual care: randomised n =105, analysed n = 75 (19 withdrew, 11 died during the study) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported. |
| Method of ascertaining falls | Low risk | Prospective weekly recording, and telephone call |

**Newbury 2001**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: Australia<br>Number randomised: 100<br>Number analysed: 89<br>Number lost to follow-up: 11<br>Sample: Every 20th name in an age-sex register of community-dwelling patients registered with 6 general practices (63% women)<br>Age: Median (intervention group) 78.5; (control group) 80, range 75 - 91<br>Sex: 63% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 75; independently community-dwelling<br>Exclusion criteria: None reported |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Health assessment of people aged 75 years or older by nurse (75+HA). Problems identified were counted and reported to participant's GP. No reminders or other intervention for 12 months (n = 50)<br>2. No 75+HA until 12 months after randomisation (n = 50)<br>Who delivered intervention: Nurse<br>Complaince assessed: Not reported |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Health-related quality of life |

**Newbury 2001** *(Continued)*

| | |
|---|---|
| Notes | Source of funding: General Practice Evaluation Prgram, Commonwealth Dept of Health and Aged Care<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomisation by random numbers |
| Allocation concealment (selection bias) | Low risk | Sequentially-numbered sealed envelopes |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Self-report by participant, timeframe not specified |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. 75+HA: randomised n = 50, analysed n = 45 (1 died, 1 too unwell, 3 discontinued)<br>2. No 75+HA: randomised n = 50, analysed 44 (5 died, 1 declined) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Self-report by participant, time frame not specified |

**Ng 2015**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 5 (3 eligible)<br>Study centres: Single centre<br>Length of follow-up: 12 months |

**Ng 2015** *(Continued)*

| | |
|---|---|
| Participants | Setting: Singapore<br>Number randomised: 246 (147 eligible)<br><br>Number analysed: 228<br><br>Number lost to follow-up: 18<br><br>Sample: Community<br><br>Age (years): Mean 70 (SD 4.7)<br><br>Sex: 61% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Aged 65 years and above, able to walk without personal assistance, and living at home. Pre-frail or frail defined as at least 1 of: unintentional weight loss, slowness, weakness, exhaustion, and low activity<br>Exclusion criteria: Significant cognitive impairment (MMSE score ≤ 23), major depression, severe audiovisual impairment, any progressive degenerative neurologic disease, terminal illness with life expectancy < 12 months; were participating in other interventional studies, or were unavailable to participate for the full duration of the study |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Combination: Physical activity, nutritional supplements,cognitive training (n = 49)<br><br>2. Physical exercise: Resistance exercises (integrated with functional tasks); and balance training exercises (involving functional strength and sensory input) (n = 48)<br><br>3. Usual care: Placebo (n = 50)<br><br>Who delivered the intervention: Interventional nurses<br><br>Compliance assessed: Yes, adherence of participants to the intervention was determined by averaged proportion of supplements consumed and sessions completed. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people who experience a fall that required hospital admission<br><br>3. Adverse events of the intervention |
| Notes | Source of Funding: National Medical Research Council (Singapore)<br><br>Conflicts of interest: None<br><br>Economic information: Not reported<br><br>Adverse events: “2 subjects who participated in exercise training had joint pain (hip and knee) initially, that was relieved after adjusting the training regime. No other adverse events occurred during the study” |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Central computerised randomisation procedure |
| Allocation concealment (selection bias) | Low risk | Treatment was allocated by a project manager not involved in the enrolment, intervention or assessment. |

**Ng 2015** *(Continued)*

| | | |
|---|---|---|
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Self-reported by participant, time frame not specified |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Self-reported by participant |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Combination: randomised n = 49, analysed n = 46 (3 withdrew)<br>2. Physical exercise: randomised n = 48, analysed n = 46 (1 withdrew, 1 unable to contact)<br>3. Placebo: randomised n = 50, analysed n = 46 (3 withdrew, 1 died) |
| Selective reporting (reporting bias) | Low risk | All outcomes given in Methods are reported in Results |
| Method of ascertaining falls | Unclear risk | Self-reported by participant, time frame not specified |

**Olsen 2014**

| | |
|---|---|
| Methods | Study Design: RCT(parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Norway<br>Number randomised: 89<br>Number analysed: 70<br>Number lost to follow-up: 19<br>Sample: Participants were recruited from the osteoporosis outpatient clinic at the Ostfold Hospital, Sarpsborg, Norway<br>Age (years): Mean 71<br>Sex: 100% women<br>Ethnicity: Not reported |

**Olsen 2014** *(Continued)*

| | |
|---|---|
| | Inclusion criteria: Established osteoporosis by means of dual energy x-ray absorptiometry using WHO criteria for osteoporosis, history of 1 or more vertebral fractures verified by radiography, aged 60 years or older, living at home and ambulatory<br>Exclusion criteria: Major cognitive impairments (MMSE), recent vertebral fractures, inability to complete questionnaires |
| Interventions | Type of intervention: Multiple intervention<br>1. Multiple intervention: 3-month group-based circuit exercise programme and 3-hour educational session focusing on the reduction of the risk of falls and challenges specific to osteoporosis and vertebral fractures. (n = 47)<br>2. Control: Usual care (n = 42)<br>Who delivered the intervention: Physiotherapist<br>Compliance assessed: Yes, session attendance |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Adverse events of the intervention |
| Notes | Source of Funding: The Norwegian Fund for postgraduate training in physiotherapy<br>Conflicts of interest: None<br>Economic information: Not reported<br>Adverse events: “No adverse events or side effects associated with the exercise program were reported by the intervention group participants” |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: " the subjects were randomly assigned by a computer generated list in two groups, intervention and control". |
| Allocation concealment (selection bias) | Unclear risk | Quote: "Researchers not involved in the study performed the randomization by drawing lots concealed in sealed opaque envelopes". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Self-reported by participant, time frame not specified |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) | Unclear risk | Less than 20% missing outcome data,unbalanced losses across groups with similar reasons for missing data |

**Olsen 2014** *(Continued)*

| | | |
|---|---|---|
| All outcomes | | 1. Multiple intervention: randomised n = 47, analysed n = 38 (2 did not receive allocated intervention, 7 lost to follow-up)<br>2. Usual care: randomised n = 42, analysed n = 32 (10 lost to follow-up) |
| Selective reporting (reporting bias) | Unclear risk | All outcomes stated in the Methods section were reported |
| Method of ascertaining falls | Unclear risk | Falls were recorded retrospectively by self-report, time frame not specified |

**Palvanen 2014**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study centres: 2<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: Finland<br>Number randomised: 1314<br>Number analysed: 1145<br>Number lost to follow-up: 169<br>Sample: Home-dwelling persons, aged > 70 with increased risk of falling and fall-induced injuries<br>Age (years): Mean 77 (SD 5.7)<br>Sex: 86% women<br>Ethnicity: Not reported<br>Inclusion criteria: Home-dwelling; aged ≥ 70; problems in mobility or every day function, 3 or more falls in last 12 months, high risk for falling and fall-induced injuries and fractures<br>Exclusion criteria: Inability to consent, disabilities or illness preventing physical activity, inability to move |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Chaos clinic intervention: Baseline assessment and general injury-prevention brochure plus individual preventive measures by Chaos Clinic staff based on baseline assessment: physical activity prescription, nutritional advice, individually-tailored or group exercises, treatment of conditions, medication review, alcohol reduction, smoking cessation, hip protectors, osteoporosis treatment, home hazard assessment and modification (n = 661)<br>2. Control: Baseline assessment and general injury prevention brochure alone (not falls-specific) (n = 653)<br>Who delivered intervention: Nurse, physiotherapist and physician<br>Compliance assessed: Yes, adherence was 'checked' at each contact session with the therapist |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls |
| Notes | Source of funding: multiple sources of Finnish government bodies |

**Palvanen 2014** *(Continued)*

| | |
|---|---|
| | Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Insufficient information |
| Allocation concealment (selection bias) | Low risk | Sealed opaque envelopes |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Falls measured by phone calls at 3 and 9 months, and on follow-up visits at 6 and 12 months |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Chaos clinic intervention: randomised n = 661, analysed n = 589 (35 illness, 31 refusal to continue, 3 died, 3 other)<br>2. Control: randomised n = 653, analysed n = 556 (54 illness, 29 refusal to continue, 8 died, 4 moved, 2 other) |
| Selective reporting (reporting bias) | Low risk | All outcomes stated in the Methods section were reported |
| Method of ascertaining falls | High risk | Measured by phone calls at 3 and 9 months, and on follow-up visits at 6 and 12 months from the beginning |

**Pardessus 2002**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: France |

**Pardessus 2002** *(Continued)*

| | |
|---|---|
| | Number randomised: 60<br><br>Number analysed: 51<br><br>Number lost to follow-up: 9<br><br>Sample: Recruited from acute geriatric department of the geriatric hospital<br><br>Age (years): Mean 83.2 (SD 7.7)<br><br>Sex: 78.3% female<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Age 65 years or older, hospitalised for falling, able to return home after hospitalisation, and gave informed consent for participation<br>Exclusion criteria: Patients with cognitive impairment (MMSE < 24), without phone, patients who lived further than 30 km from the hospital, those whose falls were secondary to cardiac, neurologic, vascular, or therapeutic problems |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Home visits: Home visit to evaluate the participant's abilities in his/her real-life environment. Modifications made or advice provided. (n = 30)<br><br>2. Control: Usual care (n = 30)<br><br>Who delivered the intervention: Physical medicine and rehabilitation doctor, ergo-therapist, hospital social worker<br><br>Compliance assessed: Yes, OT checked if the home modifications had been made or encouraged their implementation. |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people who experienced a fall that required hospital admission |
| Notes | Source of Funding: Not reported<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | A random number table was used. |
| Allocation concealment (selection bias) | Unclear risk | Not reported |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias) | Unclear risk | Self-report by participant based on monthly telephone call |

**Pardessus 2002** *(Continued)*

| | | |
|---|---|---|
| Falls and fallers | | |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Self-report by participant based on monthly telephone call |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses unbalanced across groups with similar reasons for missing data. (20% died in intervention group and 10% died in control group).<br>1. Home visits: randomised n = 30, analysed n = 24 (6 died)<br>2. Usual care: randomised n = 30, analysed n = 27 (3 died) |
| Selective reporting (reporting bias) | Low risk | All outcomes reported in methods were given in results |
| Method of ascertaining falls | Unclear risk | Falls were recorded by self-report by participant based on monthly telephone call |

**Rubenstein 2007**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: United States of America<br>Number randomised: 792<br>Number analysed: 694<br>Number lost to follow-up: 98<br>Sample: Patients receiving care at ambulatory care centre<br>Age (years): Mean 74.5 (SD 6)<br>Sex: 3% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 65; previously randomised to either of the 2 practice groups involved in the trial; ≥ 1 clinic visit in previous 18 months; scoring ≥ 4 on GPSS<br>Exclusion criteria: Living over 30 miles from care centre; already enrolled in outpatient geriatric services at care centre; living in long-term care facility; scoring less than 4 GPSS |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multifactorial intervention: Structured risk and needs assessment and referral algorithm implemented by case manager (physician assistant). Targeting 5 geriatric conditions including falls. Assessment followed by referrals and recommendations for further assessment or treatment. 3-monthly telephone contact with case manager (n = 380) |

**Rubenstein 2007** *(Continued)*

| | |
|---|---|
| | 2. Control: usual care (n = 412)<br><br>Who delivered intervention: Physician assistant, case manager, geriatricians, internal medicine home staff, geriatric psychiatrist, physical therapist<br><br>Compliance assessed: Yes, the case manager phoned intervention participants 1 month after the first telephone contact, and again every 3 months over the 3-year study period. The purpose of these follow-up falls was to encourage participants to adhere to referrals and recommendations, and also to monitor changes in health. |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people who experience a fall that require hospital admission<br><br>4. Health-related quality of life (SF-36 0 - 100: endpoint score) |
| Notes | Source of funding: The research was supported by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service (HSR&D), and the VA Greater Los Angeles Geriatric Research, Education and Clinical Center.<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Participants "previously" randomly assigned by Social Security number to one of 3 primary care practice groups. One practice was assigned to intervention and one to control; the third practice group was not included in this study because it was involved in the pilot study |
| Allocation concealment (selection bias) | Unclear risk | Insufficent information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | Data were collected by telephone at 12 months. Participants unwilling to be surveyed by telephone were mailed questionnaires. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br><br>1. Multifactorial intervention: randomised n = 380, analysed n = 334 (8 refused, 9 unable to contact, 29 died) |

**Rubenstein 2007** *(Continued)*

| | | |
|---|---|---|
| | | 2. Usual care: randomised n = 412, analysed n = 360 (11 refused, 17 unable to contact, 24 died) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | High risk | Data were collected by telephone at 12 months. Participants unwilling to be surveyed by telephone were mailed questionnaires. |

**Russell 2010**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: Australia<br>Number randomised: 712<br>Number analysed: 650<br>Number lost to follow-up: 62<br>Sample: People presenting to ED after a fall<br>Age (years): 13% 60 to 64; 17% 65 to 70; 19% 70 to 74; 19% 75 to 79; 32% ≥ 80<br>Sex: 70% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 60; community-dwelling; presenting to ED after a fall and discharged straight home<br>Exclusion criteria: Unable to comply with simple instructions; unable to walk independently indoors (with or without walking aids) |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multifactorial falls prevention programme: standard care in ED + assessed (FROP-Com) and offered multifactorial falls prevention programme consisting of referrals to existing community services and health promotion recommendations. Participants at high risk of falls (FROP-Com score ≥ 25) referred to falls clinic for comprehensive multidisciplinary assessment (n = 351)<br>2. Control: standard care in ED + letter to participants informing them of level of falls risk (FROP-Com), recommendation to speak to GP (n = 361)<br>Who delivered intervention: Baseline assessor, physiotherapist, OT, podiatrist, dietitian, family physician, research fellow<br>Compliance assessed: Yes, the research officer who collected the 12-month falls and fall-injury data also collected adherence data 4 and 6 months after the baseline assessment. Participants were questioned about all referrals and recommendations made by the study assessors and the ED. They were asked whether they attended the appointment, what recommendations the service made, and whether they had followed the recommendations. |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls |

**Russell 2010** *(Continued)*

| | |
|---|---|
| | 3. Number of people sustaining 1 or more fall-related fractures |
| Notes | Source of funding: Australian Government Department of Veterans' Affairs and the Victorian Department of Human Services<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Randomization was performed using a computer-generated randomization list." |
| Allocation concealment (selection bias) | Low risk | Quote: "A researcher otherwise not involved in the project generated and held the randomization sequence." |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Participants recorded falls and injuries on a falls calender which they were asked to return monthly using postage-paid mail. Participants were also telephoned every 2 months to confirm details in the calender. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Participants recorded falls and injuries on a falls calender which they were asked to return monthly using postage-paid mail. Participants were also telephoned every 2 months to confirm details in the calender. |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Quote: " After each participant's 12-month follow-up period, his or her hospital medical record was reviewed to verify ED presentations, days in the hospital, and when available, falls and fall injuries.The medical record reviewed in each case was that held at the hospital to which the participant presented after the initial fall". However, medical record information was unavailable for 10.6% of participants. |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% of missing outcome, losses balanced across groups with similar reasons for missing data<br><br>1. Multifactorial falls prevention program: randomised n = 351, analysed n = 344 (4 withdrew, 3 died)<br><br>2. Standard care: randomised n = 361, analysed n = 354 (7 withdrew) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Participants recorded falls and injuries on a falls calender which they were asked to return monthly using postage-paid mail. Participants were also telephoned every 2 months to confirm details in the calender. |

**Schrijnemaekers 1995**

| | |
|---|---|
| Methods | Study design: RCT (parallel design) |

**Schrijnemaekers 1995** *(Continued)*

| | |
|---|---|
| | Number of study arms: 2<br><br>Study centres: Single centre<br><br>Length of follow-up: 36 months |
| Participants | Setting: The Netherlands<br>Number randomised: 222<br><br>Number analysed: 182<br><br>Number lost to follow-up: 40<br><br>Sample: People living at home (N = 146) or in residential homes (N = 76)<br><br>Age (years): 70% aged 77 to 84, 30% ≥ 85<br><br>Sex: 70% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 75; living at home or in 1 of 2 residential homes; having problems with ≥ 1 of the following: IADL, ADL, toileting, mobility or fallen in last 6 months, serious agitation or confusion; informed consent from participant and their GP<br>Exclusion criteria: Living in nursing home; received outpatient or inpatient care from geriatric unit in previous 2 years |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1.Comprehensive assessment: Comprehensive assessment in outpatient geriatric unit (geriatrician, psychologist, social worker); advice to participant and GP about treatment and support (n = 110)<br>2. Control: usual care (n = 112)<br><br>Who delivered intervention: Geriatrician, psychologist, social worker, physiotherapist<br><br>Compliance assessed: Yes, a written report was given to the elderly and their GP. GP asked if they followed advice of OGA-unit. |
| Outcomes | 1. Number of people sustaining recurrent falls |
| Notes | Source of funding: The Province of Limburg and the Directorate of Policy for the Elderly of The Netherlands Ministry of Social Welfare. Public Health and Culture.<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported<br><br>Included in this review as most of the participants were living at home (N = 146) |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Stratified by living condition (home versus home for the elderly) then "randomly allocated" by researcher in blocks of 10 |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |

**Schrijnemaekers 1995** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Falls and fallers | Unclear risk | Method of falls detection not reported |
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | Less than 20% missing outcome data, losses are unbalanced across groups with similar reasons for missing data<br>1. Comprehensive assessment: randomised n = 110, analysed n = 85 (10 died, 15 no response)<br>2. Usual care: randomised n = 112, analysed n = 97 (5 died, 10 no response) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Method of falls detection not reported |

**Serra-Prat 2017**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 12 months |
| Participants | Setting: Spain<br>Number randomised: 172<br>Number analysed: 133<br>Number lost to follow-up: 39<br>Sample: All non-institutionalised patients aged ≥ 70 years consulting for any reason at any of the 3 participating primary care centres in Mataro (Barcelona, Spain) were screened for frailty according to Fried criteria.<br>Age (years): Mean 78.3<br>Sex: 57% women<br>Ethnicity : Not reported<br>Inclusion criteria: Non-institutionalised patients, aged ≥ 70 years, pre-fail status as defined by one or more of the Fried criteria<br>Exclusion criteria: persons unable to stand without assistance, completely blind, previous diagnosis of dementia recorded in clinical notes, receiving palliative care or with life expectancy below 6 months |

**Serra-Prat 2017** *(Continued)*

| | |
|---|---|
| Interventions | Type of intervention: Multiple intervention<br><br>1. Nutritional and physical activity components: Malnutrition screening, dietary recommendations and corrective measures, physical activity programme (aerobic exercise and 15 mixed exercises) (n = 80)<br><br>2. Control: Usual care (n = 92)<br><br>Who delivered the intervention: Nurses<br><br>Compliance assessed: Yes, a) A nurse monitored compliance by regular telephone contacts with the participants; b) To assess adherence to the study intervention, participants were asked to keep a diary. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Health-related quality of life (QoL VAS 0 - 10: endpoint score)<br><br>3. Adverse events of the intervention |
| Notes | Source of funding: Partially funded by grants from the Spanish Ministry of Health. Instituto de Salud Carlos III, Fondo de Investigacion Sanitaria FIS programme P113/00931<br><br>Conflicts of interest: None<br><br>Economic information: Not reported<br><br>Adverse events: "No adverse events were reported" |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: " Blocked random code and sequentially numbered sealed envelopes were prepared in the research unit". |
| Allocation concealment (selection bias) | Low risk | Quote: " Randomisation was based on the opaque envelope method and was stratified according to 21 general practitioners participating in the study". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Method of fall assessment not reported |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | More than 20% missing outcome data, losses are balanced across groups with similar reasons for missing data<br><br>1. Nutritional and physical activity components: randomised n = 80, analysed n = 61 (19 declined, 0 died) |

**Serra-Prat 2017** *(Continued)*

| | | |
|---|---|---|
| | | 2. Usual care: randomised n = 92, analysed n = 72 (18 declined, 2 died) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in abstract were reported |
| Method of ascertaining falls | Unclear risk | Not reported |

**Sheffield 2013**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 3 months |
| Participants | Setting: United States of America<br>Number randomised: 90<br>Number analysed: 60<br>Number lost to follow-up: 30<br>Sample: Adults over 65 receiving some form of agency care. All participants were known to the 2 local public agencies involved in the study.<br>Age (years): Mean 81.67 (SD 9.46)<br>Sex: 80% women<br>Ethnicity : 58% white, 41% non-white, 1% not disclosed; 7% Hispanic, 93% non-Hispanic<br>Inclusion criteria: Community-dwelling over-65s receiving some form of agency care. Additional inclusion criteria included ability to speak English, adequate mobility within the home and sufficient cognitive capacity to participate in the intervention.<br>Exclusion criteria: None reported |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Home assessment of daily activities in the context of environment, client-family collaboration to achieve mutual goals, provision and training in the use of assistive devices, design and implementation of home modifications, removal of environmental hazards, training in medication management and education in adaptive and compensatory strategies to improve safety and independence: Home assessment, goal-setting, assistive devices, home modification and education (n = 46)<br>2. Delayed intervention control group: As above but delayed (n = 44)<br>Who delivered the intervention: Occupational therapist<br>Compliance assessed: No |
| Outcomes | 1. Health-related quality of life |
| Notes | Source of Funding: Not reported<br>Conflicts of interest: None |

**Sheffield 2013** *(Continued)*

| | |
|---|---|
| | Economic information: Intervention costs for equipment and home modifications averaged USD 205 per client. Therapy costs inclusive of travel time were USD 940. The mean intervention costs was USD 1145 per client. |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "independent researcher blinded to participant characteristics performed block randomisation using computer generated random allocation". |
| Allocation concealment (selection bias) | Low risk | Quote: "independent researcher blinded to participant characteristics performed block randomisation using computer generated random allocation". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to group assignment but effect of non-blinding unclear. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% of missing outcome data, losses are balanced across groups with different reasons for missing data<br>1. Multifactorial intervention: randomised n = 46, analysed n = 31 (5 refused follow-up, 2 unknown reasons, 1 died, 7 found to be ineligible).<br>2. Delayed intervention : randomised n = 44, analysed n = 29 (1 moved, 2 institutionalised, 7 found to be ineligible, 5 required emergency intervention) |
| Selective reporting (reporting bias) | High risk | Not all secondary outcome measures stipulated in protocol paper reported in study paper |
| Method of ascertaining falls | Low risk | Prospective falls calender returning a page every 3 months |

**Shyu 2010**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Taiwan |

**Shyu 2010** *(Continued)*

| | |
|---|---|
| | Number randomised: 162<br><br>Number analysed: 122<br><br>Number lost to follow-up: 40<br>Sample: Admitted to hospital for an accidental single side hip fracture<br>Age (years): Mean 78.2 (SD 7.8)<br><br>Sex: 69% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 60; received hip arthroplasty or internal fixation; able to perform full range of motion; prefracture Chinese Barthel Index > 70<br>Exclusion criteria: severely cognitively impaired; terminally ill |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multidisciplinary programme: geriatric consultation services, a continuous rehabilitation programme, discharge planning services (n = 80)<br>2. Control: usual care (n = 82)<br><br>Who delivered intervention: Geriatric nurses, geriatrician, physical rehabilitation physician, orthopaedists<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people who sustained 1 or more falls<br><br>2. Number of people who experienced a fall and required hospital admission<br><br>3. Number of people who experienced a fall that required medical attention<br><br>4. Health-related quality of life (SF-36 0 - 100, mental and physical subscales: endpoint score) |
| Notes | Source of funding: National Health Research Institute, Taiwan<br><br>Conflicts of interest: None<br><br>Economic information: The estimated cost added by the intervention program to the current routine care was USD 438 |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "The randomization was conducted using flip of coin by a neutral third party who was not involved in delivering the intervention or assessing outcomes". |
| Allocation concealment (selection bias) | Unclear risk | Quote: "Those persons who agreed to participate were randomly assigned to an experimental or control group at the time of admission. The randomization was conducted using flip of coin by a neutral third party who was not involved in delivering the intervention or assessing outcomes".<br><br>Insufficient detail to allow a definite judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but effect of non-blinding unclear |

**Shyu 2010** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Falls and fallers | Unclear risk | Self-reports of patients and family caregivers, face-to-face interviews |
| Blinding of outcome assessment (detection bias) Fractures | Low risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Self-reports of patients and family caregivers, face-to-face interviews |
| Incomplete outcome data (attrition bias) All outcomes | High risk | More than 20% of missing outcome data, losses are balanced across groups with similar reasons for missing data<br>1. Multidisciplinary programme: randomised n = 80, analysed n = 60 (16 refused to participate, 4 died)<br>2. Usual care: randomised n = 82, analysed n = 62 (14 refused to participate, 6 died) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Self-reports of patients and family caregivers, face-to-face interviews |

**Sosnoff 2015**

| | |
|---|---|
| Methods | Study Design: RCT (2 x 2 factorial design)<br>Number of study arms: 4<br>Study centres: Single centre<br>Length of follow-up: 6 months |
| Participants | Setting: Canada<br>Number randomised: 37<br>Number analysed: 34<br>Number lost to follow-up: 3<br>Sample: Recruited from the North American Research Commitee on Multiple Sclerosis Patient Registry<br>Age (years): Mean 62.3 (SD 8.7)<br>Sex: 65% women<br>Ethnicity : Not reported<br>Inclusion criteria: Neurologist-confirmed diagnosis of Multiple Sclerosis, able to walk with/without aid, demonstrate a comprehension of English, self-reported fall in the last 12 months, age between 45 and 75 years old, live within 175-mile radius of testing site, relapse-free for 30 days prior to participation<br>Exclusion criteria: None |
| Interventions | Type of intervention: Multiple intervention |

**Sosnoff 2015** *(Continued)*

| | |
|---|---|
| | 1. Home-Based Exercise: Home-based exercise, focusing on improving balance and lower limb/core muscle strength (n = 11)<br><br>2. Education group: Visited laboratory at baseline, weeks 2, 4 and 8, groups ranged from 2 to 4 people and lasted approximately 1 hour; education drew on psychoeducational group theory and self-management literature (group brain-storming, problem-solving and action-planning). The programme also applied core principles of self-efficacy enhancement, in particular peer-modelling, vicarious learning, social persuasion and guided mastery (n = 9)<br><br>3. Exercise and education: Exercise focusing on improving balance and lower limb/core muscle strength<br><br>Education drew on psychoeducational group theory and self-management literature (group brain-storming, problem-solving and action-planning). The programme also applied core principles of self-efficacy enhancement, in particular peer-modelling, vicarious learning, social persuasion and guided mastery. (n = 8)<br><br>4. Waiting List Control: Usual care (n = 9)<br><br>Who delivered the intervention: 6 trained nurses qualified in the field of geriatrics and working for home-care agencies, trained interventionalist/specialist<br><br>Compliance assessed: Yes, Exercise Diary |
| Outcomes | 1. Number of people sustaining 1 or more falls |
| Notes | Source of Funding: National Multiple Sclerosis Society<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: " Simple randomization method with a 1:1:1:1 allocation ratio (independent of baseline assessment) by computer generated random numbers". |
| Allocation concealment (selection bias) | Low risk | Quote: "Group allocation for each participant was concealed in opaque envelopes" |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel for blind to allocated group but effect of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Monthly falls diary and follow-up telephone call |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |

**Sosnoff 2015** *(Continued)*

| | | |
|---|---|---|
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing outcome data, losses are balanced across groups with similar reasons for missing data<br><br>1. Home-based exercise group: randomised n = 11, analysed n = 1 (unable to travel)<br><br>2. Education group: randomised n = 9, analysed n = 1 (lost contact)<br><br>3. Home-based exercise and education group: randomised n = 8, analysed n = 8<br><br>4. Wait list Control: randomised n = 9, analysed n = 8 (1 elective spinal surgery) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the Methods were reported |
| Method of ascertaining falls | Low risk | Questionnaire, falls diary and telephone calls |

**Spice 2009**

| | |
|---|---|
| Methods | Study design: Cluster RCT<br><br>Number of study arms: 3<br><br>Number of clusters: 18<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 12 months |
| Participants | Setting: United Kingdom<br>Number randomised: 516<br><br>Number analysed: 422<br><br>Number lost to follow-up: 94<br>Sample: Patients in 18 general practices<br>Age (years): Mean 82<br><br>Sex: Not reported<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Aged ≥ 65; community-dwelling; history of at least 2 falls in previous year; not presenting to A&E with index fall<br>Exclusion criteria: None described |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Primary care intervention: health visitor/practice nurse falls risk assessment/referral (n = 141)<br><br>2. Secondary care intervention: multidisciplinary day hospital assessment by physician, OT, and physiotherapist (n = 213)<br>3. Control: usual care (n = 162)<br><br>Who delivered the intervention: Trained nurses, GP, occupational therapist, physiotherapist, geriatrician<br><br>Compliance assessed: Yes, proportion of different interventions provided such as medication changes, smoke alarms and duration measured |

**Spice 2009** *(Continued)*

| | |
|---|---|
| Outcomes | 1. Number of people who sustained 1 or more falls<br>2. Number of people who sustained 1 or more fall-related fractures<br>3. Number of people who experienced a fall that required hospital admission<br>4. Health-related quality of life |
| Notes | Source of funding: Grants were received from Winchester Health Promotion Service, Shire Pharmaceuticals and Proctor and Gamble, with later funding from Mid-Hampshire Primary Care Trust.<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Cluster-randomised. Quote: "Practices were stratified into urban (three) and rural (fifteen) and randomly allocated to the three arms, in blocks of three, using a random number generator on a Hewlett Packard 21S pocket calculator". |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Participants were followed monthly for 12 months, with participants indicating how many falls they had by selecting from the options of 1, 2, 3, 4 or > 4. If the card was not returned, the participant was contacted by telephone. Participants were unblinded to intervention. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Participants were followed monthly for 12 months |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Monthly self-reports from participants |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, losses are unbalanced across groups with similar reasons for missing data<br>1. Primary care intervention group: randomised n = 141 (8 clusters), analysed n = 114 (12 died, 10 withdrew, 5 ineligible)<br>2. Secondary care intervention group: randomised n = 213 (4 clusters), analysed n = 176 (11 died, 23 withdrew, 3 ineligible)<br>3. Usual care: randomised n = 162 (6 clusters), analysed n = 132 (17 died, 10 withdrew, 3 ineligible). |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |

**Spice 2009** *(Continued)*

| | | |
|---|---|---|
| Method of ascertaining falls | Unclear risk | Participants were followed monthly for 12 months, with participants indicating how many falls they had by selecting from the options of 1, 2, 3, 4 or > 4. If the card was not returned, the participant was contacted by telephone. Participants were unblinded to intervention. |
| Relating to cluster randomisation | Unclear risk | Recruitment bias: all GP practices were invited to participate prior to randomisation, but it is unclear how participants were then recruited (unclear risk)<br><br>Baseline imbalance: baseline similar between intervention arms (low risk)<br><br>Loss of clusters: no clusters lost from the trial (low risk)<br><br>Incorrect analysis: the trial adjusted for clustering (low risk)<br><br>Comparability: results comparable with individually randomised trials (low risk) |

**Tinetti 1994**

| | |
|---|---|
| Methods | Study design: Cluster RCT<br><br>Number of study arms: 2<br><br>Number of clusters: 16 treating physicians, matched in 4 groups of 4, into 2 control and 2 intervention in each group; enrolled subjects assigned to same group as their physician<br><br>Study centres: Multiple centres<br><br>Length of follow-up: 12 months |
| Participants | Setting: United States of America<br>Number randomised: 301<br><br>Number analysed: 291<br><br>Number lost to follow-up: 10<br>Sample: People enrolled with participating physicians<br>Age (years): Mean 77.9 (SD 5.3)<br><br>Sex: 69% women<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged > 70; community-dwelling; independently ambulant; at least 1 targeted risk factor for falling (postural hypotension, sedative/hypnotic use, use of > 4 medications, inability to transfer, gait impairment, strength or range of motion loss, domestic environmental hazards)<br>Exclusion criteria: Enrolment in another study; MMSE < 20; current (within last month) participation in vigorous activity |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial intervention: Interventions targeting individual risk factors, according to decision rules and priority lists. 3-month programme duration (n = 153)<br>2. Control: visits by social work students over same period (n = 148)<br><br>Who delivered the intervention: Nurse practitioner, physical therapist, physicians, social work students<br><br>Compliance assessed: Yes, adherence to exercise programmes as reported by participants was assessed by the physical therapist on weekly basis |
| Outcomes | 1. Rate of falls |

**Tinetti 1994** *(Continued)*

| | |
|---|---|
| | 2. Number of people sustaining 1 or more falls<br>3. Number of people who experienced a fall that required hospital admission<br>4. Number of people who experienced a fall that required medical attention<br>5. Adverse effects of the intervention |
| Notes | Source of funding: A grant from the National Institute on Aging<br>Conflicts of interest: Not reported<br>Economic Information: Yale (New Haven) FICSIT trial. Cost-effectiveness analysis reported in Rizzo 1996.<br>The total cost of Intervention, including development, equipment, personnel, travel, and overhead costs, was USD 136,318 or an average of USD 891 per participant in intervention group.<br>The cost per fall prevented USD 136,318/70 (164 falls in the control group - 94 in the intervention group) was USD 1947. The cost for preventing one fall that required medical care was USD 12,392.<br>Adverse events: "10 subjects developed musculoskeletal symptoms in the intervention group which were thought to be related to the exercise program". |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Computerised randomization program" |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but effect of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls were recorded on a calender that participants mailed to the research staff monthly |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | High risk | Quote: " during a follow-up telephone interview, research staff asked subjects about medical care sought after falls and injuries sustained". |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, with no reasons given for loss to follow-up<br>1. Multifactorial intervention: randomised n = 153; analysed n = 147<br>2. Visits by social work students: randomised n = 148; analysed n = 144 |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |

**Tinetti 1994** *(Continued)*

| | | |
|---|---|---|
| Method of ascertaining falls | Low risk | Falls were recorded on a calender that participants mailed to the research staff monthly |
| Relating to cluster randomisation | High risk | Recruitment bias: participants were recruited and randomised based on risk score for all participants at the same time (low risk)<br>Baseline imbalance: baseline similar between intervention arms (low risk)<br>Loss of clusters: no clusters lost from the trial (low risk)<br>Incorrect analysis: the trial did not adjusted for clustering (high risk)<br>Comparability: results comparable with individually-randomised trials (low risk) |

**Ueda 2017**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 1 month |
| Participants | Setting: Japan<br>Number randomised: 60<br>Number analysed: 51<br>Number lost to follow-up: 9<br>Sample: All were discharged orthopaedic patients aged ≥ 65 years who experienced falls in the past year<br>Age (years): Mean 75.9<br>Sex: 68.5% women<br>Ethnicity : Not reported<br>Inclusion criteria: Discharged orthopedic patients, aged ≥ 65 years, experienced ≥ 1 fall in the past year<br>Exclusion criteria: Cognitive impairment - MMSE score ‹ 24, patients without care service, who spoke little or no Japanese, severe neurological visual disorders, who were planning to move within the next month |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Tailored education programme and standard care exercises: Tailored education programme using home floor plans/modifying hazards, standard care exercises (as received by control arm) (n = 30)<br>2. Exercise (n = 30)<br>Who delivered the intervention: Physical therapist<br>Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls |

**Ueda 2017** *(Continued)*

| | |
|---|---|
| Notes | Source of Funding: Not reported<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Stratified randomization was conducted using a computer generated random number schedule with randomly ordered blocks of 6". |
| Allocation concealment (selection bias) | Unclear risk | Insufficent information |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | "Single blind", does not state who was blinded |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Prospectively using a monthly falls calender and contact by telephone |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% of missing outcome data, losses are balanced across groups with similar reasons for missing data<br>1. Multifactorial intervention: tailored education programme and standard care exercises: randomised n = 30, analysed n = 25 (5 withdrew).<br>2. Usual care: randomised n = 30, analysed n = 26 (4 withdrew) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in Methods were reported |
| Method of ascertaining falls | Low risk | Each participant was given a falls calender |

**Uusi-Rasi 2015**

| | |
|---|---|
| Methods | Study Design: RCT (2 x 2 factorial design)<br>Number of study arms: 4<br>Study centres: Multiple centres<br>Length of follow-up: 24 months |

**Uusi-Rasi 2015** *(Continued)*

| | |
|---|---|
| Participants | Setting: Finland<br>Number randomised: 409<br><br>Number analysed: 370<br><br>Number lost to follow-up: 39<br><br>Sample: Aged 70 - 80 years old, living in Tampere, Finland<br><br>Age (years): Mean 74.2<br><br>Sex: 100% women<br><br>Ethnicity: Not reported<br><br>Inclusion criteria: Women; aged 70 to 80 years; independently community-dwelling; history of at least 1 fall in previous year; no contraindication to exercise; giving informed consent<br><br>Exclusion criteria: Undertaking moderate-to-vigorous exercise more than 2 hours a week; regular user of vitamin D, or calcium + vitamin D supplements; recent fracture (during preceding 12 months); contraindication or inability to exercise; marked decline in the basic activities of daily living (ADL-test); cognitively impaired (MMSE < 18); chronic conditions, e.g. Parkinson's disease |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Exercise with vitamin D: 20 µg of vitamin D a day for 2 years supervised training (twice a week for 52 weeks), and once a week for next 52 weeks (n = 102)<br><br>2. Exercise with placebo: as above (n = 103)<br><br>3. No exercise with vitamin D: 20 µg of vitamin D a day for 2 years, no supervised training (maintenance of their current level of physical activity) (n = 102)<br><br>4. No exercise with placebo: placebo once a day for 2 years, no supervised training (maintenance of their current level of physical activity) (n = 102)<br><br>Who delivered the intervention: Physiotherapist<br><br>Compliance assessed: Yes, adherence was measured by monitored attendance, pill counts, return of used packs in time of laboratory measurements every 6 months |
| Outcomes | 1. Rate of falls<br><br>2. Adverse events of the intervention |
| Notes | Source of funding: Academy of Finland, Ministry of Education and Culture, competitive research, fund of Pirkanmaa Hospital District and Juho Vainio Foundation<br><br>Conflicts of interest: None<br><br>Economic information (all costs in Euros): The average 2-year cost of vitamin D supplementation was EUR 73 per participant (EUR 0.10 per pill), while that of implementing the exercise intervention was EUR 47 per participant (EUR 63 per hour). There were no significant between-group differences for mean fall-related healthcare costs. Total costs per person year (including costs of the 2-year intervention) were lowest in the D-Ex group EUR 30.9 (9.5), compared with EUR 73.4 (10.4) in D-Ex+, EUR 188.0 (45.4) in D+Ex+, and EUR 206.9 (80.2) in D+Ex-.<br><br>Given a willingness to pay EUR 3000 per injurious fall prevented, the exercise intervention had an 86% probability of being cost-effective in this population. Step-wise calculation of ICERS resulted in exclusion of D+Ex- as more expensive and less effective. Recalculated ICERS were EUR 221 for D-Ex-, EUR 708 for D-Ex+, and EUR 3820 for D+Ex+; bootstrapping indicated 93% probability that each injurious fall avoided by D-Ex+ per person year costs EUR 708. |

**Uusi-Rasi 2015** *(Continued)*

The corresponding ICERS per fall prevented (i.e. total number of falls in the comparator group minus total number of falls in the intervention group) were EUR 250 for group D-Ex+ and EUR 3920 for group D +Ex+.

Adverse events: “In general, the training programme was well tolerated. There were no severe adverse events or injuries due to the training”

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "409 participants were randomly assigned to 1 of 4 groups using a computer generated list based on simple randomization with random allocation sequence". |
| Allocation concealment (selection bias) | Unclear risk | Quote: "409 participants were randomly assigned to 1 of 4 groups using a computer generated list based on simple randomization with random allocation sequence". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blind to allocated group but effect of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Prospectively monthly falls diaries and follow-up telephone call |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% of missing outcome data, losses are balanced across groups with similar reasons for missing data<br>1. Vitamin D + Exercise: randomised n = 102, analysed n = 96 (2 lost interest, 4 health reasons)<br>2. Placebo + exercise: randomised n = 103, analysed n = 91 (3 lost interest, 9 health reasons) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in Methods were reported |
| Method of ascertaining falls | Low risk | Number of falls were recorded by monthly prospective recording using a falls diary and follow-up telephone call |

**Van Haastregt 2000**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2 |

**Van Haastregt 2000** *(Continued)*

| | |
|---|---|
| | Study centres: Multiple centres<br><br>Length of follow-up: 18 months |
| Participants | Setting: The Netherlands<br>Number randomised: 316<br><br>Number analysed: 235<br><br>Number lost to follow-up: 81<br>Sample: People registered with 6 general medical practices (66% women)<br>Age (years): Mean 77.2 (SD 5.1)<br><br>Sex: 66% women<br>Inclusion criteria: Aged ≥ 70; community-dwelling; 2 or more falls in previous 6 months or score 3 or more on mobility scale of Sickness Impact Profile<br>Exclusion criteria: Bed-ridden; fully wheelchair-dependent; terminally ill; awaiting nursing home placement; receiving regular care from community nurse |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Multifactorial intervention: 5 home visits from community nurse over 1 year. Screened for medical, environmental, and behavioural risk factors for falls and mobility impairment; advice, referrals, and "other actions" (n = 159)<br>2. Control: usual care (n = 157)<br><br>Who delivered intervention: Community nurse<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people who experienced a fall that required medical attention |
| Notes | Source of funding: Zorg Onderlock, Netherlands<br><br>Conflicts of interest: None<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomisation by computer-generated random numbers |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Quote: "The doctors and healthcare staff dealing with the participants were not told which patients were allocated to the usual care group". Participants and nurses conducting home visits in intervention group were not blinded. Partial blinding of other health professionals. Insufficient evidence to make judgement on impact of lack of blinding. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded by the participant using a monthly falls diary |

**Van Haastregt 2000** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | High risk | Assessed by means of self-administered questionnaire at 12 and 18 months follow-up |
| Incomplete outcome data (attrition bias) All outcomes | High risk | More than 20% missing outcome data<br>1. Multifactorial intervention: randomised n = 159, analysed n = 120 (10 died, 14 medical reasons, 15 non medical reasons)<br>2. Control: randomised n = 157, analysed 115 (14 died, 9 medical reasons, 16 non medical reasons, 3 other) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Low risk | Falls recorded by the participant using a falls diary |

**Van Rossum 1993**

| | |
|---|---|
| Methods | Study design: RCT (but some clusters as people living together allocated to same group)<br>Number of study arms: 2<br>Study centres: Unclear<br>Length of follow-up: 36 months |
| Participants | Setting: The Netherlands<br>Number randomised: 580<br>Number analysed: 493<br>Number lost to follow-up: 87<br>Sample: General population sampled, not volunteers<br>Age (years): range 75 to 84<br>Sex: 58% women<br>Ethnicity: not reported<br>Inclusion criteria: Aged 75 to 84; living at home<br>Exclusion criteria: Patient or partner already receiving regular home-nursing care |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Preventive home visits by public health nurse 4 times a year for 3 years. Extra visits/telephone contact as required. Check list of health topics to discuss. Advice given and referrals to other services (n = 292)<br>2. Control: no home visits (n = 288)<br>Who delivered intervention: Nurses and GP<br>Complaince assessed: Not reported |

**Van Rossum 1993** *(Continued)*

| | |
|---|---|
| Outcomes | 1. Number of people who experienced a fall that required hospital admission |
| Notes | Source of funding: Netherlands Ministry of Welfare and Cultural Affairs and Foundation for Research and Development of Social Health care<br><br>Conflicts of interest: None<br><br>Economic information: Mean total healthcare costs Intervention NLG 20,080 versus 19,321 per person. During the intervention period exchange rate 1 Dutch Guilder = GBP 0.29 |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Stratified by sex, self-rated health, composition of household and social class then randomised by computer-generated random numbers. Participants in intervention group then randomised to nurses |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and nurses conducting home visits in intervention group were not blinded. Insufficient evidence to make judgement on impact of lack of blinding. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Requring hospital admission confirmed by postal questionnaire and personal interview |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data but number analysed per arm and reasons for missing data not reported |
| Selective reporting (reporting bias) | Unclear risk | Insufficient information |
| Method of ascertaining falls | Unclear risk | Not applicable |

**Vetter 1992**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br><br>Number of study arms: 2<br><br>Study centres: Single centre |

**Vetter 1992** *(Continued)*

| | |
|---|---|
| | Length of follow-up: 48 months |
| Participants | Setting: United Kingdom<br><br>Number randomised: 674<br><br>Number analysed: 450<br><br>Number lost to follow-up: 224<br>Sample: People on 5 GPs' patient lists<br>Age (years): > 70<br><br>Sex: Not reported<br><br>Ethnicity: Not reported<br>Inclusion criteria: Aged > 70<br><br>Exclusion criteria: None listed |
| Interventions | Type of intervention: Multifactorial intervention<br><br>1. Health visitor visits, minimum yearly, for 4 years, with advice on nutrition, environmental modification, concomitant medical conditions, and availability of physiotherapy classes if desired (n = 350)<br>2. Control: usual care (n = 324)<br><br>Who delivered intervention: Health visitors, physiotherapist<br><br>Compliance assessed: Yes, the effectiveness of the health visitor was checked by giving the respondents a photograph of the health visitor, asking whether the person had visited them previously, and details of what happened as a result of the visit. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Number of people sustaining 1 or more fall-related fractures |
| Notes | Source of funding: Grand Charity and Welsh office<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Randomised "using random number tables with subjects' study numbers and without direct contact with the subjects". |
| Allocation concealment (selection bias) | Low risk | Randomised "using random number tables with subjects' study numbers and without direct contact with the subjects". Introduction of bias unlikely. |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and health visitor conducting home visits in intervention group were not blinded. Insufficient evidence to make judgement on impact of lack of blinding. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Self-reported questionnaire and follow-up interview |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Self-reported questionnaire, and a scheduled interview the questions about fractures were followed up by asking for details of where and when they had occurred and what had caused them. If satisfactory answers were obtained a |

**Vetter 1992** *(Continued)*

| | | |
|---|---|---|
| | | fracture or fall was counted. In the case of fractures, the case notes were referred to if clear answers were not obtained. |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | High risk | More than 20% missing outcome data, losses balanced across groups with similar reasons for missing data<br>1. Health visitor visits: randomised n = 350, analysed n = 240 (14 moved, 8 refused, 88 died)<br>2. Usual care: randomised n = 324, analysed n = 210 (5 moved, 3 refused, 106 died) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | Unclear risk | Self-reported questionnaire and follow-up interview . |

**Vind 2009**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 12 months |
| Participants | Setting: Denmark<br>Number randomised: 392<br>Number analysed: 364<br>Number lost to follow-up: 28<br>Sample: People contacted by post after ED treatment or hospital discharge<br>Age (years): Mean 74 (SD 6)<br>Sex: 74% women<br>Inclusion criteria: Aged ≥ 65; treated in ED or admitted to hospital because of a fall<br>Exclusion criteria: Fall caused by external force or alcohol intoxication; not living locally; institutionalised; unable to walk; terminally ill; impaired communication; described as suffering from dementia in hospital notes or by staff; having a planned geriatric intervention |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Comprehensive multifactorial intervention. Assessed by doctor (1 hour), and nurse and PT (1½ hours), during 2 visits to geriatric outpatient clinic. Team discussion with senior geriatrician, interventions planned and offered to participants. Carried out in clinic or referred to specialists. Included progressive, individualised exercise, drug modification, treatment of untreated disease, advice or referral to ophthalmologist, etc. (*see* Table 1 in Vind 2009 for details) (n = 196)<br>2. Usual care as planned in ED or during admission (n = 196)<br>Who delivered intervention: Multidisiplinary team (Doctor (ABV), nurse, physiotherapist, geriatrician) |

**Vind 2009** *(Continued)*

| | |
|---|---|
| | Compliance assessed: Not reported |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls<br>3. Number of people sustaining recurrent falls (reported as number with > 3 falls)<br>4. Number of people who experienced a fall that required medical attention |
| Notes | Source of funding: Danish Ministry of Health, Danish Medical Research Council<br>Conflicts of interest: None<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Participants were randomised by simple method, 1:1, using a computer-generated random list and sealed envelopes; a secretary not involved in the intervention performed randomisation." |
| Allocation concealment (selection bias) | Low risk | Quote: "… using a computer-generated random list and sealed envelopes; a secretary not involved in the intervention performed randomisation." |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and/or intervention delivery personnel were not blind to group allocation |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls recorded daily by completion of participant fall diaries |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Requiring medical attention confirmed by hospital records |
| Incomplete outcome data (attrition bias)<br>All outcomes | Low risk | Less than 20% missing data, losses balanced across groups with similar reasons for missing data<br>1. Comprehensive multifactorial intervention: randomised n = 196, analysed n = 186 (5 withdrew, 4 died, 1 reason not given)<br>2. Usual care: randomised n = 196, analysed n = 178 (12 withdrew, 4 died, 2 reason not given) |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes reported |
| Method of ascertaining falls | Low risk | Falls were recorded monthly by participants returning fall diaries |

**Wagner 1994**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 3<br>Study centres: multiple centres<br>Length of follow-up: 24 months |
| Participants | Setting: United States of America<br>Number randomised: 1559<br>Number analysed: Not reported<br>Number lost to follow-up: Not reported<br>Sample: "Healthy elderly" people, HMO enrollees<br>Age (years): Mean 72<br>Sex: 59% women<br>Ethnicity: Predominantly white<br>Inclusion criteria: Aged ≥ 65; HMO members; ambulatory and independent<br>Exclusion criteria: Too ill to participate as defined by primary care physician |
| Interventions | Type of intervention: Multifactorial intervention<br>1. 60- to 90-minute interview with nurse, including review of risk factors, audiometry and blood pressure measurement, development of tailored intervention, motivation to increase physical and social activity (n = 635)<br>2. Chronic disease prevention nurse visit (n = 317) [ineligible comparator]<br>3. Control: usual care (n = 607)<br>Who delivered the intervention: Specially-trained nurse, educator, trained volunteer, pharmacist, audiologists<br>Compliance assessed: Yes, the nurse provided follow-up telephone calls to check attendance and mailed reminders. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Number of people who experienced a fall that required hospital admission<br>3. Number of people who experienced a fall that required medical attention |
| Notes | Source of funding: The Centres for Disease Control and Prevention (CDC)<br>Conflicts of interest: Not reported<br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "Randomized into three groups in a ratio of 2:1:2." |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |

**Wagner 1994** *(Continued)*

| | | |
|---|---|---|
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | High risk | The incidence of falls was assessed from self-reports of episodes in the previous year |
| Blinding of outcome assessment (detection bias)<br>Fractures | Low risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Low risk | Self-reports checked against computerised hospital discharge files |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | It was reported that 97% returned 1-year questionnaire, but the number of participants analysed and the number lost to follow-up were not reported.<br>1. Multifactorial intervention: randomised n = 635, analysed n = Not reported<br>2. Chronic disease prevention nurse visit: randomised n = 317, analysed n = Not reported<br>3. Control-usual care: randomised n = 607, analysed n = Not reported |
| Selective reporting (reporting bias) | Low risk | All prespecified outcomes were reported |
| Method of ascertaining falls | High risk | The incidence of falls was assessed from self-reports of episodes in the previous year |

**Waterman 2016**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 3<br>Study centres: unclear<br>Length of follow-up: 6 months |
| Participants | Setting: United Kingdom<br>Number randomised: 49<br>Number analysed: 43<br>Number lost to follow-up: 6<br>Sample: Participants were initially identified from a low-vision clinic by NIHR research staff at a hospital in north-west England<br>Age (years): 81.4 (SD 7.6)<br>Sex: 61%<br>Ethnicity: Intervention (94% white British); Control (100% white British) |

**Waterman 2016** *(Continued)*

| | |
|---|---|
| | Inclusion criteria: Passed vision-related criteria, aged 65 or over, independently living in the community, able to walk around their own residence, cognitively able to participate and understand study requirements<br>Exclusion criteria: Receiving an OT or physiotherapist intervention at home, home-safety assessment and modification, or exercise intervention including attendance at a falls clinic , did not achieve between 7 and 10 on abbreviated mental test |
| Interventions | Type of intervention: Multiple intervention<br>1. Home exercise programme and home-safety intervention: Shortened version of Otago exercise programme and Westmead home safety assessment (n = 17)<br>2. Usual care plus social visits: Usual care from NHS, 3 social visits, 2 telephone calls by lay visitors (n = 16)<br>3. Home-safety intervention only (n = 16)<br>Who delivered the intervention: Occupational therapists, peer mentors<br>Compliance assessed: Yes, the OT visited twice and a peer mentor visited 3 times and rang twice over the 6-month period, to encourage the person to adhere to the exercise programme. |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls<br>3. Number of people sustaining recurrent falls<br>4. Health-related quality of life (SF-12 0 - 100, mental and physical subscales: endpoint score)<br>5. Adverse events of the intervention |
| Notes | Source of funding: National Institute for Health Research under the Patient Benefit programme (RfPB)<br>Conflicts of interest: 2 authors are directors of a not-for-profit training company that runs Otago exercise training for health professionals.<br>Economic information: Intervention cost: GBP 674 per person<br>Adverse events: “There were no serious adverse events that could be attributed to the interventions of the study” |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Participants were independently randomised by the clinical trials unit by a web-based secure randomisation service |
| Allocation concealment (selection bias) | Low risk | Participants were independently randomised by the clinical trials unit by a web-based secure randomisation service |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel were not blind to allocated group but effect of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Participants prospectively completed and returned monthly falls diaries |

**Waterman 2016** *(Continued)*

| | | |
|---|---|---|
| Blinding of outcome assessment (detection bias) Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias) Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) All outcomes | Unclear risk | Less than 20% missing outcome data, balanced losses across groups with similar reasons for missing data<br>1. Home exercise programme and home-safety intervention: randomised n = 17, analysed n = 15 (2 withdrew)<br>2. Usual care and social visits: randomised n= 16, analysed n = 13 (1 withdrew, 2 died) |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in Methods section were reported |
| Method of ascertaining falls | Low risk | Falls calender comprising a single postcard for each month |

**Wesson 2013**

| | |
|---|---|
| Methods | Study Design: RCT (pilot study)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 3 months |
| Participants | Setting: Australia<br>Number randomised: 22<br>Number analysed: 22<br>Number lost to follow-up: 0<br>Sample: Recruited from a Memory Disorders, a Cognitive Disorders and an Aged Care Clinic, and a clinical dementia service network within the local health network in the eastern suburbs of Sydney, Australia<br>Age (years): 75.9<br>Sex: 41% women<br>Ethnicity : Not reported<br>Inclusion criteria: Community-dwellings over-65s with a specialist diagnosis of dementia or an Addenbrooke's Cognitive Examination (ACE-R) score ≤ 82<br>Exclusion criteria: Deliruim, acute medical condition, severe psychiatric disorder, progressive neurological disorder (except dementia), MMSE < 12, severe visual impairment, residents in age care facilities |
| Interventions | Type of intervention: Multiple intervention<br>1. Strength and balance training exercise and home-hazard reduction: Up to 6 individually-tailored strength and balance exercises selected from the Weight-bearing Exercise for Better Balance (WEBB) |

**Wesson 2013** *(Continued)*

| | |
|---|---|
| | programme based on the results of the physical performance assessment, the Westmead home safety assessment was used to audit the home environment. A booklet was provided with home safety recommendations which formed the basis for subsequent occupational therapy visits. (n = 11)<br><br>2. Control: Usual care (n = 11)<br><br>Who delivered the intervention: Physiotherapist, occupational therapist<br><br>Compliance assessed: Yes, exercise adherence recorded in booklet containing prescribed strength and balance exercises. |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people sustaining 1 or more fall-related fractures<br><br>3. Adverse events of the intervention |
| Notes | Source of funding: New investigator grant from the Alzeheimer's Association, USA (Clemson, L) and an Alzheimer's Australia Research (AAR), Dementia Research Grant for new researchers (Wesson J)<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported<br><br>Adverse events: “No serious adverse events related to the intervention were reported during the study period. Minor complaints relating to stiffness, dizziness and mild joint pain (n = 4; 36%) were reported by participants intermittently and exercises were adjusted accordingly." |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Conducted by investigator not involved in assessment or treatment. Used a random numbers table and permutated blocks of four and six". |
| Allocation concealment (selection bias) | Low risk | Quote: "Allocation concealed using opaque, sealed envelopes with study ID in sequential order". |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel not blinded to group assignment but effect of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Falls were recorded by monthly fall diaries completed by the carer. Investigators would ring if diaries were not returned |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not clear how fractures were reported |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | No losses across groups<br><br>1. Strength and balance training exercise and home hazard reduction: randomised n = 11, analysed n = 11 |

**Wesson 2013** *(Continued)*

| | | |
|---|---|---|
| | | 2. Control (usual care): randomised n = 11, analysed n = 11 |
| Selective reporting (reporting bias) | Low risk | All outcomes listed in the Methods were reported |
| Method of ascertaining falls | Unclear risk | Monthly fall diaries completed by the carer. If not returned the investigator would ring to obtain details. |

**Whitehead 2003**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Single centre<br>Length of follow-up: 6 months |
| Participants | Setting: Australia<br>Number randomised: 140<br>Number analysed: 123<br>Number lost to follow-up: 17<br>Sample: Patients presenting with a fall to A&E<br>Age (years): Mean 77.8 (SD 7.0)<br>Sex: 71% women<br>Ethnicity: Not reported<br>Inclusion criteria: Aged ≥ 65; fall-related attendance at A&E; community-dwelling or in low-care residential care (hostel accommodation)<br>Exclusion criteria: Resident in nursing home; presenting fall-related to a stroke, seizure, cardiac or respiratory arrest, major infection, haemorrhage, motor vehicle accident, or being knocked to the ground by another person; MMSE < 25; no resident carer; not English-speaking; living out of catchment area; terminal illness |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Home visit and questionnaire. "Fall risk profile" developed and participant given written care plan itemising elements of intervention. Letter to GP informing him/her of participant's fall, inviting them to review participant, highlighting identified risk factors, suggesting possible strategies (evidence-based). GP also given 1-page evidence summary (n = 70)<br>2. Home visit. No intervention. Standard medical care from GP (n = 70)<br>Who delivered the intervention: General practitioner, specialist geriatrician, occupational therapist, trained health professional<br>Compliance assessed: Yes, compliance as to whether the GP referred patients to falls clinic if suggested. In addition, at the end of the 6th month, a research assistant who was blind to participant's allocation undertook a telephone interview with all participants. All falls prevention activities undertaken during the course of the study were recorded. |
| Outcomes | 1. Number of people sustaining 1 or more falls |
| Notes | Source of funding: Part of Commonwealth-funded programme aimed at the interface between public hospitals and general practice<br>Conflicts of interest: Not reported |

**Whitehead 2003** *(Continued)*

| | |
|---|---|
| | Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Randomisation and allocation schedules created by a researcher external to the trial |
| Allocation concealment (selection bias) | Low risk | Randomised by a researcher external to the trial using numbered, sealed opaque envelopes |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls diary used to log occurrence of all falls, all participants were contacted by telephone by the principal research officer once every month to monitor any falls, and encourage the use of fall diaries. |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias)<br>All outcomes | Unclear risk | Less than 20% missing outcome data, losses are unbalanced across groups with no reasons given for missing data<br>1. Home visit and questionnaire: randomised n = 70, analysed n = 58<br>2. Home visit and standard medical care from GP: randomised n = 70, analysed n = 65 |
| Selective reporting (reporting bias) | High risk | Modified Barthel Index reported in the Methods as being collected at 6 months but not reported in Results |
| Method of ascertaining falls | Low risk | Falls diary used to log occurrence of all falls, all participants were contacted by telephone by the principal research officer once every month to monitor any falls, and encourage the use of fall diaries. |

**Wilder 2001**

| | |
|---|---|
| Methods | Study design: RCT (parallel design)<br>Number of study arms: 3<br>Study centres: unclear<br>Length of follow-up: 9 months |
| Participants | Setting: United States of America<br>Number randomised: 60 |

**Wilder 2001** *(Continued)*

| | |
|---|---|
| | Number analysed: Not reported<br><br>Number lost to follow-up: Not reported<br>Sample: "frail elderly" (proportion of women not stated)<br>Age (years): Not reported<br><br>Sex: Not reported<br>Inclusion criteria: Aged ≥ 75 years, living at home, using home services (i.e. Meals on Wheels, Telecare or Lifeline)<br>Exclusion criteria: None described |
| Interventions | Type of intervention: Multiple intervention<br><br>1. Home modifications plus home-exercise programme monitored by a "trained volunteer buddy"<br>2. Simple home modifications<br>3. Control: no intervention<br><br>Who delivered intervention: Physiotherapist and buddy volunteer (high school student or healthy elder)<br><br>Compliance assessed: Not reported |
| Outcomes | 1. Number of people sustaining 1 or more falls (abstract only) |
| Notes | Source of funding: Not reported<br><br>Conflicts of interest: Not reported<br><br>Economic information: Not reported |

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Unclear risk | Quote: "randomly assigned" to 3 arms. Method not described. |
| Allocation concealment (selection bias) | Unclear risk | Insufficient information to permit judgement |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel implementing the intervention not blind to allocated group, but impact of non-blinding unclear |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Unclear risk | Insufficient information |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Not applicable |
| Incomplete outcome data (attrition bias) | Unclear risk | Insufficient information |

**Wilder 2001** *(Continued)*
All outcomes

| | | |
|---|---|---|
| Selective reporting (reporting bias) | High risk | Results not published in full, only published as conference abstract |
| Method of ascertaining falls | Unclear risk | Insufficient information |

**Zijlstra 2009**

| | |
|---|---|
| Methods | Study Design: RCT (parallel design)<br>Number of study arms: 2<br>Study centres: Multiple centres<br>Length of follow-up: 14 months |
| Participants | Setting: The Netherlands<br>Number randomised: 540<br>Number analysed: 405<br>Number lost to follow-up: 135<br>Sample: Questionnaires were sent out to random samples of 7341 community-dwelling adults<br>Age (years): Control: Mean 78 (SD 5.0), Intervention: Mean 77.8 (SD 4.6)<br>Sex: Control: 73% women, Intervention: 71% women<br>Ethnicity: Not reported<br>Inclusion criteria: Community-dwelling adults 70 years or older reporting at least some fear of falling<br>Exclusion criteria: People confined to bed, restricted by permanent use of a wheelchair, waiting for nursing home admission or participating in other intervention studies. |
| Interventions | Type of intervention: Multifactorial intervention<br>1. Multicomponent cognitive behavioural group intervention: 8 weekly sessions of 2 hours, and booster session 6 months after the 8th session (n = 280)<br>2. Control: Usual care (n = 260)<br>Who delivered the intervention: Qualified geriatric nurses<br>Compliance assessed: Yes, method not described |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls<br>3. Number of people sustaining recurrent falls<br>4. Adverse effects of the intervention |
| Notes | Source of funding: CAPHRI - School for Public Health and Primary Care And The Facility of Health, Medicine and Life Sciences of the Maastricht University<br>Conflicts of interest: None |

**Zijlstra 2009** *(Continued)*

Economic information: Not reported

Adverse events: “No adverse events or side effects reported”

***Risk of bias***

| Bias | Authors' judgement | Support for judgement |
|---|---|---|
| Random sequence generation (selection bias) | Low risk | Quote: "Independent researcher blinded to participant characteristics performed block randomisation using computer generated random allocation". |
| Allocation concealment (selection bias) | Low risk | Independent researcher was blinded to participant's characteristics. |
| Blinding of participants and personnel (performance bias)<br>All outcomes | Unclear risk | Participants and personnel were not blinded to group but effect is unclear. |
| Blinding of outcome assessment (detection bias)<br>Falls and fallers | Low risk | Falls reported by monthly fall diaries |
| Blinding of outcome assessment (detection bias)<br>Fractures | Unclear risk | Not applicable |
| Blinding of outcome assessment (detection bias)<br>Hospital admission & medical attention | Unclear risk | Insufficient information on how medical attention was assessed |
| Incomplete outcome data (attrition bias)<br>All outcomes | High risk | More than 20% missing outcome data, losses are unbalanced across groups with similar reasons for missing data<br>1. Multicomponent cognitive behavioural group intervention: randomised n = 280, analysed n = 196 (6 died, 36 health problems, 21 lost interest, 12 felt trial too burdensome, 6 life event significant other, 3 other reasons)<br>2. Usual care: randomised n = 260, analysed n = 209 (6 died, 19 health problems, 13 lost interest, 6 felt trial too burdensome, 1 life event significant other, 6 other reasons) |
| Selective reporting (reporting bias) | High risk | Not all secondary outcome measures stipulated in protocol paper reported in study paper |
| Method of ascertaining falls | Low risk | Prospective falls calender returning a page every 3 months |

A&E: accident and emergency; ADL: activities of daily living; AMT: abbreviated mental test; BMI: body mass index; CB: cognitive behavioural; CHS: Cardiovascular Health Study; DSST: digit symbol substitution test; ED: emergency department; GP: general practitioner; GPSS: Geriatric Postal Screening Survey; HMO: health maintenance organisation; ICER: incremental cost-effectiveness ratio; IQR: interquartile range; MMSE: Mini Mental State Examination; OT: occupational therapist; PT: physiotherapist; QoL: quality of life; SD: standard deviation; TUG: timed up and go; VAS: visual analogue scale

## Characteristics of excluded studies *[ordered by study ID]*

| Study | Reason for exclusion |
|---|---|
| ACTRN12610000838011 | A randomised trial comparing 2 different models of service delivery for falls prevention in older adults living in the community |
| Alexander 2003 | A quasi-randomised trial assessing the effects of a multifactorial intervention to reduce falls in people attending daycare centres |
| Assantachai 2002 | A quasi-randomised trial assessing the effects of a multiple intervention versus no intervention to reduce falls in Thai elderly people living in the community |
| Bruce 2016 | A protocol for a randomised controlled trial comparing a multifactorial intervention versus advice on falls prevention versus advice on falls prevention and exercise in older adults living in the community |
| Chu 2017 | A randomised controlled trial comparing occupational therapy home-hazard modification versus control in older adults in Hong Kong after an emergency visit following a fall |
| Clemson 2012 | A randomised controlled trial comparing Lifestyle integrated Functional Exercise (LiFE), exercises for balance and lower limb strength, versus a sham control programme for the prevention of falls in older people |
| Cockayne 2014 | A randomised controlled trial comparing a multiple intervention of orthotic, foot and ankle exercises and footwear advice for the prevention of falls versus falls prevention advice in older adults living in the community |
| Cohen 2015 | A randomised controlled trial comparing a multifactorial intervention (LIFT - Living Independently and Falls free Together) intervention versus an active falls control group and an administration falls control group in older people living in the community |
| Comans 2010 | A randomised controlled trial comparing an individualised community rehabilitation service versus a group-based community rehabilitation service in community-dwelling older adults |
| Conroy 2010 | A randomised controlled trial comparing a multifactorial intervention versus another falls prevention programme in community-dwelling older people |
| De Negreiros 2013 | A protocol for a randomised controlled trial comparing a multifactorial falls prevention programme versus another active falls prevention intervention in older adults living in the community |
| Di Monaco 2008 | A quasi-randomised trial assessing the effectiveness of a multiple intervention to prevent falls versus usual care in elderly women who sustained a fall-related hip fracture in the community |
| Fox 2010 | A randomised controlled trial comparing the effects of a multifactorial intervention versus another active falls prevention intervention among older adults living in the community |
| Gianoudis 2014 | A randomised controlled trial comparing a multi-modal exercise programme combined with education versus self-management (education only) in older people living in the community |
| Gill 2008 | A randomised controlled trial comparing a specialised geriatric services multifactorial intervention versus a family physician-based multifactorial intervention for the prevention of falls in community-dwelling older male veterans |
| Giordano 2016 | A protocol for a randomised controlled trial comparing a multifactorial falls prevention programme versus another active falls prevention intervention in older adults living in the community |
| Hill 2000 | A randomised controlled trial comparing a nurse-led multifactorial intervention of exercise and individualised falls prevention advice versus standard falls-prevention advice in older people living in the community |

| Study | Reason for exclusion |
|---|---|
| Hornbrook 1994 | A randomised controlled trial comparing the effects of 2 different types of multifactorial intervention among older people living in the community |
| Huang 2004 | A randomised controlled trial comparing the effects a multifactorial intervention versus standardised fall-prevention information in Taiwanese older people living the community |
| Lamb 2010 | A randomised controlled trial comparing a multifactorial intervention plus advice versus exercise plus advice versus advice on falls prevention only in older adults living in the community |
| Lee 2013 | A randomised controlled trial comparing a multifactorial intervention versus control intervention in older adults living in the community. Included adults with Parkinsons diease and stroke - data were not available separately for analysis. |
| Mahoney 2007 | A randomised controlled trial comparing the effects of a community-based multifactorial falls-prevention intervention versus home safety assessments in adults living in the community |
| Matchar 2017 | A randomised controlled trial comparing a multifactorial intervention versus falls-prevention education materials in older adults living in the community |
| Mikolaizak 2017 | A randomised controlled trial comparing a multidisciplinary intervention versus individualised written fall-prevention advice to prevent subsequent falls and health service use using fall-related paramedic care |
| NCT00126152 | A randomised controlled trial comparing a multifactorial intervention versus control in older adults living in the community. The control group also received written information on falls prevention. |
| NCT00483275 | A randomised controlled trial comparing alfacalcidol and exercise versus control in older adults. This study was withdrawn prior to enrolment of the first participant. |
| Perula 2012 | A randomised controlled trial comparing the effect of a multifactorial intervention to reduce the incidence of falls in older adults versus individual advice and information leaflet on falls prevention |
| Salminen 2009 | A randomised controlled trial comparing the effects of a multifactorial intervention versus counselling and guidance about falls in older people living in the community |
| Shaw 2003 | A randomised controlled trial assessing the effects of a multifactorial intervention in cognitively-impaired people. Most participants not community-dwelling (79% of participants lived in high and intermediate nursing-care facilities). |
| Sherrington 2014 | A randomised controlled trial comparing exercise and fall-prevention advice materials versus fall-prevention advice materials in older adults post-discharge from hospital |
| Shumway-Cook 2007 | A randomised controlled trial comparing a multiple-component exercise intervention versus written materials on falls prevention in sedentary older adults living in the community |
| Snooks 2010 | A cluster-randomised controlled trial comparing paramedics receiving training and clinical protocols for assessing and referring older people who had fallen versus control paramedics who deliver care as usual |
| Snooks 2017 | A cluster-randomised controlled trial comparing paramedics receiving training and clinical protocols for assessing and referring older people who had fallen versus control paramedics who deliver care as usual |
| Spink 2011 | A randomised controlled trial comparing a multifaceted podiatry intervention versus routine podiatry care in community-dwelling older people with disabling foot pain |

| Study | Reason for exclusion |
|---|---|
| Steinberg 2000 | A randomised controlled trial assessing the effectiveness of a multiple intervention targeting major risk factors to reduce falls versus another active fall-prevention intervention among older adults living in the community |
| Suman 2011 | A randomised controlled trial assessing the effects of a community-based multifactorial fall-prevention intervention versus a hospital-based multifactorial fall-prevention intervention in older adults living in the community |
| Swanenburg 2007 | A randomised controlled trial assessing the effects of a multiple intervention of exercise and nutrition supplementation versus nutrition supplementation alone in elderly people with decreased bone mineral density |
| Tiedemann 2015 | A randomised controlled trial comparing a falls-prevention brochure plus physical activity promotion and a fall-prevention intervention enhanced with health coaching and a pedometer versus a fall-prevention brochure only in older adults |
| Von Stengel 2011 | A randomised controlled trial comparing the effects of exercise, exercise plus whole-body vibration, and a wellness control group for the prevention of falls in postmenopausal women |
| Wyman 2005 | A randomised controlled trial comparing the effects of a multifactorial intervention versus education and advice about falls prevention among older people living in the community |
| Xia 2009 | A randomised controlled trial of a population-based multifactorial intervention. Falls outcomes were based on a random sample from participating communities. |
| Yamada 2013 | A randomised controlled trial of multi-target stepping programme in combination with a standardised multicomponent exercise programme to prevent falls in community-dwelling older adults |

## Characteristics of ongoing studies *[ordered by study ID]*

### ACTRN12607000206426

| | |
|---|---|
| Trial name or title | Community care and hospital based collaborative falls prevention project |
| Methods | Study design: RCT<br><br>Number of study arms: 2 |
| Participants | Setting: Australia<br><br>Target sample size: 200<br>Inclusion criteria: Male or female, aged ≥ 65, presenting to A&E or falls clinic, community-dwelling in Perth north<br>Exclusion criteria: Functional cognitive impairment, unable to speak or read English |
| Interventions | Type of intervention: Multifactorial<br><br>1. Community follow-up by support worker (8 hours over 2 to 3 weeks) to review risk factors in the home, strategies to reduce risk factors, assistance to implement Falls Action Plan provided by A&E or clinic (see ANZCTR website for further details).<br>2. No community follow-up after discharge |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Number of people who experience a fall that requires medical attention |

**ACTRN12607000206426** *(Continued)*

| | |
|---|---|
| Starting date | April 2007 |
| Contact information | J Johnson<br>Perth Home Care Services<br>30 Hasler Road<br>PO Box 1597<br>Osborne Park<br>Western Australia 6017<br>Australia |
| Notes | Listed as "Not yet recruiting". Emailed author 6 July 2017; no response |

**ACTRN12614000827639**

| | |
|---|---|
| Trial name or title | Does nutrition and exercise prevent frailty and reduce falls in pre-frail older adults in New Zealand? |
| Methods | Study design: RCT<br><br>Number of study arms: 4 |
| Participants | Setting: New Zealand<br><br>Target sample size: 635<br><br>Sample: Older people living in the community<br><br>Inclusion criteria: Non-Maori aged 75 and older, Maori aged 60 and over; living in the community; pre-fail criteria of 1 or 2 on FRAIL questionnaire; able to stand; able to use kitchen utensils safely<br><br>Exclusion criteria: Terminally ill; advanced dementia from GP record |
| Interventions | Type of intervention: Multiple component<br><br>1. Senior Chief Programme consisting of 8 week programme of 3-hour weekly cooking classes followed by nutrition education<br><br>2. Steady as You Go programme (SAYGO) consisting of 1 hour weekly for 10-week exercise programme based on adapted Otago Exercise Programme<br><br>3. Senior Chief programme and SAYGO<br><br>4. Control - social activity course |
| Outcomes | 1. Number of people sustaining 1 or more falls<br><br>2. Health-related quality of life |
| Starting date | Auguest 2014 |
| Contact information | Dr Ruth Teh<br><br>The School of Population Health<br>Tamaki Campus<br>University of Auckland<br>261 Morrin Rd St Johns<br>Auckland 1072<br>New Zealand |

**ACTRN12614000827639** *(Continued)*

| | |
|---|---|
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**ACTRN12615001326583**

| | |
|---|---|
| Trial name or title | Preventing falls in older people after discharge from hospital as a result of a fall |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Austrialia<br>Target sample size: 30<br>Sample: Older people after discharge from hospital following admission as a result of a fall<br>Inclusion criteria: Aged 65 and older; discharged from hospital into the community following a fall; deemed medically fit<br>Exclusion criteria: Weight-bearing restrictions; medically unstable; terminal illness; referred to falls prevention service on discharge; transition care hospital stay |
| Interventions | Type of intervention: Multiple intervention<br>1. Exercise programme based on a modified version of the Otago Exercise Programme (20 - 30 minutes 5 times a week), with medication review component and education on falls-prevention component<br>2. Control: usual care |
| Outcomes | 1. Rate of falls<br>2. Health-related quality of life |
| Starting date | November 2015 to March 2016 (anticipated) |
| Contact information | Dr Dianne Goeman<br>Royal District Nursing Service Institute,<br>31 Alma Road,<br>St Kilda, Victoria 3182<br>Australia |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**Barker 2015**

| | |
|---|---|
| Trial name or title | RESPOND—a patient-centred programme to prevent secondary falls in older people presenting to the emergency department with a fall: protocol for a multicentre randomised controlled trial |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Australia |

**Barker 2015** *(Continued)*

| | |
|---|---|
| | Target sample size: 528<br><br>Sample: Older people presenting to the emergency department following a fall<br><br>Inclusion criteria: Community-dwelling persons, aged 60 to 90 years who present to the Royal Perth and Alfred Hospital EDs with a fall, and who are planned to be discharged directly home from the hospital within 72 hours<br><br>Exclusion criteria: Live further than 50 kilometres from the study site, discharged to high-level residential aged-care, require palliative care or have a terminal illness, require hands-on assistance to walk, are unable to use a telephone, need an interpreter, have cognitive impairment (MMSE < 23), display social aggression or have a history of psychoses |
| Interventions | Type of intervention: Multifactorial<br><br>1. RESPOND intervention incorporating (1) a home-based risk factor assessment; (2) education, coaching, goal-setting and<br>follow-up telephone support for management of 1 or more of 4 risk factors with evidence of effective interventions and (3)<br><br>healthcare provider communication and community linkage delivered over 6 months<br><br>2. Usual care |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Number of people who experience a fall that requires medical attention<br><br>4. Health-related quality of life |
| Starting date | March 2014 to July 2016 (actual) |
| Contact information | Anna Barker<br><br>Monash University, The Alfred Centre<br>DEPM, Level 6, 99 Commercial Road<br>Melbourne VIC 3004<br>Australia |
| Notes | Listed as "Completed" but results not yet published |

**Blank 2011**

| | |
|---|---|
| Trial name or title | Prevent Falls (PreFalls) |
| Methods | Study design: RCT (cluster-randomised)<br><br>Number of study arms: 2 |
| Participants | Setting: Germany<br><br>Target sample size: 382<br><br>Sample: Community-dwelling people registered with general practices<br>Inclusion criteria: Aged 65 and older; with at least 1 of the following: fall within last 12 months; fear of falling; chair stand-ups > 10 sec; TUG Test > 10 sec; impaired balance; self-reported balance deficits |

**Blank 2011** *(Continued)*

| | |
|---|---|
| | Exclusion criteria: Not living independently; with physical or mental restrictions which do not allow exercising or participating in falls risk assessments |
| Interventions | Type of intervention: Multiple component<br><br>1. Group- and home-based exercises (progressive strength and flexibility training; challenging balance; gait and motor co-ordination training; progressive endurance training). Fear of falling cognitive behavioural intervention (Matter of Balance programme). 60 min, 1 a week for 16 weeks<br>2. Control: no intervention |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls |
| Starting date | April 2009 to March 2012 |
| Contact information | Dr. Wolfgang Blank<br>Institute of General Practice<br>Klinikum rechts der Isar, Technische Universitaet Muenchen<br>Orleanstr. 47<br>81667 Muenchen<br>Germany<br>Telephone: +49 89 614658913<br>Email: blank@lrz.tum.de |
| Notes | Listed as "Completed" but results not yet published |

**Close 2014**

| | |
|---|---|
| Trial name or title | Can a tailored exercise and home hazard reduction program reduce the rate of falls in community dwelling older people with cognitive impairment: protocol paper for the i-FOCIS randomised controlled trial |
| Methods | Study design: RCT<br><br>Number of study arms: 2 |
| Participants | Setting: Australia<br><br>Target sample size: 360<br><br>Inclusion criteria: Aged 65 and above living in the community; MMSE < 24 or ACE-R < 83 or specialist clinical diagnosis of cognitive impairment or dementia; must have an identifiable and consenting person responsible and a carer (likely to be the person responsible in many cases) who have a minimum of 3½ hours of face-to-face contact with the participant each week for the purposes of reporting of falls and supervising the exercise intervention (3 times a week); willingness of participant and carer to give informed consent and to participate in and comply with the study protocol; proxy consent and participant assent will be used where participants cannot give informed consent.<br><br>Exclusion criteria: Participants with a MMSE < 12/30; following medical conditions: delirium, acute medical illnesses, severe psychiatric disorders, progressive neurological diseases other than dementia and blindness; residents of residential aged-care facilities; highly dependent on medical care |
| Interventions | Type of intervention: Multifactorial<br><br>1. Individual risk assessment followed by 12-month home-based exercise (based on Weight-bearing Exercise for Better Balance programme) and home-hazard reduction programme tailored to their |

**Close 2014** *(Continued)*

| | |
|---|---|
| | cognitive and physical abilities. Frequency and duration individually prescribed up to 30 minutes 3 - 6 times a week<br><br>2. Control: usual care |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Health-related quality of life |
| Starting date | June 2014 to July 2018 (anticipated) |
| Contact information | Jacqueline Close<br><br>Neuroscience Research Australia<br>Barker Street, Randwick NSW 2031<br>PO Box 1165<br>Australia |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**Hill 2017**

| | |
|---|---|
| Trial name or title | Reducing falls after hospital discharge: a protocol for a randomised controlled trial evaluating an individualised multimodal falls education programme for older adults |
| Methods | Study design: RCT<br><br>Number of study arms: 2 |
| Participants | Setting: Australia<br><br>Target sample size:390<br><br>Inclusion criteria: Aged 60 years or older, Abbreviated Mental Test Score > 7/10, 34 admitted to participating wards for this trial, discharged to the community, able to understand English sufficiently to take part in the education and receive telephone calls<br><br>Exclusion criteria: Unstable medical problem, discharged to transitional or residential care, requiring palliative care, short-stay admissions that preclude screening, enrolment and intervention during the admission (defined as admission planned of < 5 days) |
| Interventions | Type of intervention: Multiple<br><br>1. Falls prevention programme incorporating a video, workbook and individualised follow-up from an expert health professional to foster capability and motivation to engage in falls prevention strategies<br><br>2. Usual care plus social visit |
| Outcomes | 1. Rate of falls<br><br>2. Number of people sustaining 1 or more falls<br><br>3. Health-related quality of life |
| Starting date | July 2015 to September 2016 (anticipated) |

**Hill 2017** *(Continued)*

| | |
|---|---|
| Contact information | Anne-Marie Hill<br>School of Physiotherapy and Exercise Science<br>Curtin University Kent St, Bentley WA<br>Australia |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**ISRCTN21120199**

| | |
|---|---|
| Trial name or title | The effect of an assessment-based falls prevention programme in elderly people utilising day-care services |
| Methods | Study design: RCT (cluster RCT)<br>Number of study arms: 2 |
| Participants | Setting: Japan<br>Target sample size: 5000<br>Inclusion criteria: Aged over 65; using day-care services<br>Exclusion criteria: Acute health conditions |
| Interventions | Type of intervention: Multifactorial<br>1. Fall risk assessment and fall-prevention education for care providers and elderly participants<br>2. Control: usual care |
| Outcomes | 1. Rate of falls<br>2. Number of people sustaining 1 or more falls |
| Starting date | September 2008 to December 2009 |
| Contact information | Tokyo Metropolitan Institute of Gerontology<br>35-2 Sakae-cho<br>Itabashi<br>Tokyo<br>Japan |
| Notes | Listed as "Completed" but results not yet published |

**Landi 2017**

| | |
|---|---|
| Trial name or title | The “Sarcopenia and Physical fRailty IN older people: multi-componenT Treatment strategies” (SPRINTT) randomized controlled trial: design and methods |
| Methods | Study design: RCT<br>Number of study arms: 2 |

**Landi 2017** *(Continued)*

| | |
|---|---|
| Participants | Setting: Europe<br><br>Target sample size: 1500 (estimated)<br><br>Inclusion criteria: Age ≥ 70 years; Short Physical Performance Battery (SPPB) score between 3 and 9; ability to complete the 400-metre walk test within 15 minutes without sitting, the help with another person or the use of a walker; presence of low muscle mass<br><br>Exclusion criteria: Residence in long-term care; other health conditions such as lung, heart and inflammatory disease |
| Interventions | Type of intervention: Multiple component<br><br>1. Structured physical activity, nutritional counselling/dietary intervention, and an information and communication technology intervention<br><br>2. Healthy ageing lifestyle education programme |
| Outcomes | Number of people sustaining 1 or more falls |
| Starting date | Not specified |
| Contact information | Francesco Landi<br><br>Department of Geriatrics, Neurosciences and Orthopedics<br>Catholic University of the Sacred Heart School of Medicine<br>Rome, Italy |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**NCT01080196**

| | |
|---|---|
| Trial name or title | Reducing falls with RENEW in older adults who have fallen |
| Methods | Study design: RCT<br><br>Number of study arms: 2 |
| Participants | Setting: USA<br><br>Target sample size: 100<br><br>Inclusion criteria: Men and women between 65 and 95 years; 2 or more self-reported comorbid conditions; history of ≥ 1 fall in last 12 months; ambulatory; community-dwelling; gait speed 25 metres/minute to 80 metres/minute; with permission from physician to participate in a 60-minute (with rests) exercise programme; capable of performing RENEW on the ergometer<br><br>Exclusion criteria: Dementia; progressive neurologic disease or disease affecting muscle, e.g. Parkinson's, muscular dystrophy: participated in a regular (3 a week) aerobic or resistance exercise programme in past 12 months; any contraindication to having magnetic resonance imaging |
| Interventions | Type of intervention: Multifactorial<br><br>1. High-intensity (lower body) Resistance Exercise via Negative, Eccentrically-induced Work (RENEW)<br><br>2. Traditional lower-body resistance exercise |

**NCT01080196** *(Continued)*

| | |
|---|---|
| Outcomes | 1. Rate of falls |
| Starting date | April 2008 to February 2013 |
| Contact information | Sheldon B Smith<br>Department of Physical Therapy<br>University of Utah<br>Salt Lake City<br>Utah<br>USA<br>Email: sheldon.smith@hsc.utah.edu |
| Notes | Listed as "Recruitment status unknown". Completion date has passed and the status has not been verified in more than 2 years. |

**NCT01552551**

| | |
|---|---|
| Trial name or title | Assessment and referral versus exercise in primary prevention of falls: PA Healthy Steps Program |
| Methods | Study design: RCT<br>Number of study arms: 3 |
| Participants | Setting: USA<br>Target sample size: 189<br>Inclusion criteria: Aged 50 and above; scoring in the lowest tertile on at least 1 test in the Healthy Steps lower extremity performance battery<br>Exclusion criteria: hospice enrollee or life-threatening illness; active cancer treatment; neurologic disease linked to falls risk, such as Parkinson's; unable to walk indoors; high likelihood of moving in next 6 months |
| Interventions | Type of intervention: Multifactorial<br>1. Asssessment and care by physician and home-safety assessment<br>2. Exercise programme - Healthy Steps a 4-week exercise programme<br>3. Control: usual care |
| Outcomes | 1. Number of people sustaining 1 or more falls |
| Starting date | January 2013 to December 2015 |
| Contact information | Steven Albert<br>University of Pittsburgh<br>USA |
| Notes | Listed as "Completed" but the results have not yet been published |

**NCT01713543**

| | |
|---|---|
| Trial name or title | Community-based falls prevention program for the elderly |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Singapore<br>Target sample size: 354<br>Inclusion criteria: Aged 65 and above; seen in the Emergency Department for a fall or injury related to a fall; able to follow 3-step commands; Singapore citizen or Permanent Resident; living at home upon discharge; if admitted to the hospital, the illness or disability is one from which they are expected to recover basic ADLs or weight bearing of the lower extremity within the next month<br>Exclusion criteria: Severe physical and/or mental impairments which preclude participation in a programme of physical therapy; unable to walk even with assistance; community-dwelling prior to ED visit; total blindness |
| Interventions | Type of intervention: Multifactorial<br>1. Individually-tailored intervention programme based on a number of risk factors, including exercise, poor vision, medication review and home-hazard modification.<br>2. Control: usual care |
| Outcomes | 1. Number of people who sustained 1 or more falls<br>2. Number of people who experience a fall who require medical attention |
| Starting date | December 2012 to April 2015 |
| Contact information | David B Matchar<br>Duke-NUS Graduate Medical School<br>Singapore |
| Notes | Listed as "Completed" but results have not yet been published |

**NCT02374307**

| | |
|---|---|
| Trial name or title | Falls prevention in older people receiving home-help services |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Norway<br>Target sample size: 155<br>Inclusion criteria: Aged 67 and above; has fallen at least once in the last 12 months; receives home-help services; able to walk independently indoors with or without walking aid<br>Exclusion criteria: Medical contraindication to exercise; life expectancy < 1 year; scores under 23 points on MMSE; participating in another falls-prevention programme |

**NCT02374307** *(Continued)*

| | |
|---|---|
| Interventions | Type of intervention: Multiple component<br>1. Exercise and education, 12-week tailored exercise programme in accordance with Otago exercise programme, education on motivation and importance of adherence to exercise<br>2. Control: usual care |
| Outcomes | 1. Number of people sustaining 1 or more falls<br>2. Health-related quality of life |
| Starting date | February 2016 to January 2018 (anticipated) |
| Contact information | Astrid Bergland<br>Oslo University College of Applied Sciences<br>Norway |
| Notes | Listed as "Ongoing but not recruiting" |

**NCT02631330**

| | |
|---|---|
| Trial name or title | Effect on falls reduction of a multimodal intervention in frail and pre-frail elderly community-dwelling people (FAREMAVA) |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Spain<br>Target sample size: 466<br>Inclusion criteria: Aged 70 and above; independent ambulation; Linda Freid's criteria for pre-frailty<br>Exclusion criteria: Life expectancy of < 6 months; institutionalised patients; severe hearing or visual deficits; contraindication to physical exercise; serious psychiatric illness or moderate or severe cognitive impairment |
| Interventions | Type of intervention: Multifactorial<br>1. Monthly talk on potential falls hazards, exercise component 60 minutes including balance, muscle and strength training and medication review<br>2. Control: no intervention |
| Outcomes | 1. Rate of falls<br>2. Number of people who experience a fall that requires medical attention<br>3. Number of people who experience a fall that requires hospital admission<br>4. Health-related quality of life |
| Starting date | December 2016 to December 2017 (anticipated) |
| Contact information | Francisco J Tarazona-Santabalbina<br>Hospital Universitario de la Ribera |

**NCT02631330** *(Continued)*

| | |
|---|---|
| | Spain |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**Sherrington 2016**

| | |
|---|---|
| Trial name or title | RESTORE: Recovery exercises and Stepping On after fracture |
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Australia<br>Target sample size: 350<br>Inclusion criteria: People with a fall-related lower limb or pelvic fracture who have completed active physiotherapy or rehabilitation or both, and who are living at home or in a hostel<br>Exclusion criteria: Residing in nursing home; MMSE < 24; insufficient English language skills; inability to walk 10 metres despite assistance from another person or walking aid; progressive neurological disease; a medical condition precluding exercise |
| Interventions | Type of intervention: Multifactorial<br>1. Home visits from a physiotherapist to prescribe an individualised exercise programme and use motivational interviewing and goal-setting to encourage behaviour change about exercise, also offered the Stepping On programme as implemented by the NSW Department of Health: weekly 2-hour group discussion sessions for 7 weeks plus an additional booster session at 3 months<br>2. Usual care control |
| Outcomes | 1. Rate of falls<br>2. Number of people who experience a fall that requires medical attention<br>3. Health-related quality of life |
| Starting date | September 2010 |
| Contact information | C Sherrington<br>The George Institute for Global Health<br>PO Box M201<br>Missenden Rd NSW 2050<br>Australia |
| Notes | Listed as "Recruiting" as of 6 July 2017 |

**Tan 2014**

| | |
|---|---|
| Trial name or title | An individually-tailored multifactorial intervention program for older fallers in a middle-income developing country: Malaysian Falls Assessment and Intervention Trial (MyFAIT). |

**Tan 2014** *(Continued)*

| | |
|---|---|
| Methods | Study design: RCT<br>Number of study arms: 2 |
| Participants | Setting: Malaysia<br>Target sample size: 300<br>Inclusion criteria: Aged 65 and above; 2 or more falls or 1 injurious fall over the past 12 months<br>Exclusion criteria: Clinically-diagnosed dementia (ICD-10 definition); severe physical disabilities (i.e. unable to walk with a walking aid); major psychiatric illnesses, psychosis (i.e. schizophrenia, paranoia) or brain damage |
| Interventions | Type of intervention: Multifactorial<br>1. Individually-tailored, multifaceted interventions involving modifiable risk factors for falls: cardiovascular assessment and intervention; medication review; physiotherapy prescribed strength and balance exercise programme; home-hazards Intervention; visual assessment and intervention; others as required<br>2. Control: usual care |
| Outcomes | 1. Rate of falls<br>2. Health-related quality of life |
| Starting date | July 2012 to February 2016 |
| Contact information | Pey June Tan<br>Ageing and Age-Associated Disorders Research Group<br>Health and Translational Medicine Cluster<br>University of Malaya<br>Kuala Lumpur<br>Malaysia |
| Notes | Listed as "Completed" but results not yet published (protocol published) |

MMSE: Mini Mental State Examination; TUG: timed up and go

## DATA AND ANALYSES

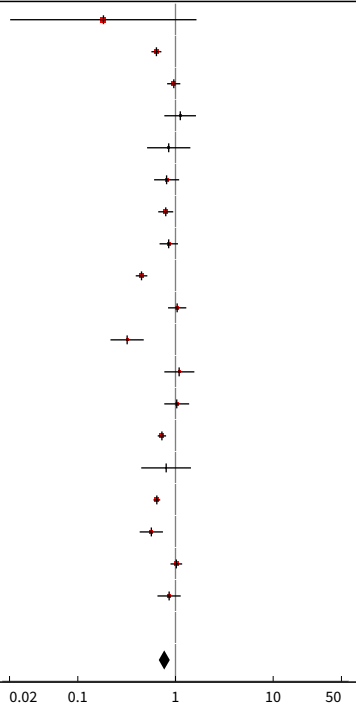
### Comparison 1. Multifactorial intervention vs usual care or attention control

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 19 | 5853 | Rate Ratio (Random, 95% CI) | 0.77 [0.67, 0.87] |
| 2 Number of people sustaining one or more falls | 29 | 9637 | Risk Ratio (Random, 95% CI) | 0.96 [0.90, 1.03] |

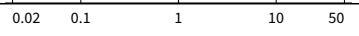
| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 12 | 3368 | Risk Ratio (Random, 95% CI) | 0.87 [0.74, 1.03] |
| 4 Number of people sustaining one or more fall-related fractures | 9 | 2850 | Risk Ratio (Random, 95% CI) | 0.73 [0.53, 1.01] |
| 5 Number of people who experience a fall that required hospital admission | 15 | 5227 | Risk Ratio (Random, 95% CI) | 1.00 [0.92, 1.07] |
| 6 Number of people who experience a fall that require medical attention | 8 | 3078 | Risk Ratio (Random, 95% CI) | 0.91 [0.75, 1.10] |
| 7 Health-related quality of life: endpoint score | 9 | 2373 | Std. Mean Difference (IV, Random, 95% CI) | 0.19 [0.03, 0.35] |
| 8 Health-related quality of life (mental): endpoint score | 3 | 376 | Std. Mean Difference (IV, Random, 95% CI) | 0.27 [-0.03, 0.56] |
| 9 Health-related quality of life (physical): endpoint score | 3 | 376 | Std. Mean Difference (IV, Random, 95% CI) | 0.39 [-0.00, 0.79] |

**Analysis 1.1. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 1 Rate of falls (falls per person years).**

| Study or subgroup | Multifactorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Beling 2009 | 11 | 8 | -1.7 (1.12) | | 0.33% | 0.18[0.02,1.64] |
| Davison 2005 | 144 | 149 | -0.4 (0.06) | | 6.75% | 0.64[0.57,0.72] |
| Elley 2008 | 155 | 157 | -0 (0.08) | | 6.47% | 0.96[0.82,1.12] |
| Fairhall 2014 | 107 | 109 | 0.1 (0.19) | | 4.5% | 1.12[0.77,1.62] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.26) | | 3.41% | 0.85[0.51,1.42] |
| Gallagher 1996 | 50 | 50 | -0.2 (0.15) | | 5.23% | 0.81[0.6,1.09] |
| Hogan 2001 | 75 | 77 | -0.2 (0.09) | | 6.31% | 0.79[0.67,0.95] |
| Lightbody 2002 | 155 | 159 | -0.2 (0.11) | | 5.97% | 0.85[0.69,1.06] |
| Logan 2010 | 98 | 99 | -0.8 (0.07) | | 6.62% | 0.45[0.39,0.52] |
| Lord 2005 | 192 | 197 | 0 (0.11) | | 5.97% | 1.04[0.84,1.29] |
| Luck 2013 | 118 | 112 | -1.1 (0.2) | | 4.33% | 0.32[0.22,0.47] |
| Markle-Reid 2010 | 49 | 43 | 0.1 (0.18) | | 4.68% | 1.09[0.77,1.56] |
| Möller 2014 | 56 | 50 | 0 (0.15) | | 5.23% | 1.03[0.77,1.38] |
| Palvanen 2014 | 661 | 653 | -0.3 (0.05) | | 6.86% | 0.73[0.66,0.8] |
| Pardessus 2002 | 30 | 30 | -0.2 (0.3) | | 2.9% | 0.8[0.45,1.44] |
| Russell 2010 | 344 | 354 | -0.4 (0.04) | | 6.96% | 0.64[0.6,0.7] |
| Tinetti 1994 | 147 | 144 | -0.6 (0.14) | | 5.42% | 0.57[0.43,0.74] |
| Vind 2009 | 196 | 196 | 0 (0.07) | | 6.62% | 1.02[0.89,1.17] |
| Zijlstra 2009 | 196 | 209 | -0.1 (0.14) | | 5.42% | 0.86[0.65,1.13] |
| **Total (95% CI)** | | | | | **100%** | **0.77[0.67,0.87]** |



| Study or subgroup | Multi-factorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Heterogeneity: Tau²=0.06; Chi²=150.01, df=18(P<0.0001); I²=88% | | | | | | |
| Test for overall effect: Z=3.99(P<0.0001) | | | | | | |




Favours intervention — Favours control

## Analysis 1.2. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 2 Number of people sustaining one or more falls.

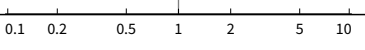
| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ciaschini 2009 | 101 | 100 | 0.4 (0.28) | | 1.25% | 1.51[0.87,2.61] |
| Close 1999 | 184 | 213 | -0.5 (0.13) | | 3.48% | 0.61[0.47,0.79] |
| Coleman 1999 | 79 | 63 | 0.1 (0.23) | | 1.7% | 1.15[0.73,1.81] |
| Davison 2005 | 144 | 149 | -0 (0.08) | | 5.02% | 0.95[0.81,1.11] |
| De Vries 2010 | 106 | 111 | -0.1 (0.13) | | 3.48% | 0.93[0.72,1.2] |
| Elley 2008 | 155 | 157 | 0.1 (0.08) | | 5.02% | 1.09[0.94,1.28] |
| Fabacher 1994 | 100 | 95 | -0.5 (0.31) | | 1.05% | 0.61[0.33,1.11] |
| Fairhall 2014 | 119 | 119 | 0.1 (0.11) | | 4.05% | 1.07[0.86,1.33] |
| Ferrer 2014 | 142 | 131 | 0.1 (0.2) | | 2.08% | 1.12[0.75,1.65] |
| Hendriks 2008 | 124 | 134 | -0 (0.14) | | 3.23% | 0.97[0.74,1.28] |
| Hogan 2001 | 75 | 77 | -0.1 (0.09) | | 4.68% | 0.9[0.76,1.08] |
| Huang 2005 | 63 | 63 | -0.3 (0.56) | | 0.36% | 0.71[0.24,2.13] |
| Kingston 2001 | 51 | 41 | -0.2 (0.98) | | 0.12% | 0.8[0.12,5.48] |
| Lightbody 2002 | 155 | 159 | -0 (0.19) | | 2.23% | 0.98[0.68,1.42] |
| Logan 2010 | 102 | 102 | -0.2 (0.06) | | 5.69% | 0.84[0.75,0.95] |
| Lord 2005 | 202 | 201 | 0 (0.11) | | 4.05% | 1.03[0.83,1.28] |
| Möller 2014 | 80 | 73 | 0.1 (0.16) | | 2.78% | 1.12[0.82,1.53] |
| Newbury 2001 | 45 | 44 | -0.4 (0.31) | | 1.05% | 0.69[0.38,1.27] |
| Palvanen 2014 | 661 | 653 | -0.2 (0.06) | | 5.69% | 0.84[0.74,0.94] |
| Pardessus 2002 | 30 | 30 | -0.1 (0.28) | | 1.25% | 0.87[0.5,1.5] |
| Russell 2010 | 320 | 330 | 0.1 (0.08) | | 5.02% | 1.12[0.95,1.31] |
| Spice 2009 | 164 | 80 | -0.1 (0.07) | | 5.35% | 0.9[0.78,1.03] |
| Spice 2009 | 106 | 80 | 0 (0.06) | | 5.69% | 1.04[0.93,1.17] |
| Tinetti 1994 | 147 | 144 | -0.3 (0.15) | | 2.99% | 0.74[0.55,0.99] |
| Van Haastregt 2000 | 120 | 115 | 0.1 (0.12) | | 3.76% | 1.13[0.89,1.43] |
| Vetter 1992 | 240 | 210 | 0.3 (0.13) | | 3.48% | 1.28[1,1.66] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 4.68% | 1.09[0.92,1.31] |
| Wagner 1994 | 635 | 607 | -0.3 (0.08) | | 5.02% | 0.75[0.64,0.88] |
| Whitehead 2003 | 58 | 65 | 0.7 (0.26) | | 1.41% | 2.1[1.26,3.49] |
| Zijlstra 2009 | 188 | 203 | -0.2 (0.1) | | 4.36% | 0.84[0.69,1.03] |
| **Total (95% CI)** | | | | | **100%** | **0.96[0.9,1.03]** |
| Heterogeneity: Tau²=0.02; Chi²=72.98, df=29(P<0.0001); I²=60.26% | | | | | | |
| Test for overall effect: Z=1.16(P=0.24) | | | | | | |




Favours intervention — Favours control

## Analysis 1.3. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

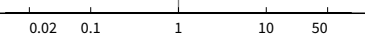
| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Close 1999 | 184 | 213 | -0.8 (0.24) | | 7.24% | 0.44[0.28,0.7] |
| De Vries 2010 | 106 | 111 | 0.1 (0.19) | | 9.14% | 1.11[0.76,1.6] |
| Elley 2008 | 155 | 157 | 0.3 (0.14) | | 11.45% | 1.3[0.99,1.71] |
| Fairhall 2014 | 119 | 119 | -0.1 (0.2) | | 8.73% | 0.86[0.58,1.27] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.39) | | 3.78% | 0.78[0.36,1.67] |
| Hendriks 2008 | 124 | 134 | 0 (0.21) | | 8.33% | 1.02[0.68,1.54] |
| Hogan 2001 | 75 | 77 | -0.3 (0.2) | | 8.73% | 0.76[0.52,1.13] |
| Lord 2005 | 202 | 201 | 0.1 (0.18) | | 9.58% | 1.08[0.76,1.54] |
| Möller 2014 | 80 | 73 | -0.3 (0.26) | | 6.6% | 0.76[0.45,1.26] |
| Schrijnemaekers 1995 | 85 | 97 | -0.3 (0.27) | | 6.31% | 0.75[0.44,1.27] |
| Vind 2009 | 196 | 196 | -0 (0.19) | | 9.14% | 0.98[0.68,1.42] |
| Zijlstra 2009 | 188 | 203 | -0.4 (0.15) | | 10.97% | 0.68[0.51,0.92] |
| **Total (95% CI)** | | | | | **100%** | **0.87[0.74,1.03]** |
| Heterogeneity: $Tau^2$=0.05; $Chi^2$=23.6, df=11(P=0.01); $I^2$=53.39% | | | | | | |
| Test for overall effect: Z=1.59(P=0.11) | | | | | | |




Favours experimental — Favours control

## Analysis 1.4. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 4 Number of people sustaining one or more fall-related fractures.

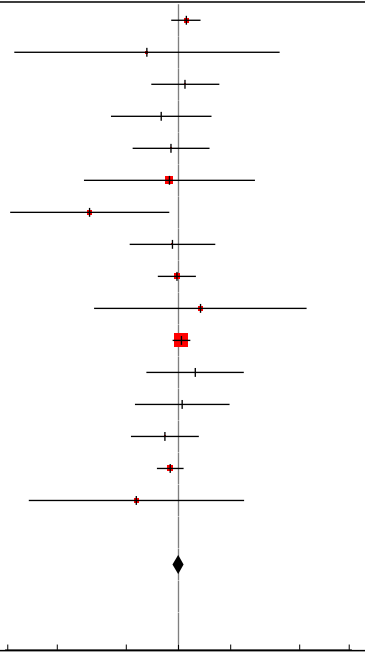
| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ciaschini 2009 | 101 | 100 | -1.8 (1.07) | | 2.36% | 0.17[0.02,1.35] |
| Davison 2005 | 159 | 154 | -0.6 (0.49) | | 11.27% | 0.53[0.2,1.38] |
| De Vries 2010 | 106 | 111 | 0.1 (0.62) | | 7.04% | 1.05[0.31,3.54] |
| Fairhall 2014 | 119 | 119 | 0.1 (0.38) | | 18.74% | 1.08[0.51,2.28] |
| Hogan 2001 | 75 | 77 | -0.5 (0.71) | | 5.37% | 0.62[0.15,2.49] |
| Logan 2010 | 102 | 102 | -0.7 (0.69) | | 5.68% | 0.5[0.13,1.94] |
| Russell 2010 | 320 | 330 | -0.6 (0.43) | | 14.64% | 0.55[0.24,1.27] |
| Spice 2009 | 114 | 67 | -0.3 (0.65) | | 6.4% | 0.73[0.21,2.62] |
| Spice 2009 | 177 | 67 | -0.7 (0.65) | | 6.4% | 0.47[0.13,1.69] |
| Vetter 1992 | 240 | 210 | 0 (0.35) | | 22.09% | 1[0.5,1.99] |
| **Total (95% CI)** | | | | | **100%** | **0.73[0.53,1.01]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=5.84, df=9(P=0.76); $I^2$=0% | | | | | | |
| Test for overall effect: Z=1.93(P=0.05) | | | | | | |




Favours intervention — Favours control

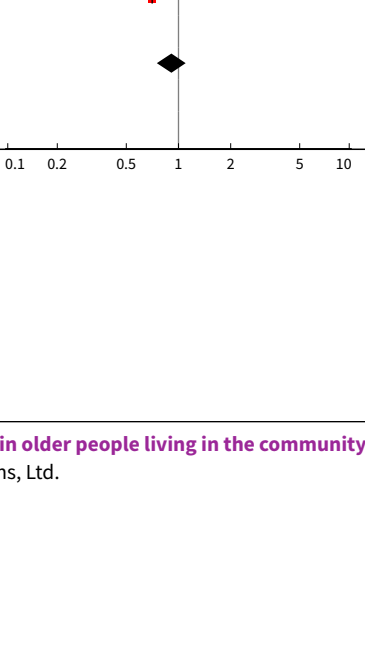
## Analysis 1.5. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 5 Number of people who experience a fall that required hospital admission.

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Carpenter 1990 | 272 | 267 | 0.1 (0.1) | | 15.06% | 1.11[0.91,1.34] |
| Ciaschini 2009 | 101 | 100 | -0.4 (0.9) | | 0.19% | 0.66[0.11,3.83] |
| Coleman 1999 | 81 | 62 | 0.1 (0.23) | | 2.85% | 1.09[0.7,1.72] |
| Davison 2005 | 159 | 154 | -0.2 (0.34) | | 1.3% | 0.79[0.41,1.55] |
| Fabacher 1994 | 100 | 95 | -0.1 (0.26) | | 2.23% | 0.9[0.54,1.51] |
| Hogan 2001 | 79 | 84 | -0.1 (0.58) | | 0.45% | 0.89[0.28,2.76] |
| Huang 2005 | 63 | 63 | -1.2 (0.54) | | 0.52% | 0.31[0.11,0.89] |
| Jitapunkul 1998 | 57 | 59 | -0.1 (0.29) | | 1.79% | 0.92[0.52,1.63] |
| Logan 2010 | 102 | 102 | -0 (0.13) | | 8.91% | 0.98[0.76,1.26] |
| Pardessus 2002 | 30 | 30 | 0.3 (0.72) | | 0.29% | 1.34[0.33,5.48] |
| Rubenstein 2007 | 334 | 360 | 0 (0.06) | | 41.84% | 1.04[0.93,1.17] |
| Spice 2009 | 106 | 63 | 0.2 (0.33) | | 1.38% | 1.25[0.65,2.38] |
| Spice 2009 | 164 | 63 | 0.1 (0.32) | | 1.47% | 1.05[0.56,1.97] |
| Tinetti 1994 | 130 | 125 | -0.2 (0.23) | | 2.85% | 0.84[0.53,1.31] |
| Van Rossum 1993 | 292 | 288 | -0.1 (0.09) | | 18.59% | 0.9[0.75,1.07] |
| Wagner 1994 | 635 | 607 | -0.6 (0.73) | | 0.28% | 0.57[0.14,2.39] |
| **Total (95% CI)** | | | | | **100%** | **1[0.92,1.07]** |
| Heterogeneity: Tau²=0; Chi²=10.65, df=15(P=0.78); I²=0% | | | | | | |
| Test for overall effect: Z=0.1(P=0.92) | | | | | | |




## Analysis 1.6. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 6 Number of people who experience a fall that require medical attention.

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Davison 2005 | 159 | 154 | -0.1 (0.25) | | 15.41% | 0.9[0.55,1.46] |
| Hendriks 2008 | 166 | 167 | -0.3 (0.33) | | 8.85% | 0.7[0.37,1.35] |
| Hogan 2001 | 79 | 84 | 0.2 (0.46) | | 4.55% | 1.2[0.49,2.95] |
| Möller 2014 | 80 | 73 | 0.4 (0.39) | | 6.33% | 1.52[0.71,3.27] |
| Tinetti 1994 | 125 | 122 | -0.2 (0.29) | | 11.46% | 0.8[0.45,1.42] |
| Van Haastregt 2000 | 120 | 115 | 0.4 (0.32) | | 9.41% | 1.43[0.77,2.68] |
| Vind 2009 | 196 | 196 | -0 (0.22) | | 19.9% | 0.97[0.63,1.49] |
| Wagner 1994 | 635 | 607 | -0.3 (0.2) | | 24.08% | 0.7[0.48,1.04] |
| **Total (95% CI)** | | | | | **100%** | **0.91[0.75,1.1]** |
| Heterogeneity: Tau²=0; Chi²=6.62, df=7(P=0.47); I²=0% | | | | | | |
| Test for overall effect: Z=0.97(P=0.33) | | | | | | |



## Analysis 1.7. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 7 Health-related quality of life: endpoint score.

| Study or subgroup | Multifactorial N | Multifactorial Mean(SD) | Control N | Control Mean(SD) | Std. Mean Difference Random, 95% CI | Weight | Std. Mean Difference Random, 95% CI |
|---|---|---|---|---|---|---|---|
| Close 1999 | 184 | 18.6 (2.4) | 213 | 17.3 (3.7) | | 13.31% | 0.41[0.21,0.61] |
| Fairhall 2014 | 107 | 57.5 (20.8) | 108 | 57.7 (19.7) | | 11.37% | -0.01[-0.28,0.26] |
| Gallagher 1996 | 50 | 36.8 (5) | 50 | 36.3 (5) | | 8.25% | 0.1[-0.29,0.49] |
| Hendriks 2008 | 124 | 0.7 (0.3) | 134 | 0.7 (0.3) | | 12.02% | -0.04[-0.28,0.21] |
| Huang 2005 | 63 | 60.8 (10.5) | 59 | 51.3 (11.6) | | 8.71% | 0.86[0.48,1.23] |
| Jitapunkul 1998 | 57 | 17.3 (3.6) | 59 | 17.1 (2.7) | | 8.88% | 0.06[-0.3,0.43] |
| Lightbody 2002 | 155 | 18.5 (2.4) | 159 | 17.8 (3.6) | | 12.66% | 0.23[0.01,0.45] |
| Logan 2010 | 82 | 14.3 (4.7) | 75 | 13.6 (4.8) | | 10.12% | 0.16[-0.15,0.47] |
| Rubenstein 2007 | 334 | 36 (12.3) | 360 | 35.5 (11.4) | | 14.7% | 0.04[-0.11,0.19] |
| **Total ***** | **1156** | | **1217** | | | **100%** | **0.19[0.03,0.35]** |
| Heterogeneity: $Tau^2$=0.04; $Chi^2$=26.69, df=8(P=0); $I^2$=70.03% | | | | | | | |
| Test for overall effect: Z=2.35(P=0.02) | | | | | | | |




Favours control — Favours intervention

## Analysis 1.8. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 8 Health-related quality of life (mental): endpoint score.

| Study or subgroup | Multifactorial N | Multifactorial Mean(SD) | Control N | Control Mean(SD) | Std. Mean Difference Random, 95% CI | Weight | Std. Mean Difference Random, 95% CI |
|---|---|---|---|---|---|---|---|
| Huang 2005 | 63 | 62.2 (19.7) | 59 | 56.3 (15.1) | | 33.34% | 0.33[-0.03,0.69] |
| Markle-Reid 2010 | 49 | 73.1 (15.3) | 43 | 74 (14.5) | | 28.84% | -0.06[-0.47,0.35] |
| Shyu 2010 | 80 | 64.5 (19) | 82 | 55.8 (18.7) | | 37.83% | 0.46[0.15,0.77] |
| **Total ***** | **192** | | **184** | | | **100%** | **0.27[-0.03,0.56]** |
| Heterogeneity: $Tau^2$=0.03; $Chi^2$=4.01, df=2(P=0.13); $I^2$=50.1% | | | | | | | |
| Test for overall effect: Z=1.78(P=0.08) | | | | | | | |




Favours control — Favours intervention

## Analysis 1.9. Comparison 1 Multifactorial intervention vs usual care or attention control, Outcome 9 Health-related quality of life (physical): endpoint score.

| Study or subgroup | Multifactorial N | Multifactorial Mean(SD) | Control N | Control Mean(SD) | Std. Mean Difference Random, 95% CI | Weight | Std. Mean Difference Random, 95% CI |
|---|---|---|---|---|---|---|---|
| Huang 2005 | 63 | 23.7 (18.9) | 59 | 13.7 (19.6) | | 33.39% | 0.51[0.15,0.87] |
| Markle-Reid 2010 | 49 | 54.8 (17.5) | 43 | 55.5 (20.4) | | 30.93% | -0.04[-0.45,0.37] |
| Shyu 2010 | 80 | 62.2 (28.1) | 82 | 43.5 (28.5) | | 35.68% | 0.66[0.34,0.97] |
| **Total ***** | **192** | | **184** | | | **100%** | **0.39[-0,0.79]** |
| Heterogeneity: $Tau^2$=0.09; $Chi^2$=7.24, df=2(P=0.03); $I^2$=72.36% | | | | | | | |
| Test for overall effect: Z=1.95(P=0.05) | | | | | | | |



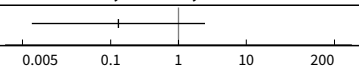

Favours control — Favours intervention

### Comparison 2. Multifactorial intervention vs exercise

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 1 | | Rate Ratio (Random, 95% CI) | Subtotals only |
| 2 Number of people sustaining one or more falls | 1 | | Risk Ratio (Random, 95% CI) | Subtotals only |

### Analysis 2.1. Comparison 2 Multifactorial intervention vs exercise, Outcome 1 Rate of falls (falls per person years).

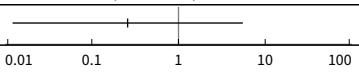
| Study or subgroup | Multifactorial N | Exercise N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ueda 2017 | 25 | 26 | -2 (1.5) | | 0% | 0.13[0.01,2.46] |




Favours intervention — Favours exercise

### Analysis 2.2. Comparison 2 Multifactorial intervention vs exercise, Outcome 2 Number of people sustaining one or more falls.

| Study or subgroup | Multifactorial N | Exercise N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ueda 2017 | 25 | 26 | -1.3 (1.56) | | 0% | 0.26[0.01,5.52] |




Favours intervention — Favours exercise

### Comparison 3. Multiple intervention vs usual care or attention control

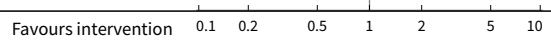
| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 6 | 1085 | Rate Ratio (Random, 95% CI) | 0.74 [0.60, 0.91] |
| 1.1 Exercise, home safety and nutrition | 1 | 145 | Rate Ratio (Random, 95% CI) | 0.70 [0.53, 0.95] |
| 1.2 Exercise and nutrition | 2 | 335 | Rate Ratio (Random, 95% CI) | 0.87 [0.69, 1.09] |
| 1.3 Exercise, home safety and vision | 1 | 310 | Rate Ratio (Random, 95% CI) | 0.69 [0.50, 0.96] |
| 1.4 Exercise and psychological component | 1 | 116 | Rate Ratio (Random, 95% CI) | 0.40 [0.11, 1.53] |
| 1.5 Nutrition and psychological component | 1 | 151 | Rate Ratio (Random, 95% CI) | 0.39 [0.22, 0.68] |
| 1.6 Exercise and home safety | 1 | 28 | Rate Ratio (Random, 95% CI) | 1.20 [0.59, 2.42] |

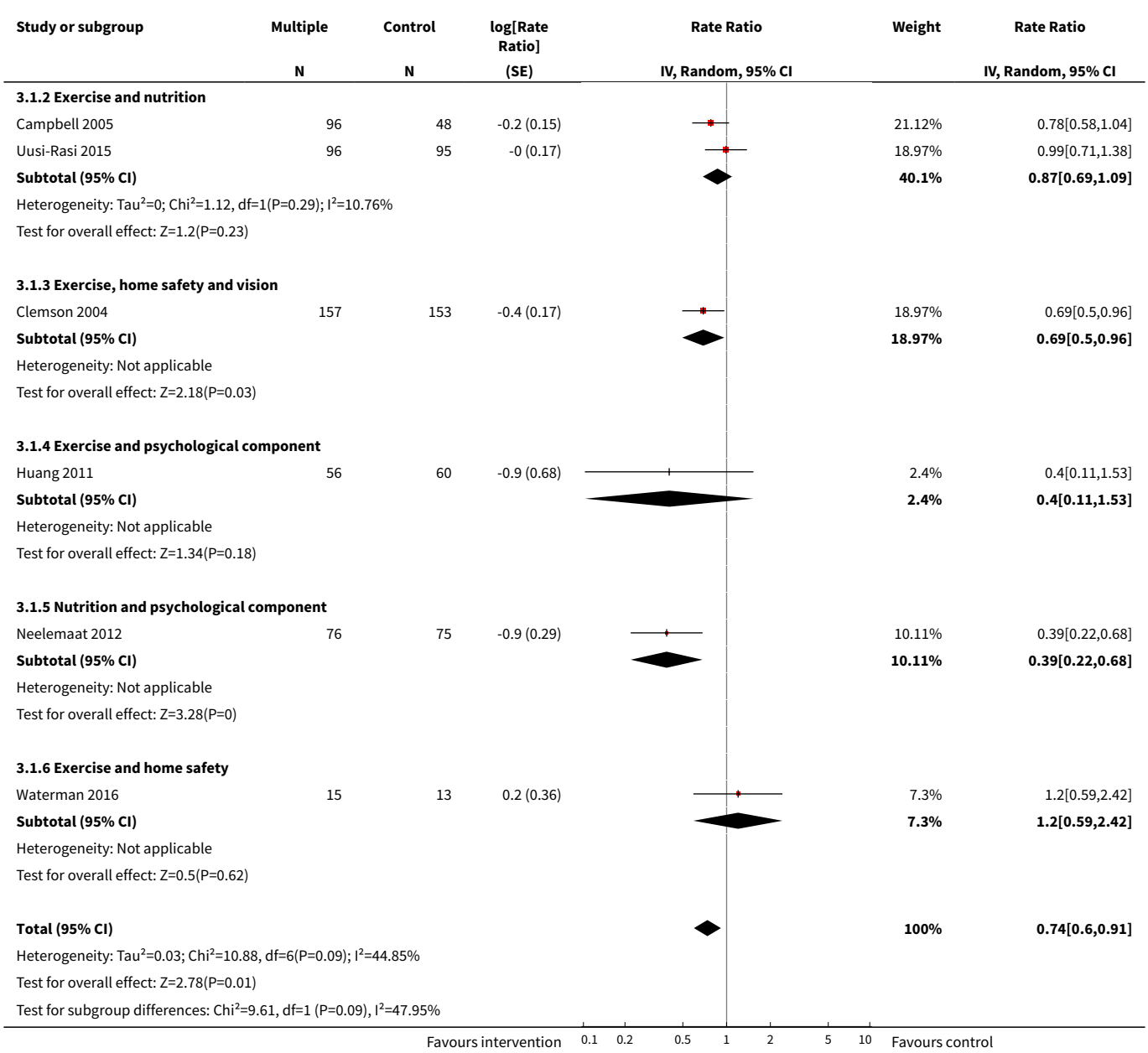
| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 2 Number of people sustaining one or more falls | 11 | 1980 | Risk Ratio (Random, 95% CI) | 0.82 [0.74, 0.90] |
| 2.1 Exercise, home safety and nutrition | 1 | 145 | Risk Ratio (Random, 95% CI) | 0.77 [0.57, 1.03] |
| 2.2 Exercise and nutrition | 1 | 146 | Risk Ratio (Random, 95% CI) | 0.78 [0.58, 1.04] |
| 2.3 Exercise, home safety and vision | 2 | 479 | Risk Ratio (Random, 95% CI) | 0.84 [0.71, 1.00] |
| 2.4 Exercise and vision | 1 | 170 | Risk Ratio (Random, 95% CI) | 0.75 [0.56, 1.00] |
| 2.5 Exercise and home safety | 3 | 219 | Risk Ratio (Random, 95% CI) | 0.84 [0.65, 1.09] |
| 2.6 Home safety and vision | 1 | 171 | Risk Ratio (Random, 95% CI) | 0.88 [0.65, 1.18] |
| 2.7 Exercise and psychological component | 2 | 149 | Risk Ratio (Random, 95% CI) | 0.84 [0.25, 2.77] |
| 2.8 Education and exercise | 2 | 192 | Risk Ratio (Random, 95% CI) | 1.09 [0.57, 2.11] |
| 2.9 Nutrition and psychological component | 1 | 210 | Risk Ratio (Random, 95% CI) | 0.41 [0.21, 0.82] |
| 2.10 Exercise, nutrition and psychological component | 1 | 99 | Risk Ratio (Random, 95% CI) | 0.41 [0.08, 1.99] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 4 | 662 | Risk Ratio (Random, 95% CI) | 0.81 [0.63, 1.05] |
| 3.1 Exercise, home safety and nutrition | 1 | 146 | Risk Ratio (Random, 95% CI) | 0.79 [0.45, 1.36] |
| 3.2 Exercise and home safety | 2 | 173 | Risk Ratio (Random, 95% CI) | 0.89 [0.54, 1.46] |
| 3.3 Exercise, home safety and vision | 1 | 310 | Risk Ratio (Random, 95% CI) | 0.74 [0.52, 1.05] |
| 3.4 Exercise and psychological component | 1 | 33 | Risk Ratio (Random, 95% CI) | 5.00 [0.68, 36.94] |
| 4 Number of people sustaining one or more fall-related fractures | 2 | 232 | Risk Ratio (Random, 95% CI) | 0.50 [0.05, 5.32] |
| 4.1 Nutrition and psychological component | 1 | 210 | Risk Ratio (Random, 95% CI) | 0.50 [0.02, 14.89] |
| 4.2 Exercise and home safety | 1 | 22 | Risk Ratio (Random, 95% CI) | 0.50 [0.02, 13.50] |
| 5 Number of people who experience a fall that required hospital admission | 1 | | Risk Ratio (Random, 95% CI) | Totals not selected |
| 5.1 Exercise, nutrition and psychological component | 1 | | Risk Ratio (Random, 95% CI) | 0.0 [0.0, 0.0] |

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 6 Number of people who experience a fall that required medical attention | 1 | 291 | Risk Ratio (Random, 95% CI) | 0.95 [0.67, 1.35] |
| 6.1 Exercise, home safety and nutrition | 1 | 146 | Risk Ratio (Random, 95% CI) | 0.91 [0.56, 1.49] |
| 6.2 Exercise and nutrition | 1 | 145 | Risk Ratio (Random, 95% CI) | 0.99 [0.61, 1.62] |
| 7 Health-related quality of life: endpoint score | 4 | 391 | Std. Mean Difference (IV, Random, 95% CI) | 0.77 [0.16, 1.39] |
| 7.1 Exercise and nutrition | 1 | 133 | Std. Mean Difference (IV, Random, 95% CI) | 0.07 [-0.27, 0.41] |
| 7.2 Exercise and psychological component | 2 | 194 | Std. Mean Difference (IV, Random, 95% CI) | 1.23 [0.92, 1.54] |
| 7.3 Exercise, nutrition and psychological component | 1 | 64 | Std. Mean Difference (IV, Random, 95% CI) | 0.57 [0.07, 1.07] |
| 8 Health-related quality of life (mental): endpoint score | 2 | 92 | Std. Mean Difference (IV, Random, 95% CI) | 0.69 [0.26, 1.11] |
| 8.1 Exercise and home safety | 1 | 28 | Std. Mean Difference (IV, Random, 95% CI) | 0.80 [0.02, 1.57] |
| 8.2 Exercise, nutrition and psychological component | 1 | 64 | Std. Mean Difference (IV, Random, 95% CI) | 0.64 [0.14, 1.14] |
| 9 Health-related quality of life (physical): endpoint score | 2 | 92 | Std. Mean Difference (IV, Random, 95% CI) | 0.12 [-0.53, 0.77] |
| 9.1 Exercise and home safety | 1 | 28 | Std. Mean Difference (IV, Random, 95% CI) | -0.27 [-1.02, 0.47] |
| 9.2 Exercise, nutrition and psychological component | 1 | 64 | Std. Mean Difference (IV, Random, 95% CI) | 0.40 [-0.10, 0.90] |

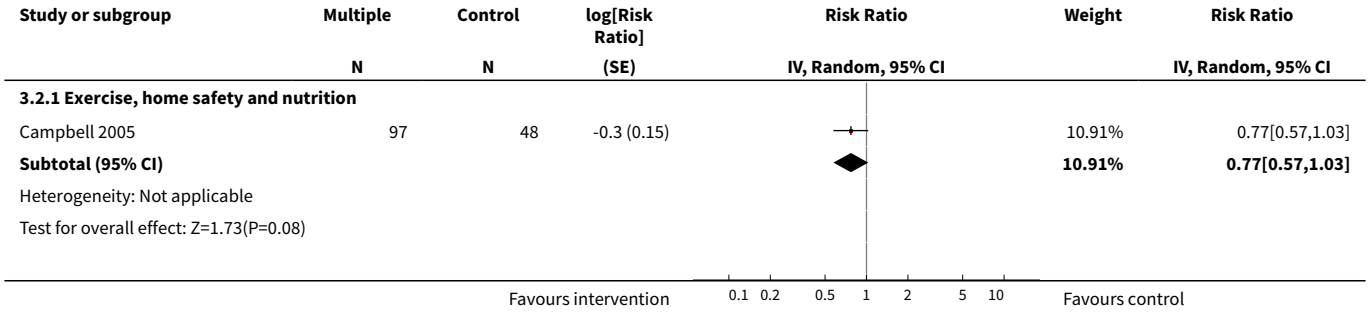
**Analysis 3.1. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 1 Rate of falls (falls per person years).**

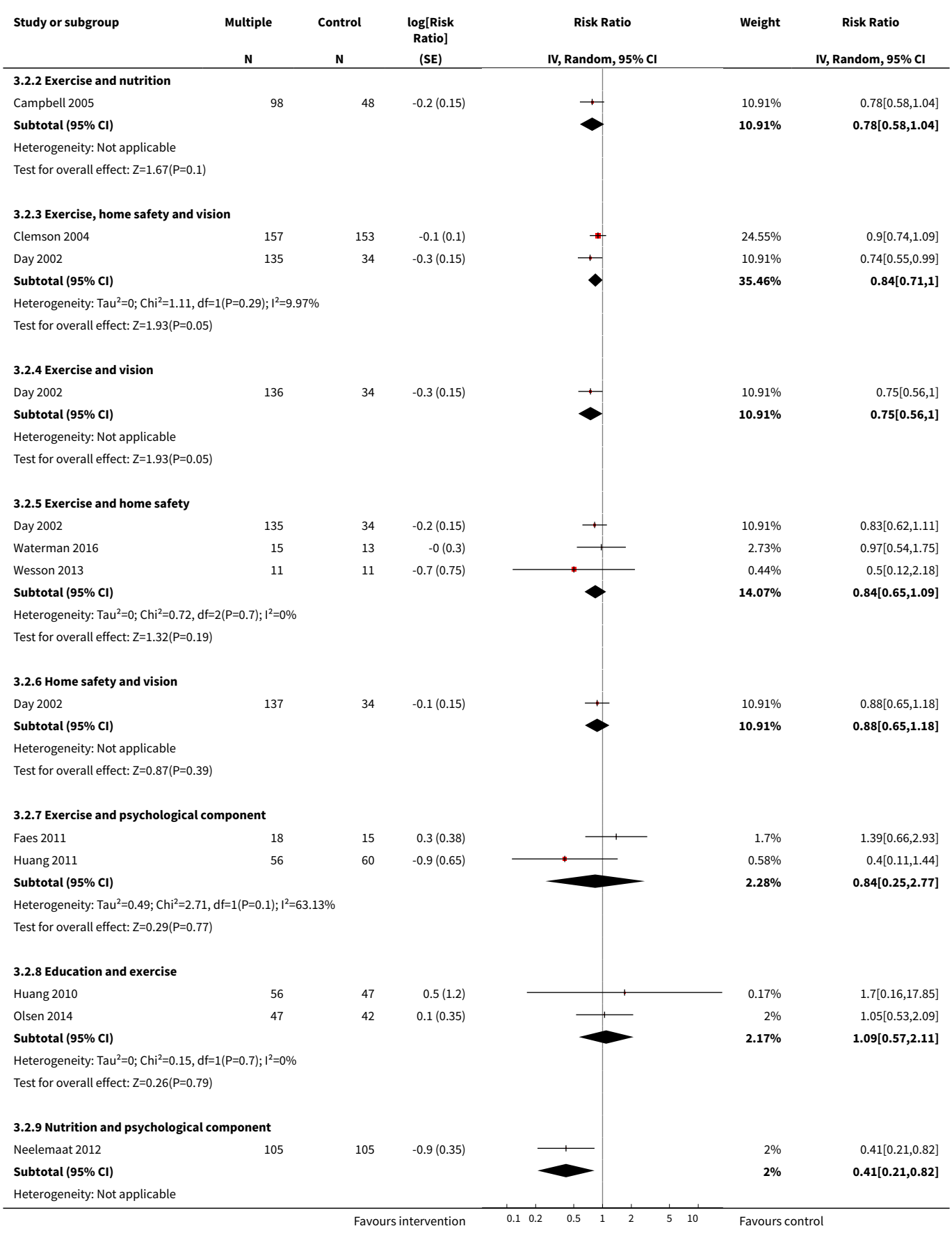
| Study or subgroup | Multiple N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **3.1.1 Exercise, home safety and nutrition** | | | | | | |
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 21.12% | 0.7[0.53,0.95] |
| **Subtotal (95% CI)** | | | | | **21.12%** | **0.7[0.53,0.95]** |
| Heterogeneity: Not applicable | | | | | | |
| Test for overall effect: Z=2.33(P=0.02) | | | | | | |

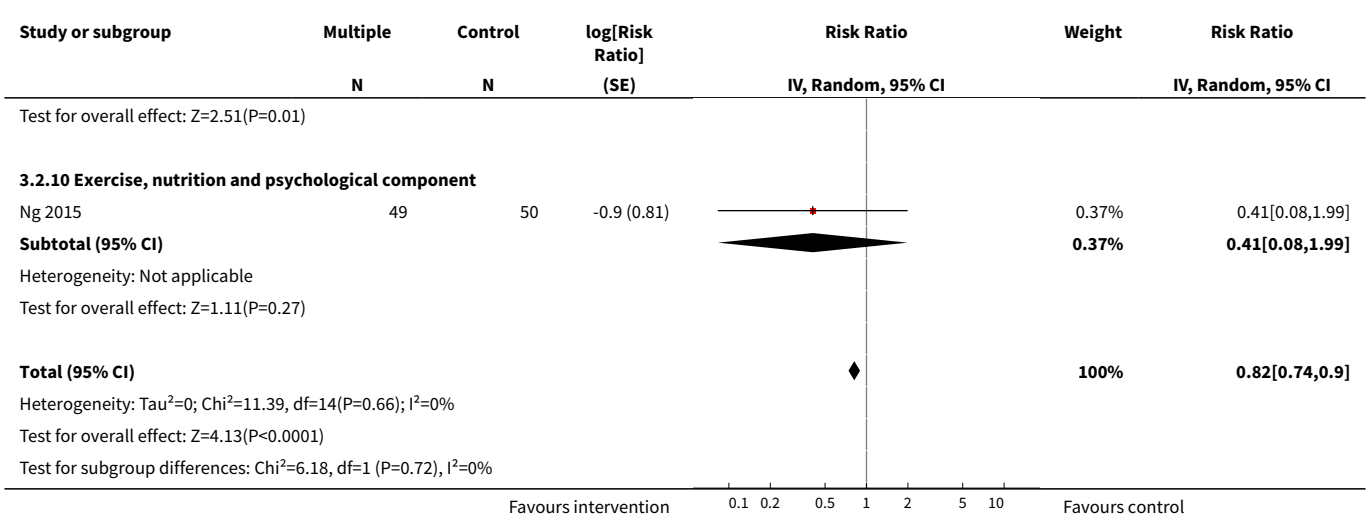




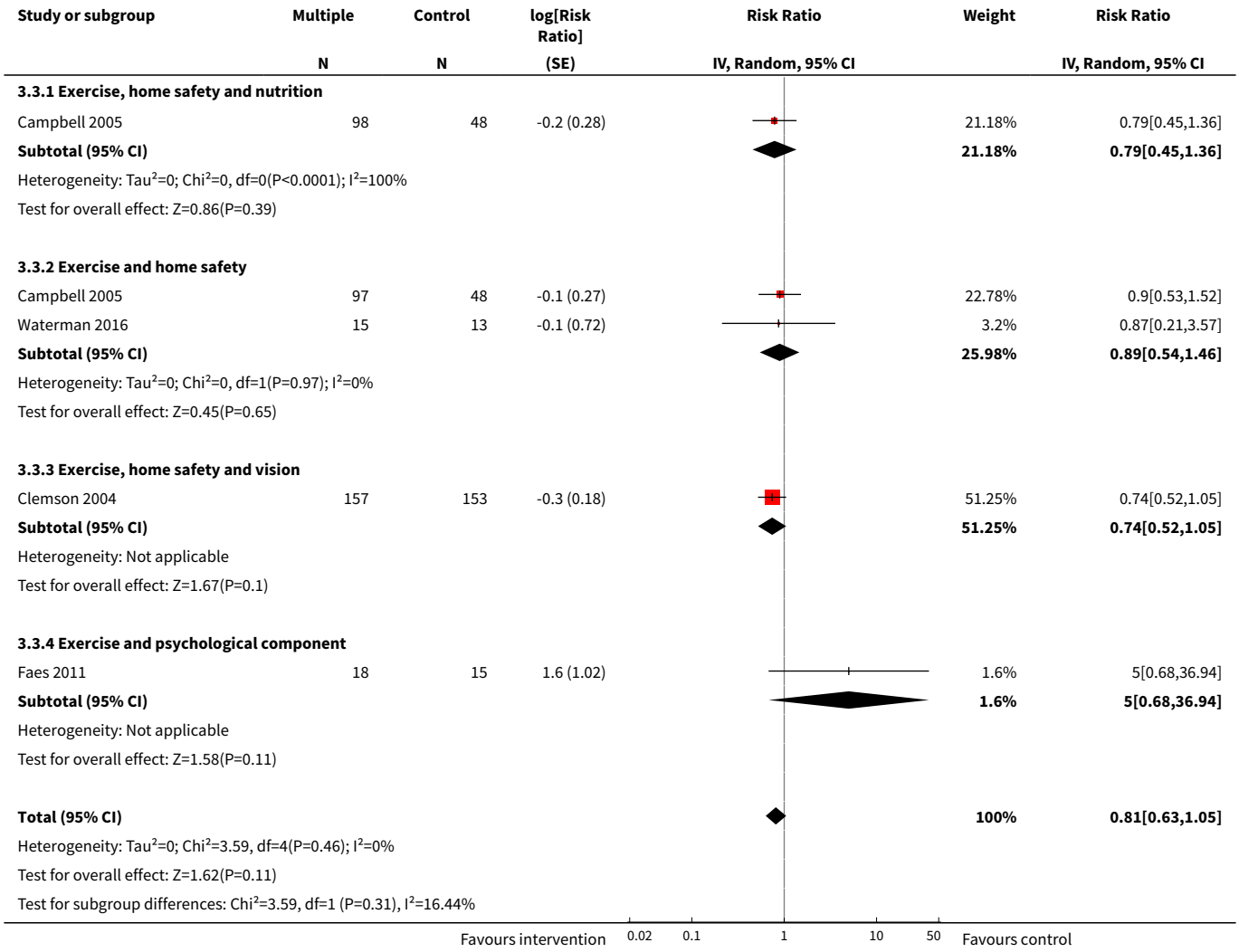

## Analysis 3.2. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 2 Number of people sustaining one or more falls.



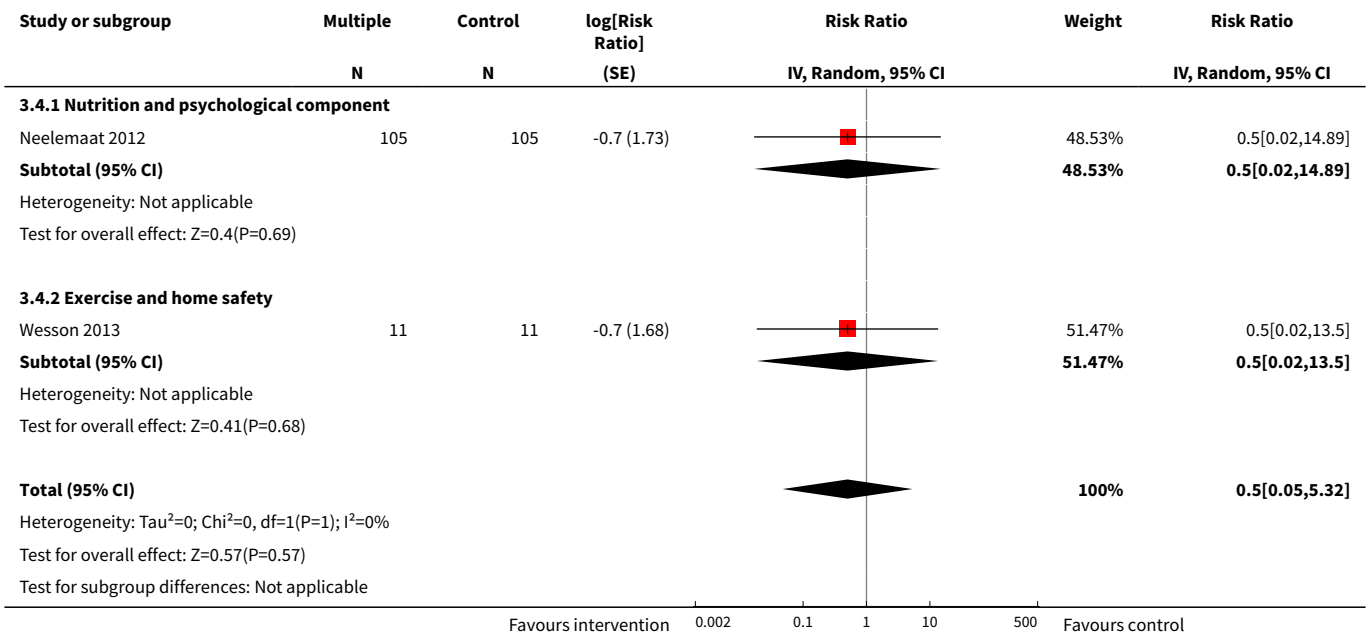




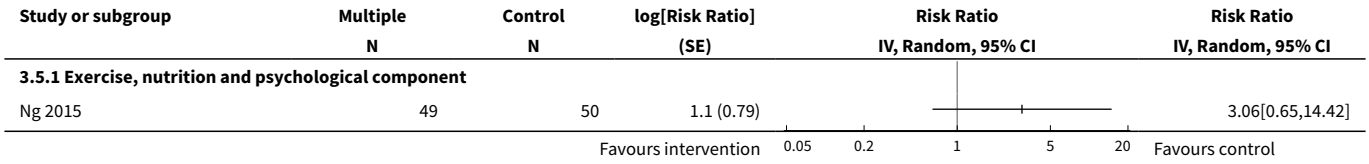

## Analysis 3.3. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).



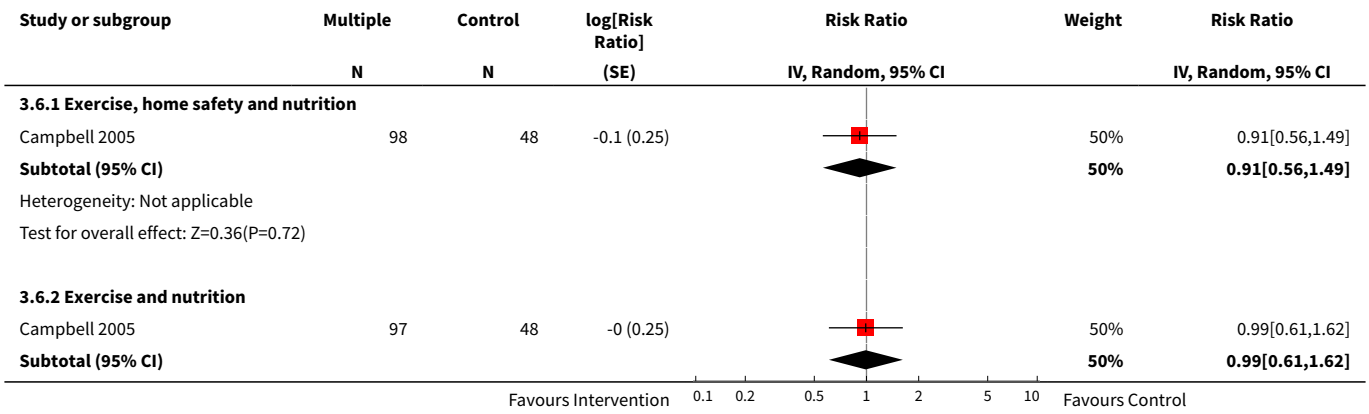
## Analysis 3.4. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 4 Number of people sustaining one or more fall-related fractures.

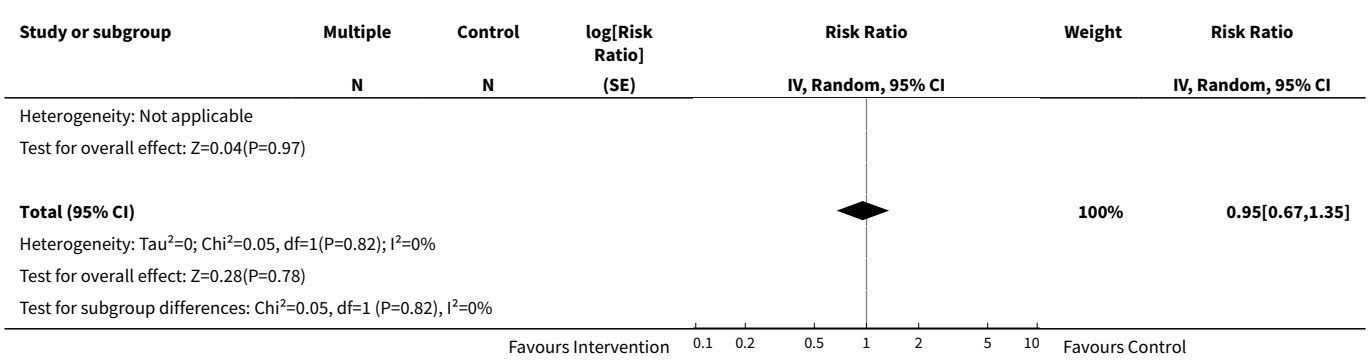



## Analysis 3.5. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 5 Number of people who experience a fall that required hospital admission.

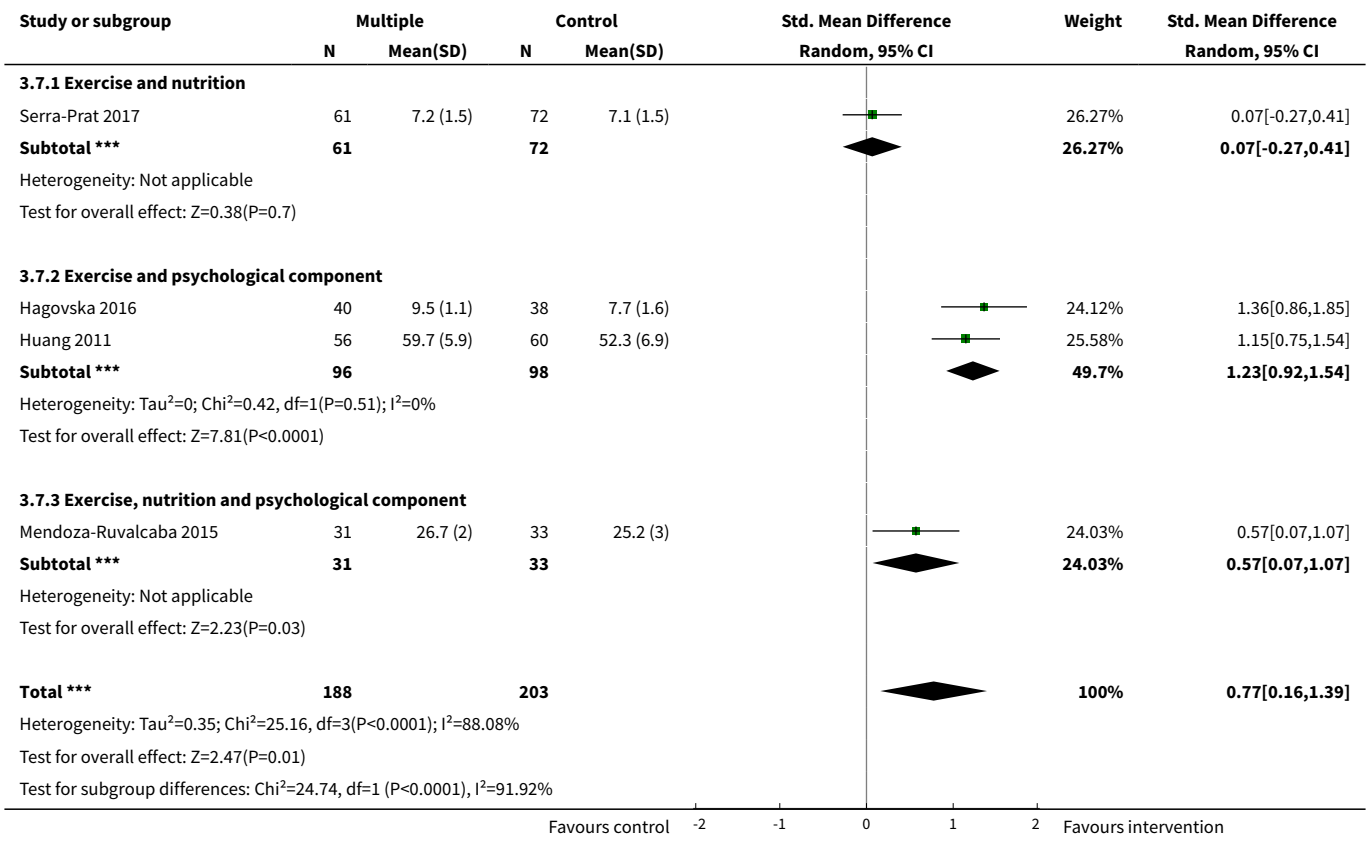



## Analysis 3.6. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 6 Number of people who experience a fall that required medical attention.

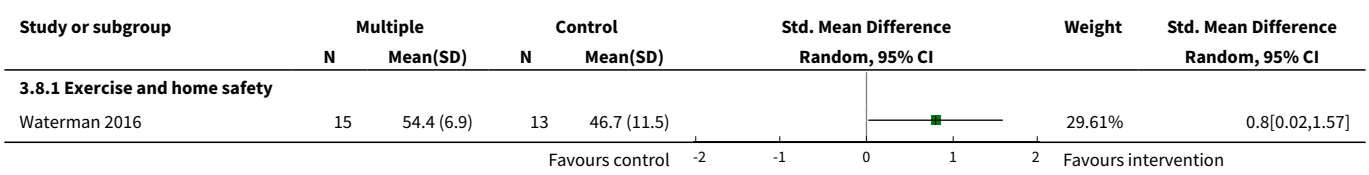


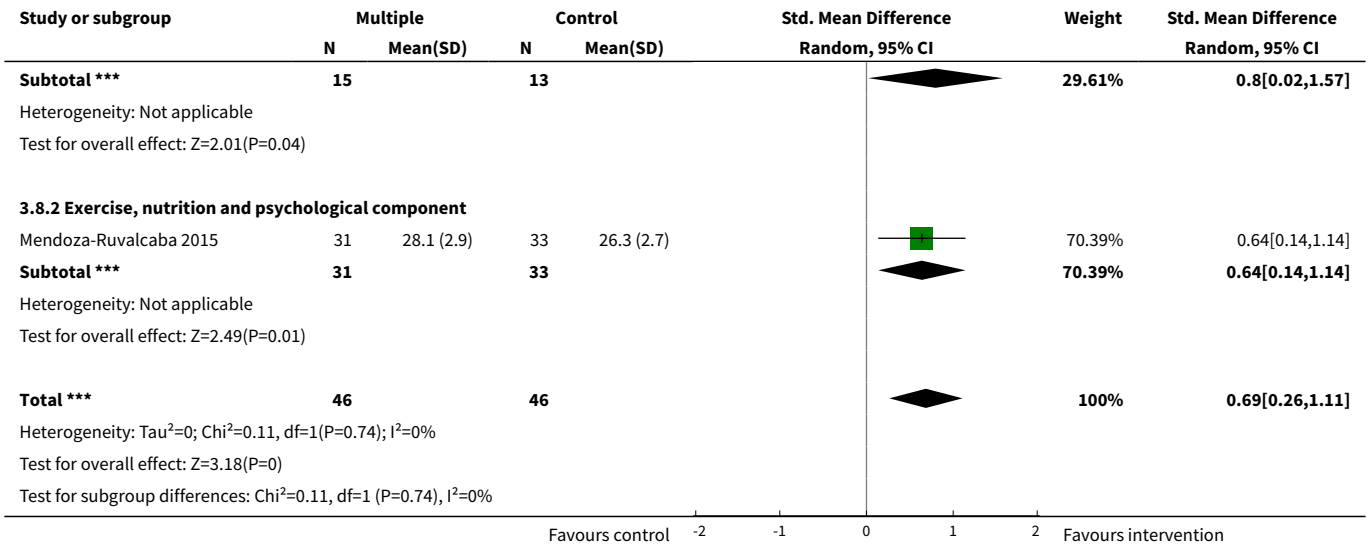



## Analysis 3.7. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 7 Health-related quality of life: endpoint score.

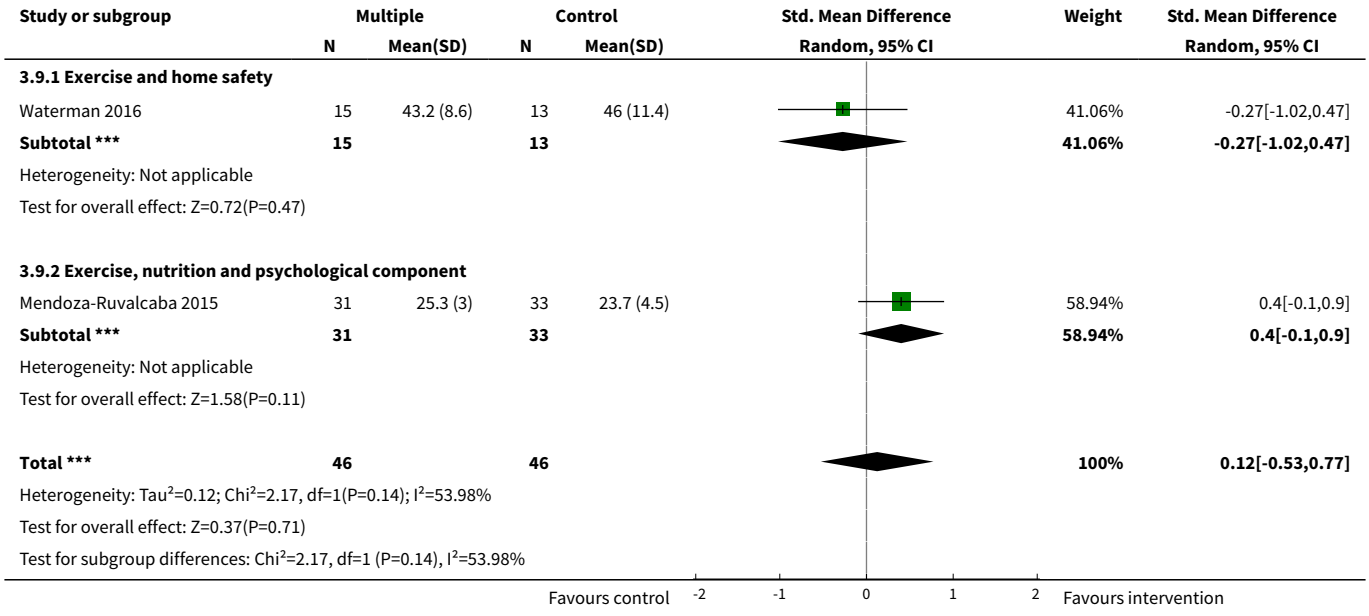



## Analysis 3.8. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 8 Health-related quality of life (mental): endpoint score.






**Analysis 3.9. Comparison 3 Multiple intervention vs usual care or attention control, Outcome 9 Health-related quality of life (physical): endpoint score.**

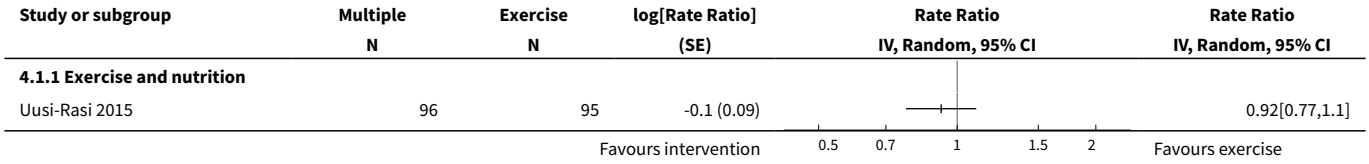



## Comparison 4. Multiple intervention vs exercise

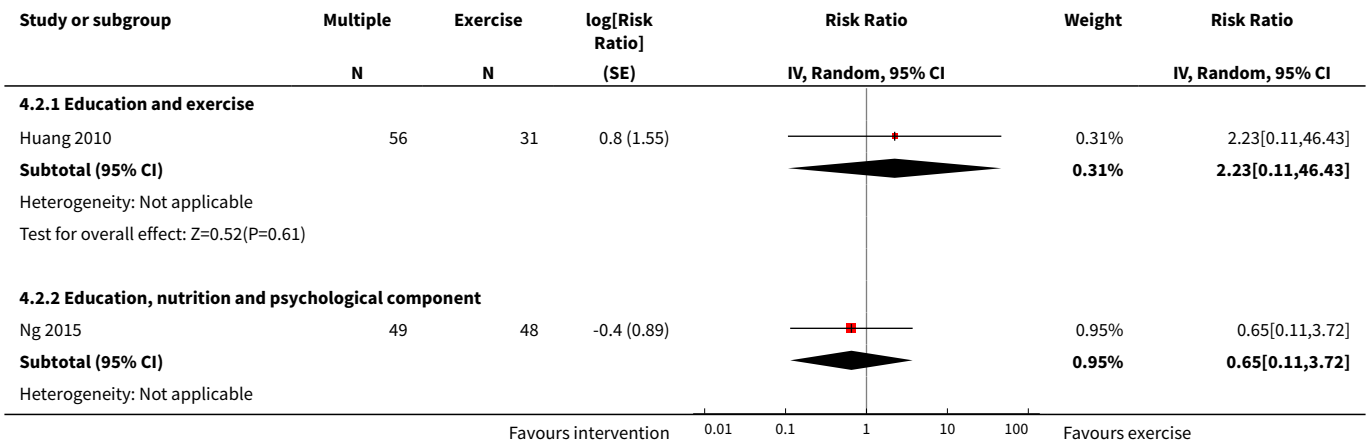
| Outcome or subgroup title | No. of studies | No. of partici-pants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 1 | | Rate Ratio (Random, 95% CI) | Totals not selected |
| 1.1 Exercise and nutrition | 1 | | Rate Ratio (Random, 95% CI) | 0.0 [0.0, 0.0] |

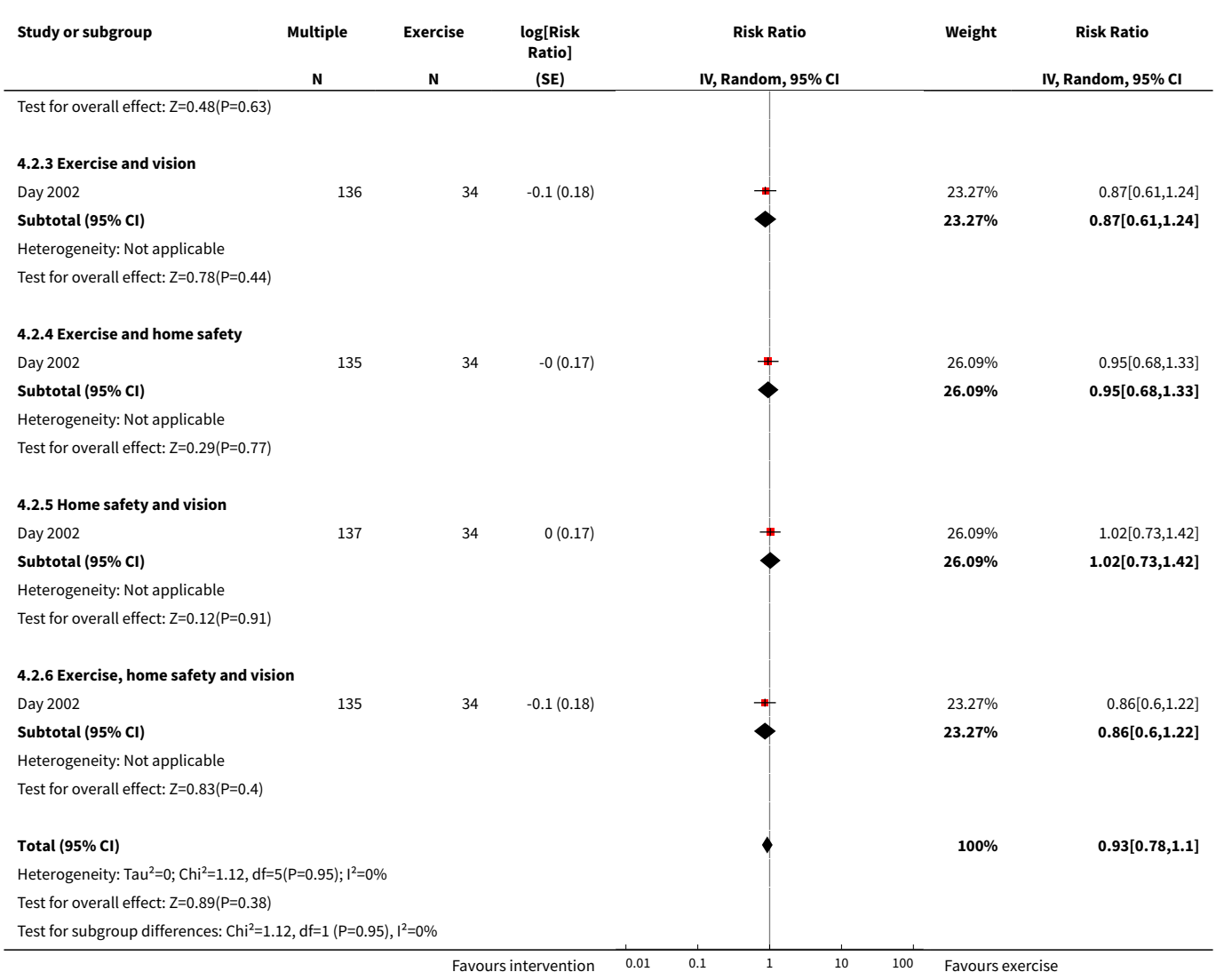
| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 2 Number of people sustaining one or more falls | 3 | 863 | Risk Ratio (Random, 95% CI) | 0.93 [0.78, 1.10] |
| 2.1 Education and exercise | 1 | 87 | Risk Ratio (Random, 95% CI) | 2.23 [0.11, 46.43] |
| 2.2 Education, nutrition and psychological component | 1 | 97 | Risk Ratio (Random, 95% CI) | 0.65 [0.11, 3.72] |
| 2.3 Exercise and vision | 1 | 170 | Risk Ratio (Random, 95% CI) | 0.87 [0.61, 1.24] |
| 2.4 Exercise and home safety | 1 | 169 | Risk Ratio (Random, 95% CI) | 0.95 [0.68, 1.33] |
| 2.5 Home safety and vision | 1 | 171 | Risk Ratio (Random, 95% CI) | 1.02 [0.73, 1.42] |
| 2.6 Exercise, home safety and vision | 1 | 169 | Risk Ratio (Random, 95% CI) | 0.86 [0.60, 1.22] |
| 3 Number of people who experience a fall that required hospital admission | 1 | | Risk Ratio (Random, 95% CI) | Totals not selected |
| 3.1 Exercise, nutrition and psychological component | 1 | | Risk Ratio (Random, 95% CI) | 0.0 [0.0, 0.0] |

### Analysis 4.1. Comparison 4 Multiple intervention vs exercise, Outcome 1 Rate of falls (falls per person years).

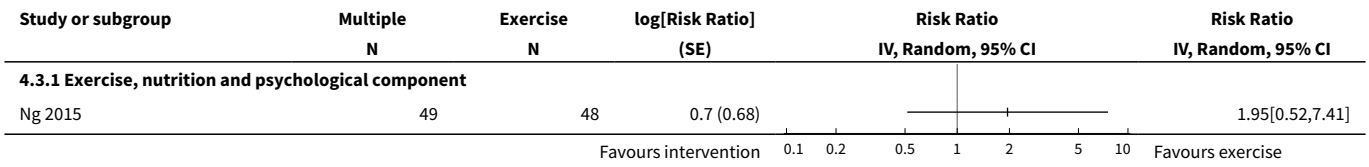



### Analysis 4.2. Comparison 4 Multiple intervention vs exercise, Outcome 2 Number of people sustaining one or more falls.






## Analysis 4.3. Comparison 4 Multiple intervention vs exercise, Outcome 3 Number of people who experience a fall that required hospital admission.

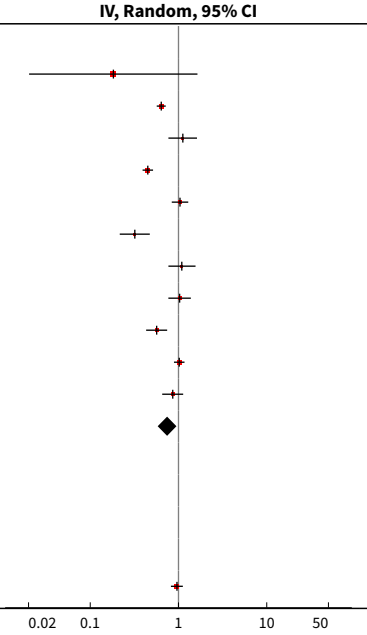


**Comparison 5. Multifactorial intervention vs control: subgroup analysis by intensity of intervention**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 19 | 5853 | Rate Ratio (Random, 95% CI) | 0.77 [0.67, 0.87] |
| 1.1 Assessment and active intervention | 11 | 2630 | Rate Ratio (Random, 95% CI) | 0.74 [0.58, 0.95] |
| 1.2 Assessment and referral or provision of information | 8 | 3223 | Rate Ratio (Random, 95% CI) | 0.78 [0.69, 0.88] |
| 2 Number of people sustaining one or more falls | 29 | 9637 | Risk Ratio (Random, 95% CI) | 0.96 [0.90, 1.03] |
| 2.1 Assessment and active intervention | 13 | 3677 | Risk Ratio (Random, 95% CI) | 0.93 [0.86, 1.01] |
| 2.2 Assessment and referral or provision of information | 16 | 5960 | Risk Ratio (Random, 95% CI) | 1.00 [0.89, 1.13] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 12 | 3368 | Risk Ratio (Random, 95% CI) | 0.87 [0.74, 1.03] |
| 3.1 Assessment and active intervention | 7 | 2191 | Risk Ratio (Random, 95% CI) | 0.82 [0.66, 1.03] |
| 3.2 Assessment and referral or provision of information | 5 | 1177 | Risk Ratio (Random, 95% CI) | 0.96 [0.74, 1.23] |

**Analysis 5.1. Comparison 5 Multifactorial intervention vs control: subgroup analysis by intensity of intervention, Outcome 1 Rate of falls (falls per person years).**

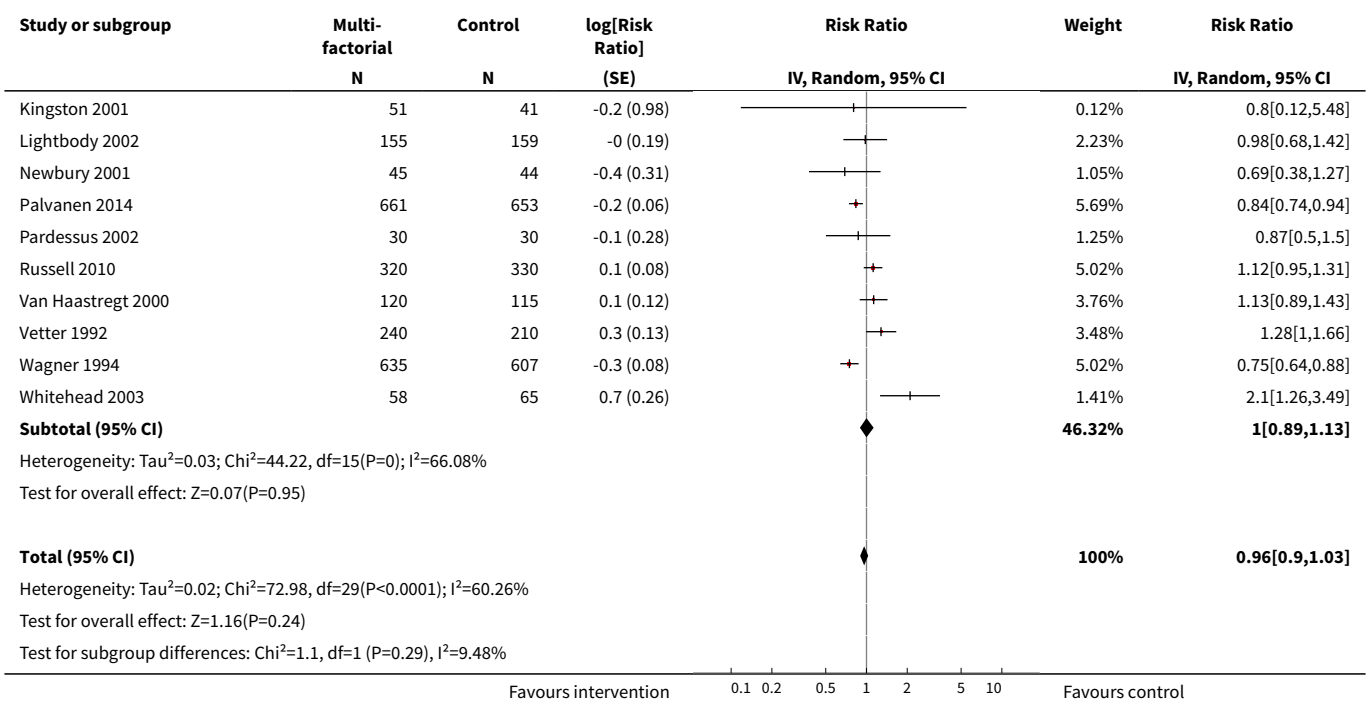
| Study or subgroup | Multifactorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **5.1.1 Assessment and active intervention** | | | | | | |
| Beling 2009 | 11 | 8 | -1.7 (1.12) | | 0.33% | 0.18[0.02,1.64] |
| Davison 2005 | 144 | 149 | -0.4 (0.06) | | 6.75% | 0.64[0.57,0.72] |
| Fairhall 2014 | 107 | 109 | 0.1 (0.19) | | 4.5% | 1.12[0.77,1.62] |
| Logan 2010 | 98 | 99 | -0.8 (0.07) | | 6.62% | 0.45[0.39,0.52] |
| Lord 2005 | 192 | 197 | 0 (0.11) | | 5.97% | 1.04[0.84,1.29] |
| Luck 2013 | 118 | 112 | -1.1 (0.2) | | 4.33% | 0.32[0.22,0.47] |
| Markle-Reid 2010 | 49 | 43 | 0.1 (0.18) | | 4.68% | 1.09[0.77,1.56] |
| Möller 2014 | 56 | 50 | 0 (0.15) | | 5.23% | 1.03[0.77,1.38] |
| Tinetti 1994 | 147 | 144 | -0.6 (0.14) | | 5.42% | 0.57[0.43,0.74] |
| Vind 2009 | 196 | 196 | 0 (0.07) | | 6.62% | 1.02[0.89,1.17] |
| Zijlstra 2009 | 196 | 209 | -0.1 (0.14) | | 5.42% | 0.86[0.65,1.13] |
| **Subtotal (95% CI)** | | | | | **55.88%** | **0.74[0.58,0.95]** |
| Heterogeneity: Tau²=0.14; Chi²=124.34, df=10(P<0.0001); I²=91.96% | | | | | | |
| Test for overall effect: Z=2.38(P=0.02) | | | | | | |
| **5.1.2 Assessment and referral or provision of information** | | | | | | |
| Elley 2008 | 155 | 157 | -0 (0.08) | | 6.47% | 0.96[0.82,1.12] |



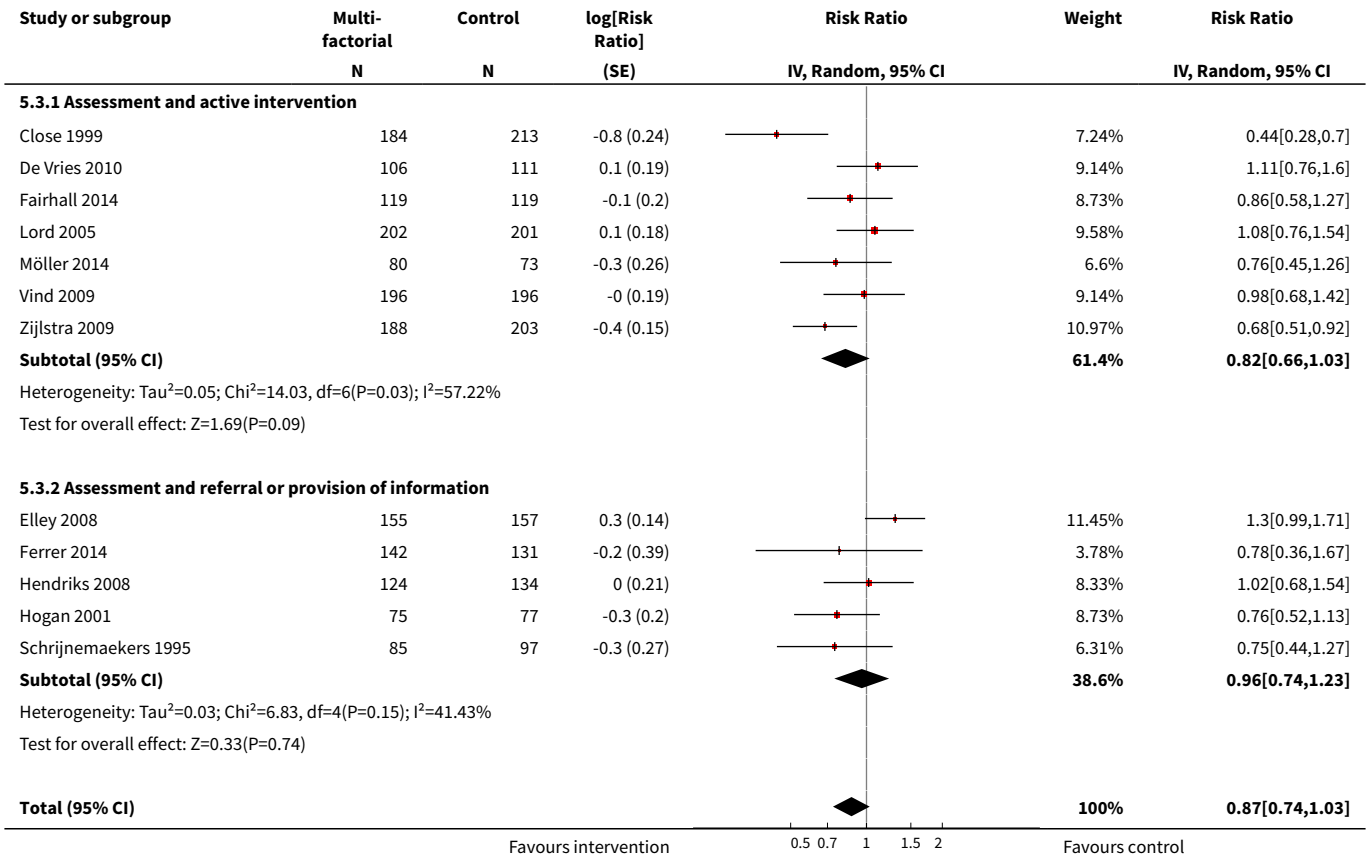
| Study or subgroup | Multi-factorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ferrer 2014 | 142 | 131 | -0.2 (0.26) | | 3.41% | 0.85[0.51,1.42] |
| Gallagher 1996 | 50 | 50 | -0.2 (0.15) | | 5.23% | 0.81[0.6,1.09] |
| Hogan 2001 | 75 | 77 | -0.2 (0.09) | | 6.31% | 0.79[0.67,0.95] |
| Lightbody 2002 | 155 | 159 | -0.2 (0.11) | | 5.97% | 0.85[0.69,1.06] |
| Palvanen 2014 | 661 | 653 | -0.3 (0.05) | | 6.86% | 0.73[0.66,0.8] |
| Pardessus 2002 | 30 | 30 | -0.2 (0.3) | | 2.9% | 0.8[0.45,1.44] |
| Russell 2010 | 344 | 354 | -0.4 (0.04) | | 6.96% | 0.64[0.6,0.7] |
| **Subtotal (95% CI)** | | | | | **44.12%** | **0.78[0.69,0.88]** |
| Heterogeneity: Tau²=0.02; Chi²=25.39, df=7(P=0); I²=72.43% | | | | | | |
| Test for overall effect: Z=3.96(P<0.0001) | | | | | | |
| **Total (95% CI)** | | | | | **100%** | **0.77[0.67,0.87]** |
| Heterogeneity: Tau²=0.06; Chi²=150.01, df=18(P<0.0001); I²=88% | | | | | | |
| Test for overall effect: Z=3.99(P<0.0001) | | | | | | |
| Test for subgroup differences: Chi²=0.15, df=1 (P=0.7), I²=0% | | | | | | |
| | | | Favours intervention | 0.02 0.1 1 10 50 | | Favours control |

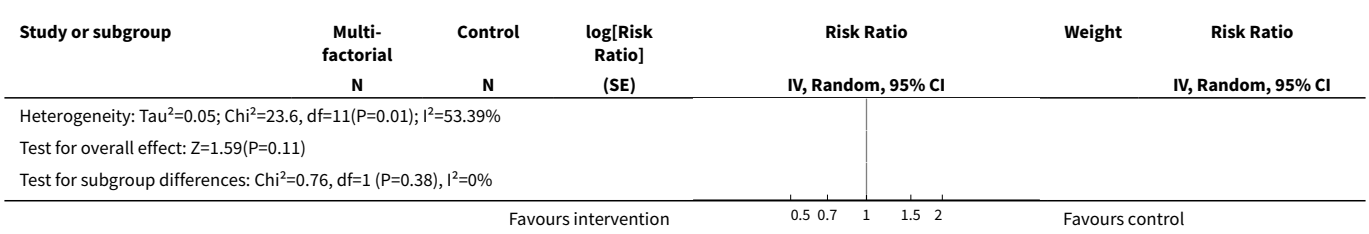
## Analysis 5.2. Comparison 5 Multifactorial intervention vs control: subgroup analysis by intensity of intervention, Outcome 2 Number of people sustaining one or more falls.

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **5.2.1 Assessment and active intervention** | | | | | | |
| Close 1999 | 184 | 213 | -0.5 (0.13) | | 3.48% | 0.61[0.47,0.79] |
| Coleman 1999 | 79 | 63 | 0.1 (0.23) | | 1.7% | 1.15[0.73,1.81] |
| Davison 2005 | 144 | 149 | -0 (0.08) | | 5.02% | 0.95[0.81,1.11] |
| De Vries 2010 | 106 | 111 | -0.1 (0.13) | | 3.48% | 0.93[0.72,1.2] |
| Fairhall 2014 | 119 | 119 | 0.1 (0.11) | | 4.05% | 1.07[0.86,1.33] |
| Huang 2005 | 63 | 63 | -0.3 (0.56) | | 0.36% | 0.71[0.24,2.13] |
| Logan 2010 | 102 | 102 | -0.2 (0.06) | | 5.69% | 0.84[0.75,0.95] |
| Lord 2005 | 202 | 201 | 0 (0.11) | | 4.05% | 1.03[0.83,1.28] |
| Möller 2014 | 80 | 73 | 0.1 (0.16) | | 2.78% | 1.12[0.82,1.53] |
| Spice 2009 | 164 | 80 | -0.1 (0.07) | | 5.35% | 0.9[0.78,1.03] |
| Spice 2009 | 106 | 80 | 0 (0.06) | | 5.69% | 1.04[0.93,1.17] |
| Tinetti 1994 | 147 | 144 | -0.3 (0.15) | | 2.99% | 0.74[0.55,0.99] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 4.68% | 1.09[0.92,1.31] |
| Zijlstra 2009 | 188 | 203 | -0.2 (0.1) | | 4.36% | 0.84[0.69,1.03] |
| **Subtotal (95% CI)** | | | | | **53.68%** | **0.93[0.86,1.01]** |
| Heterogeneity: Tau²=0.01; Chi²=28.25, df=13(P=0.01); I²=53.99% | | | | | | |
| Test for overall effect: Z=1.74(P=0.08) | | | | | | |
| **5.2.2 Assessment and referral or provision of information** | | | | | | |
| Ciaschini 2009 | 101 | 100 | 0.4 (0.28) | | 1.25% | 1.51[0.87,2.61] |
| Elley 2008 | 155 | 157 | 0.1 (0.08) | | 5.02% | 1.09[0.94,1.28] |
| Fabacher 1994 | 100 | 95 | -0.5 (0.31) | | 1.05% | 0.61[0.33,1.11] |
| Ferrer 2014 | 142 | 131 | 0.1 (0.2) | | 2.08% | 1.12[0.75,1.65] |
| Hendriks 2008 | 124 | 134 | -0 (0.14) | | 3.23% | 0.97[0.74,1.28] |
| Hogan 2001 | 75 | 77 | -0.1 (0.09) | | 4.68% | 0.9[0.76,1.08] |
| | | | Favours intervention | 0.1 0.2 0.5 1 2 5 10 | | Favours control |




## Analysis 5.3. Comparison 5 Multifactorial intervention vs control: subgroup analysis by intensity of intervention, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

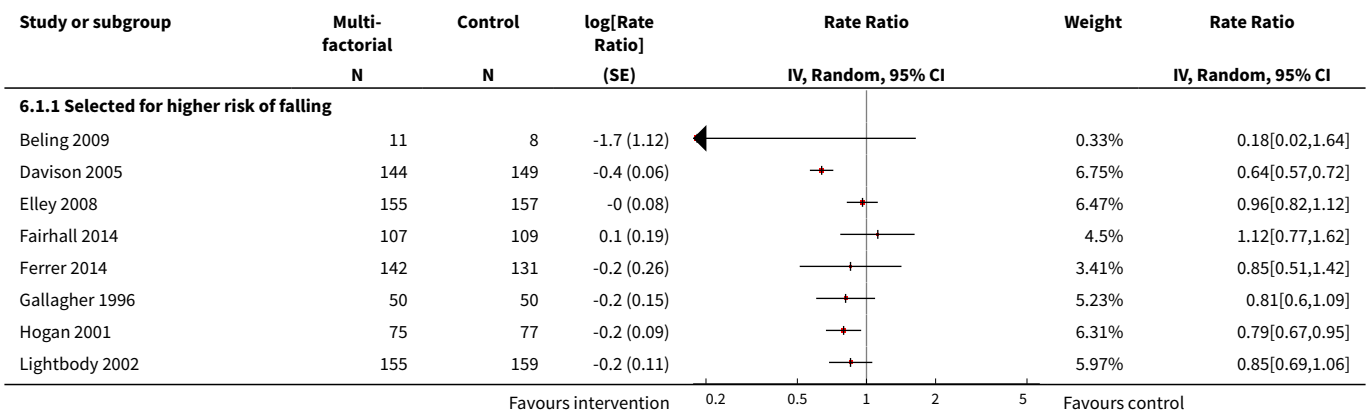


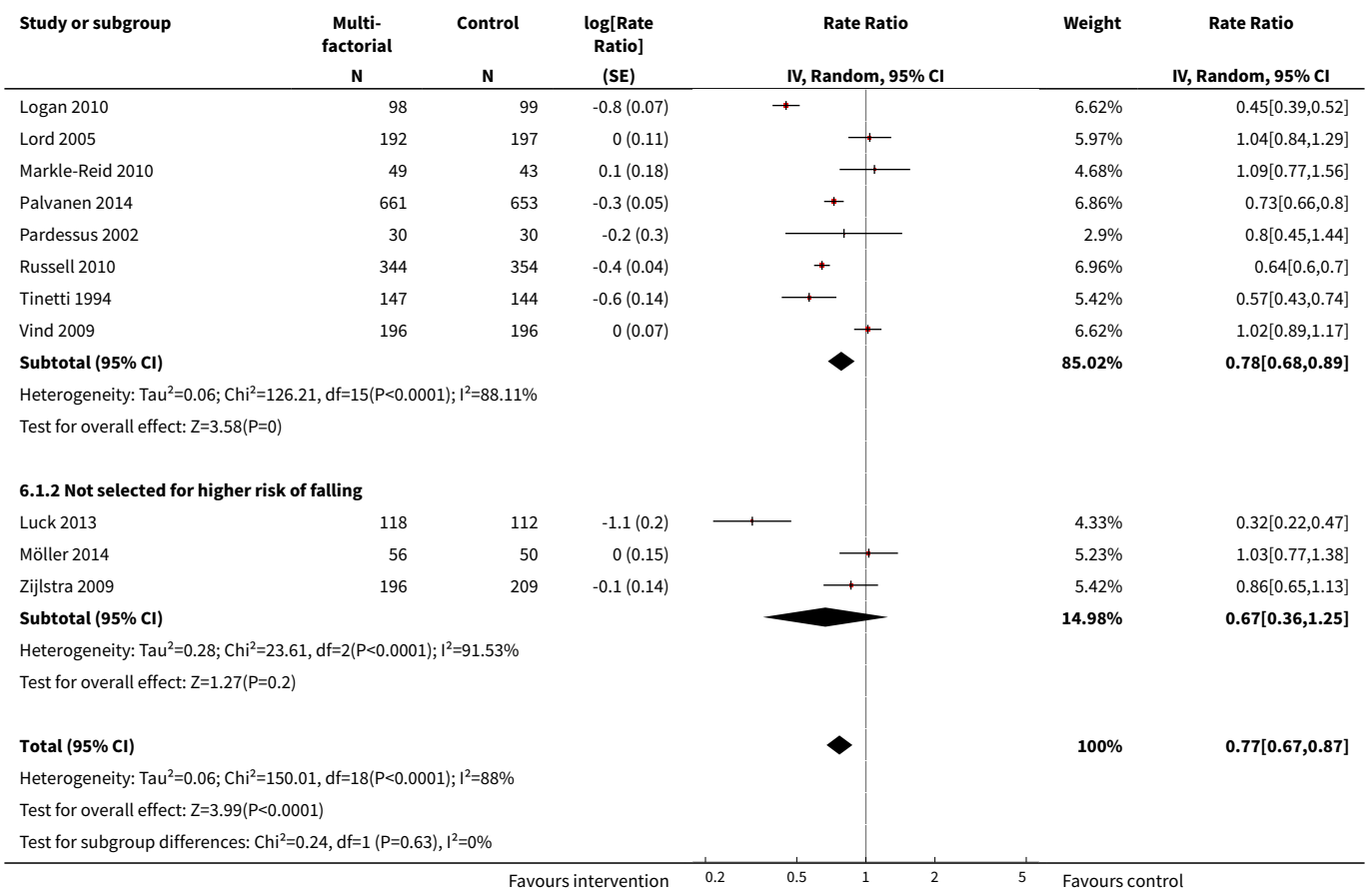



## Comparison 6. Multifactorial intervention vs control: subgroup analysis by falls risk at baseline

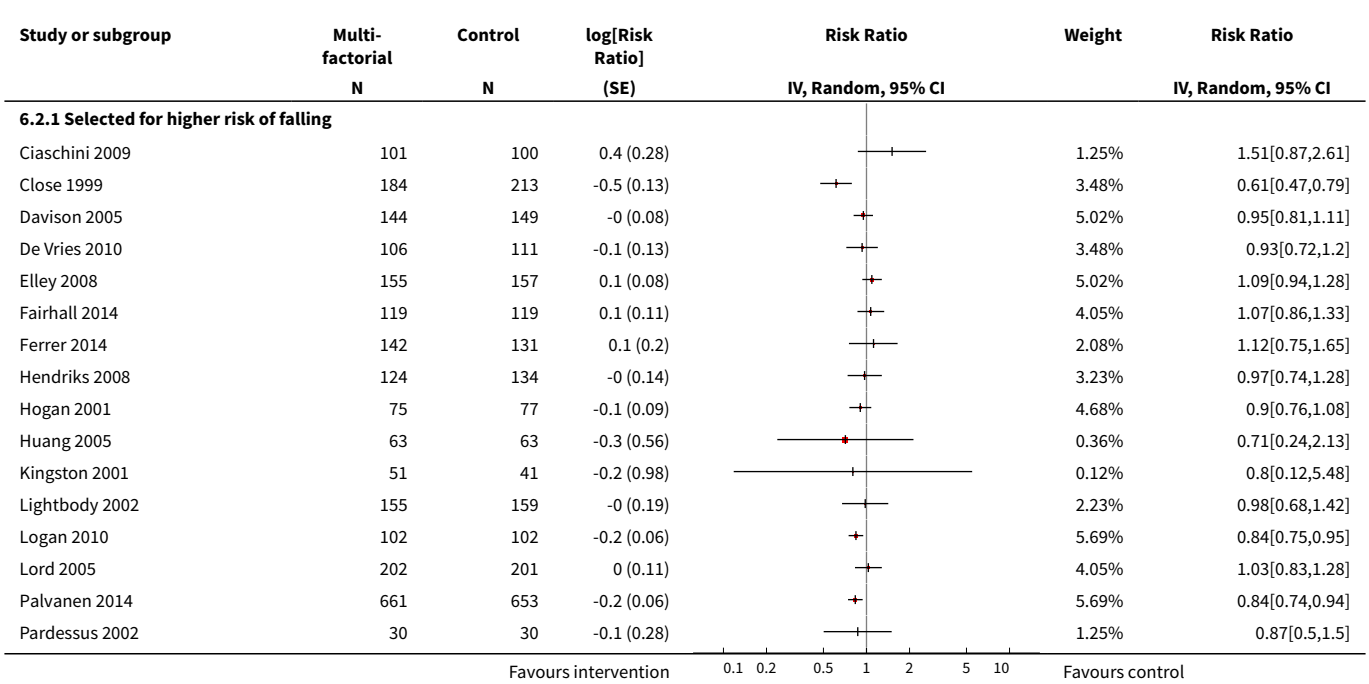
| Outcome or subgroup title | No. of studies | No. of partici-pants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 19 | 5853 | Rate Ratio (Random, 95% CI) | 0.77 [0.67, 0.87] |
| 1.1 Selected for higher risk of falling | 16 | 5112 | Rate Ratio (Random, 95% CI) | 0.78 [0.68, 0.89] |
| 1.2 Not selected for higher risk of falling | 3 | 741 | Rate Ratio (Random, 95% CI) | 0.67 [0.36, 1.25] |
| 2 Number of people sustaining one or more falls | 29 | 9637 | Risk Ratio (Random, 95% CI) | 0.96 [0.90, 1.03] |
| 2.1 Selected for higher risk of falling | 22 | 6975 | Risk Ratio (Random, 95% CI) | 0.97 [0.90, 1.04] |
| 2.2 Not selected for higher risk of falling | 7 | 2662 | Risk Ratio (Random, 95% CI) | 0.92 [0.75, 1.12] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 12 | 3368 | Risk Ratio (Random, 95% CI) | 0.87 [0.74, 1.03] |
| 3.1 Selected for higher risk of falling | 10 | 2824 | Risk Ratio (Random, 95% CI) | 0.91 [0.76, 1.10] |
| 3.2 Not selected for higher risk of falling | 2 | 544 | Risk Ratio (Random, 95% CI) | 0.70 [0.54, 0.90] |

## Analysis 6.1. Comparison 6 Multifactorial intervention vs control: subgroup analysis by falls risk at baseline, Outcome 1 Rate of falls (falls per person years).

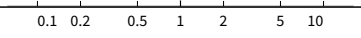





## Analysis 6.2. Comparison 6 Multifactorial intervention vs control: subgroup analysis by falls risk at baseline, Outcome 2 Number of people sustaining one or more falls.

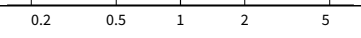


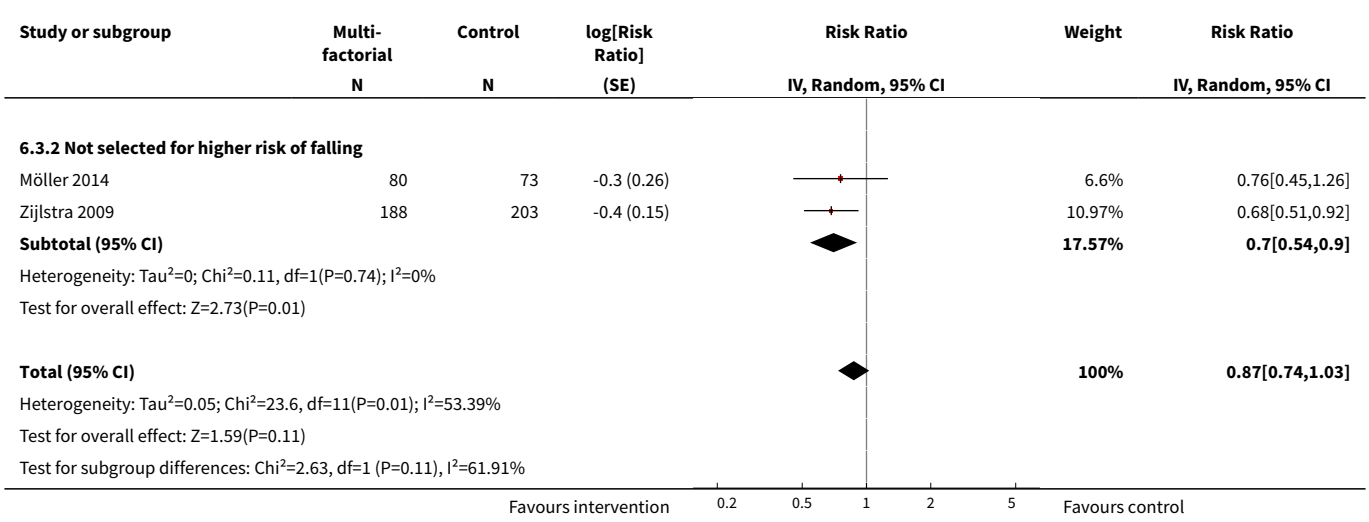
| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Russell 2010 | 320 | 330 | 0.1 (0.08) | | 5.02% | 1.12[0.95,1.31] |
| Spice 2009 | 164 | 80 | -0.1 (0.07) | | 5.35% | 0.9[0.78,1.03] |
| Spice 2009 | 106 | 80 | 0 (0.06) | | 5.69% | 1.04[0.93,1.17] |
| Tinetti 1994 | 147 | 144 | -0.3 (0.15) | | 2.99% | 0.74[0.55,0.99] |
| Van Haastregt 2000 | 120 | 115 | 0.1 (0.12) | | 3.76% | 1.13[0.89,1.43] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 4.68% | 1.09[0.92,1.31] |
| Whitehead 2003 | 58 | 65 | 0.7 (0.26) | | 1.41% | 2.1[1.26,3.49] |
| **Subtotal (95% CI)** | | | | | **80.56%** | **0.97[0.9,1.04]** |
| Heterogeneity: Tau²=0.01; Chi²=52.4, df=22(P=0); I²=58.02% | | | | | | |
| Test for overall effect: Z=0.83(P=0.41) | | | | | | |
| **6.2.2 Not selected for higher risk of falling** | | | | | | |
| Coleman 1999 | 79 | 63 | 0.1 (0.23) | | 1.7% | 1.15[0.73,1.81] |
| Fabacher 1994 | 100 | 95 | -0.5 (0.31) | | 1.05% | 0.61[0.33,1.11] |
| Möller 2014 | 80 | 73 | 0.1 (0.16) | | 2.78% | 1.12[0.82,1.53] |
| Newbury 2001 | 45 | 44 | -0.4 (0.31) | | 1.05% | 0.69[0.38,1.27] |
| Vetter 1992 | 240 | 210 | 0.3 (0.13) | | 3.48% | 1.28[1,1.66] |
| Wagner 1994 | 635 | 607 | -0.3 (0.08) | | 5.02% | 0.75[0.64,0.88] |
| Zijlstra 2009 | 188 | 203 | -0.2 (0.1) | | 4.36% | 0.84[0.69,1.03] |
| **Subtotal (95% CI)** | | | | | **19.44%** | **0.92[0.75,1.12]** |
| Heterogeneity: Tau²=0.04; Chi²=18.35, df=6(P=0.01); I²=67.3% | | | | | | |
| Test for overall effect: Z=0.83(P=0.4) | | | | | | |
| **Total (95% CI)** | | | | | **100%** | **0.96[0.9,1.03]** |
| Heterogeneity: Tau²=0.02; Chi²=72.98, df=29(P<0.0001); I²=60.26% | | | | | | |
| Test for overall effect: Z=1.16(P=0.24) | | | | | | |
| Test for subgroup differences: Chi²=0.26, df=1 (P=0.61), I²=0% | | | | | | |




## Analysis 6.3. Comparison 6 Multifactorial intervention vs control: subgroup analysis by falls risk at baseline, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **6.3.1 Selected for higher risk of falling** | | | | | | |
| Close 1999 | 184 | 213 | -0.8 (0.24) | | 7.24% | 0.44[0.28,0.7] |
| De Vries 2010 | 106 | 111 | 0.1 (0.19) | | 9.14% | 1.11[0.76,1.6] |
| Elley 2008 | 155 | 157 | 0.3 (0.14) | | 11.45% | 1.3[0.99,1.71] |
| Fairhall 2014 | 119 | 119 | -0.1 (0.2) | | 8.73% | 0.86[0.58,1.27] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.39) | | 3.78% | 0.78[0.36,1.67] |
| Hendriks 2008 | 124 | 134 | 0 (0.21) | | 8.33% | 1.02[0.68,1.54] |
| Hogan 2001 | 75 | 77 | -0.3 (0.2) | | 8.73% | 0.76[0.52,1.13] |
| Lord 2005 | 202 | 201 | 0.1 (0.18) | | 9.58% | 1.08[0.76,1.54] |
| Schrijnemaekers 1995 | 85 | 97 | -0.3 (0.27) | | 6.31% | 0.75[0.44,1.27] |
| Vind 2009 | 196 | 196 | -0 (0.19) | | 9.14% | 0.98[0.68,1.42] |
| **Subtotal (95% CI)** | | | | | **82.43%** | **0.91[0.76,1.1]** |
| Heterogeneity: Tau²=0.05; Chi²=18.99, df=9(P=0.03); I²=52.61% | | | | | | |
| Test for overall effect: Z=0.98(P=0.32) | | | | | | |






## Comparison 7. Multiple intervention vs control: subgroup analysis by falls risk at baseline

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 6 | 1085 | Rate Ratio (Random, 95% CI) | 0.74 [0.60, 0.91] |
| 1.1 Selected for higher risk of falling | 4 | 818 | Rate Ratio (Random, 95% CI) | 0.79 [0.68, 0.93] |
| 1.2 Not selected for higher risk of falling | 2 | 267 | Rate Ratio (Random, 95% CI) | 0.39 [0.23, 0.66] |
| 2 Number of people sustaining one or more falls | 11 | 1980 | Risk Ratio (Random, 95% CI) | 0.82 [0.74, 0.90] |
| 2.1 Selected for higher risk of falling | 7 | 872 | Risk Ratio (Random, 95% CI) | 0.86 [0.75, 0.98] |
| 2.2 Not selected for higher risk of falling | 4 | 1108 | Risk Ratio (Random, 95% CI) | 0.77 [0.67, 0.89] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 4 | | Risk Ratio (Random, 95% CI) | Subtotals only |
| 3.1 Selected for higher risk of falling | 4 | 662 | Risk Ratio (Random, 95% CI) | 0.81 [0.63, 1.05] |
| 3.2 Not selected for higher risk of falling | 0 | 0 | Risk Ratio (Random, 95% CI) | 0.0 [0.0, 0.0] |

## Analysis 7.1. Comparison 7 Multiple intervention vs control: subgroup analysis by falls risk at baseline, Outcome 1 Rate of falls (falls per person years).

| Study or subgroup | Multiple N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **7.1.1 Selected for higher risk of falling** | | | | | | |
| Campbell 2005 | 96 | 48 | -0.3 (0.15) | | 21.12% | 0.7[0.53,0.95] |
| Campbell 2005 | 97 | 48 | -0.2 (0.15) | | 21.12% | 0.78[0.58,1.04] |
| Clemson 2004 | 157 | 153 | -0.4 (0.17) | | 18.97% | 0.69[0.5,0.96] |
| Uusi-Rasi 2015 | 96 | 95 | -0 (0.17) | | 18.97% | 0.99[0.71,1.38] |
| Waterman 2016 | 15 | 13 | 0.2 (0.36) | | 7.3% | 1.2[0.59,2.42] |
| **Subtotal (95% CI)** | | | | | **87.49%** | **0.79[0.68,0.93]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=4.31, df=4(P=0.37); $I^2$=7.13% | | | | | | |
| Test for overall effect: Z=2.83(P=0) | | | | | | |
| **7.1.2 Not selected for higher risk of falling** | | | | | | |
| Huang 2011 | 56 | 60 | -0.9 (0.68) | | 2.4% | 0.4[0.11,1.53] |
| Neelemaat 2012 | 76 | 75 | -0.9 (0.29) | | 10.11% | 0.39[0.22,0.68] |
| **Subtotal (95% CI)** | | | | | **12.51%** | **0.39[0.23,0.66]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=0, df=1(P=0.96); $I^2$=0% | | | | | | |
| Test for overall effect: Z=3.54(P=0) | | | | | | |
| **Total (95% CI)** | | | | | **100%** | **0.74[0.6,0.91]** |
| Heterogeneity: $Tau^2$=0.03; $Chi^2$=10.88, df=6(P=0.09); $I^2$=44.85% | | | | | | |
| Test for overall effect: Z=2.78(P=0.01) | | | | | | |
| Test for subgroup differences: $Chi^2$=6.56, df=1 (P=0.01), $I^2$=84.75% | | | | | | |



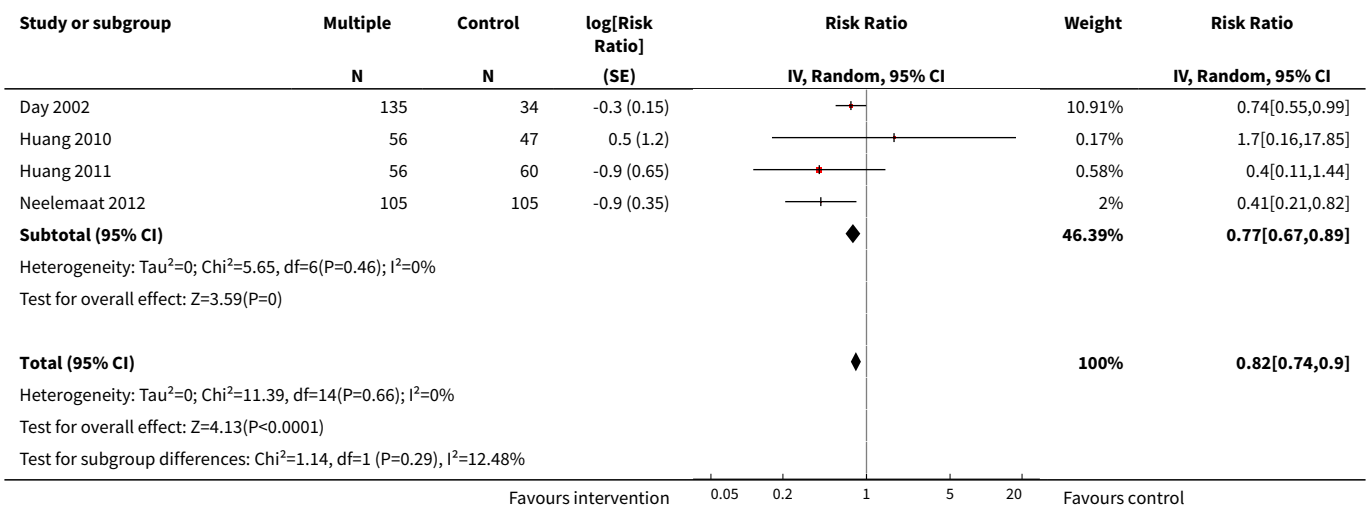

Favours intervention — Favours control

## Analysis 7.2. Comparison 7 Multiple intervention vs control: subgroup analysis by falls risk at baseline, Outcome 2 Number of people sustaining one or more falls.

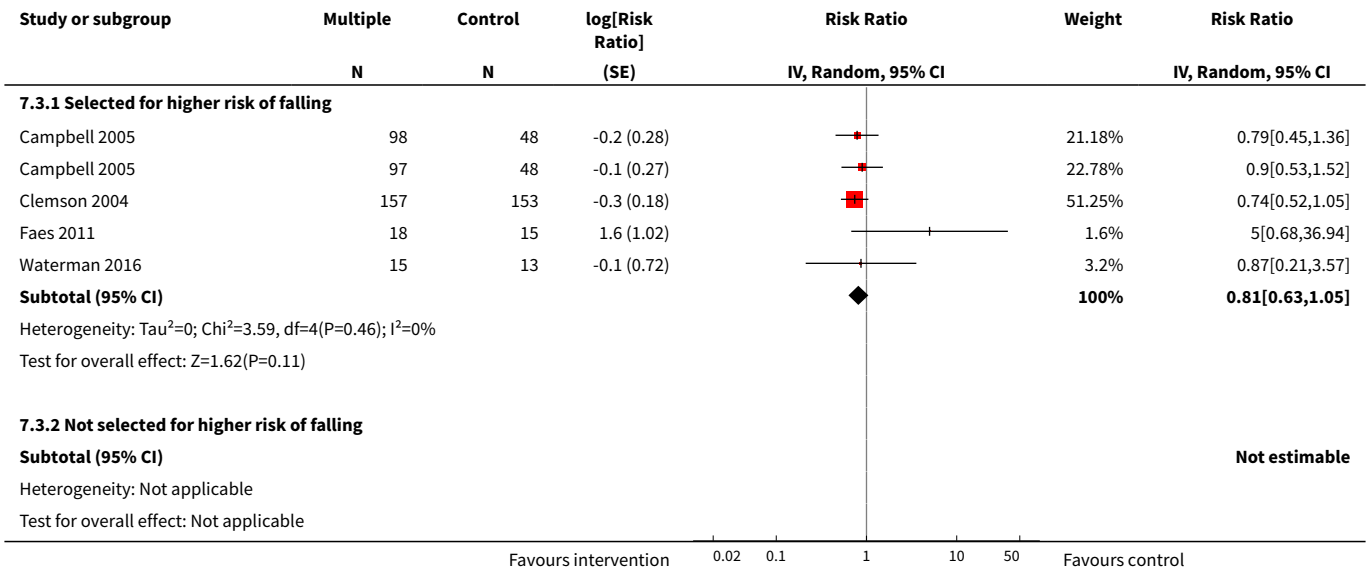
| Study or subgroup | Multiple N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| **7.2.1 Selected for higher risk of falling** | | | | | | |
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 10.91% | 0.77[0.57,1.03] |
| Campbell 2005 | 98 | 48 | -0.2 (0.15) | | 10.91% | 0.78[0.58,1.04] |
| Clemson 2004 | 157 | 153 | -0.1 (0.1) | | 24.55% | 0.9[0.74,1.09] |
| Faes 2011 | 18 | 15 | 0.3 (0.38) | | 1.7% | 1.39[0.66,2.93] |
| Ng 2015 | 49 | 50 | -0.9 (0.81) | | 0.37% | 0.41[0.08,1.99] |
| Olsen 2014 | 47 | 42 | 0.1 (0.35) | | 2% | 1.05[0.53,2.09] |
| Waterman 2016 | 15 | 13 | -0 (0.3) | | 2.73% | 0.97[0.54,1.75] |
| Wesson 2013 | 11 | 11 | -0.7 (0.75) | | 0.44% | 0.5[0.12,2.18] |
| **Subtotal (95% CI)** | | | | | **53.61%** | **0.86[0.75,0.98]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=4.59, df=7(P=0.71); $I^2$=0% | | | | | | |
| Test for overall effect: Z=2.29(P=0.02) | | | | | | |
| **7.2.2 Not selected for higher risk of falling** | | | | | | |
| Day 2002 | 135 | 34 | -0.2 (0.15) | | 10.91% | 0.83[0.62,1.11] |
| Day 2002 | 136 | 34 | -0.3 (0.15) | | 10.91% | 0.75[0.56,1] |
| Day 2002 | 137 | 34 | -0.1 (0.15) | | 10.91% | 0.88[0.65,1.18] |




Favours intervention — Favours control




**Analysis 7.3. Comparison 7 Multiple intervention vs control: subgroup analysis by falls risk at baseline, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**



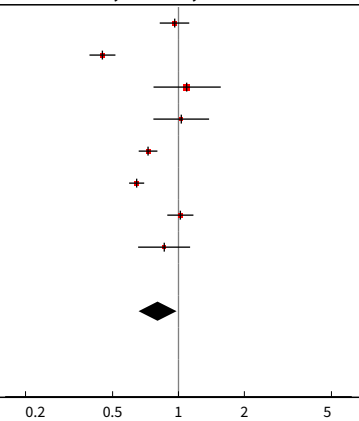

## Comparison 8. Multifactorial intervention vs control: sensitivity analysis by low risk of selection bias

| Outcome or subgroup title | No. of studies | No. of partici-pants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 8 | 3516 | Rate Ratio (Random, 95% CI) | 0.80 [0.66, 0.98] |
| 2 Number of people sustaining one or more falls | 12 | 4692 | Risk Ratio (Random, 95% CI) | 0.98 [0.86, 1.10] |

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 6 | 1862 | Risk Ratio (Random, 95% CI) | 0.85 [0.62, 1.15] |

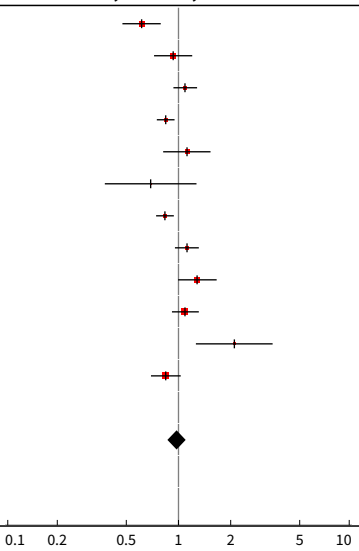
**Analysis 8.1. Comparison 8 Multifactorial intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 1 Rate of falls (falls per person years).**

| Study or subgroup | Multi-factorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Elley 2008 | 155 | 157 | -0 (0.08) | | 13.17% | 0.96[0.82,1.12] |
| Logan 2010 | 98 | 99 | -0.8 (0.07) | | 13.42% | 0.45[0.39,0.52] |
| Markle-Reid 2010 | 49 | 43 | 0.1 (0.18) | | 9.91% | 1.09[0.77,1.56] |
| Möller 2014 | 56 | 50 | 0 (0.15) | | 10.94% | 1.03[0.77,1.38] |
| Palvanen 2014 | 661 | 653 | -0.3 (0.05) | | 13.85% | 0.73[0.66,0.8] |
| Russell 2010 | 344 | 354 | -0.4 (0.04) | | 14.02% | 0.64[0.6,0.7] |
| Vind 2009 | 196 | 196 | 0 (0.07) | | 13.42% | 1.02[0.89,1.17] |
| Zijlstra 2009 | 196 | 209 | -0.1 (0.14) | | 11.28% | 0.86[0.65,1.13] |
| **Total (95% CI)** | | | | | **100%** | **0.8[0.66,0.98]** |
| Heterogeneity: Tau²=0.07; Chi²=103.66, df=7(P<0.0001); I²=93.25% | | | | | | |
| Test for overall effect: Z=2.16(P=0.03) | | | | | | |



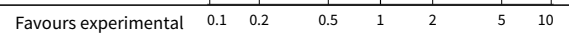

**Analysis 8.2. Comparison 8 Multifactorial intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 2 Number of people sustaining one or more falls.**

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Close 1999 | 184 | 213 | -0.5 (0.13) | | 8.06% | 0.61[0.47,0.79] |
| De Vries 2010 | 106 | 111 | -0.1 (0.13) | | 8.06% | 0.93[0.72,1.2] |
| Elley 2008 | 155 | 157 | 0.1 (0.08) | | 10.28% | 1.09[0.94,1.28] |
| Logan 2010 | 102 | 102 | -0.2 (0.06) | | 11.09% | 0.84[0.75,0.95] |
| Möller 2014 | 80 | 73 | 0.1 (0.16) | | 6.84% | 1.12[0.82,1.53] |
| Newbury 2001 | 45 | 44 | -0.4 (0.31) | | 3.07% | 0.69[0.38,1.27] |
| Palvanen 2014 | 661 | 653 | -0.2 (0.06) | | 11.09% | 0.84[0.74,0.94] |
| Russell 2010 | 320 | 330 | 0.1 (0.08) | | 10.28% | 1.12[0.95,1.31] |
| Vetter 1992 | 240 | 210 | 0.3 (0.13) | | 8.06% | 1.28[1,1.66] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 9.84% | 1.09[0.92,1.31] |
| Whitehead 2003 | 58 | 65 | 0.7 (0.26) | | 3.95% | 2.1[1.26,3.49] |
| Zijlstra 2009 | 188 | 203 | -0.2 (0.1) | | 9.39% | 0.84[0.69,1.03] |
| **Total (95% CI)** | | | | | **100%** | **0.98[0.86,1.1]** |
| Heterogeneity: Tau²=0.03; Chi²=47.61, df=11(P<0.0001); I²=76.89% | | | | | | |
| Test for overall effect: Z=0.4(P=0.69) | | | | | | |



**Analysis 8.3. Comparison 8 Multifactorial intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Close 1999 | 184 | 213 | -0.8 (0.24) | | 14.69% | 0.44[0.28,0.7] |
| De Vries 2010 | 106 | 111 | 0.1 (0.19) | | 16.88% | 1.11[0.76,1.6] |
| Elley 2008 | 155 | 157 | 0.3 (0.14) | | 19.06% | 1.3[0.99,1.71] |
| Möller 2014 | 80 | 73 | -0.3 (0.26) | | 13.85% | 0.76[0.45,1.26] |
| Vind 2009 | 196 | 196 | -0 (0.19) | | 16.88% | 0.98[0.68,1.42] |
| Zijlstra 2009 | 188 | 203 | -0.4 (0.15) | | 18.64% | 0.68[0.51,0.92] |
| **Total (95% CI)** | | | | | **100%** | **0.85[0.62,1.15]** |
| Heterogeneity: Tau²=0.11; Chi²=20.85, df=5(P=0); I²=76.02% | | | | | | |
| Test for overall effect: Z=1.07(P=0.28) | | | | | | |

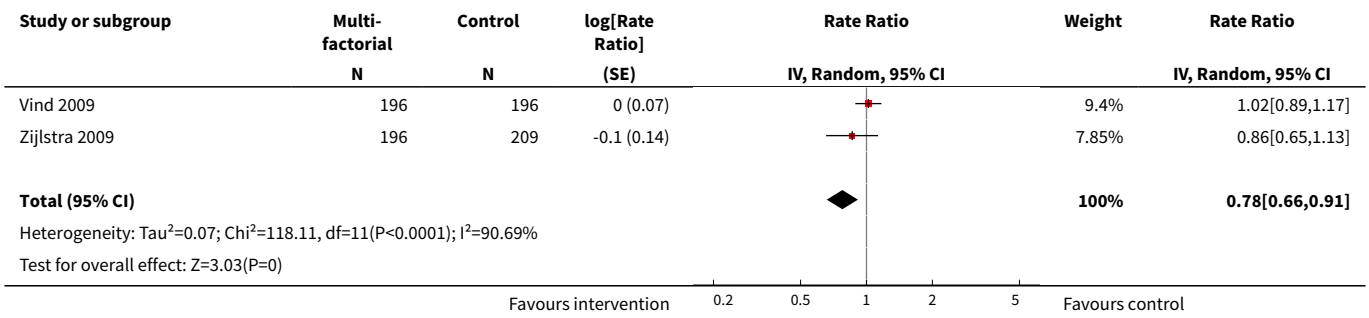



## Comparison 9. Multifactorial intervention vs control: sensitivity analysis by low risk of detection bias

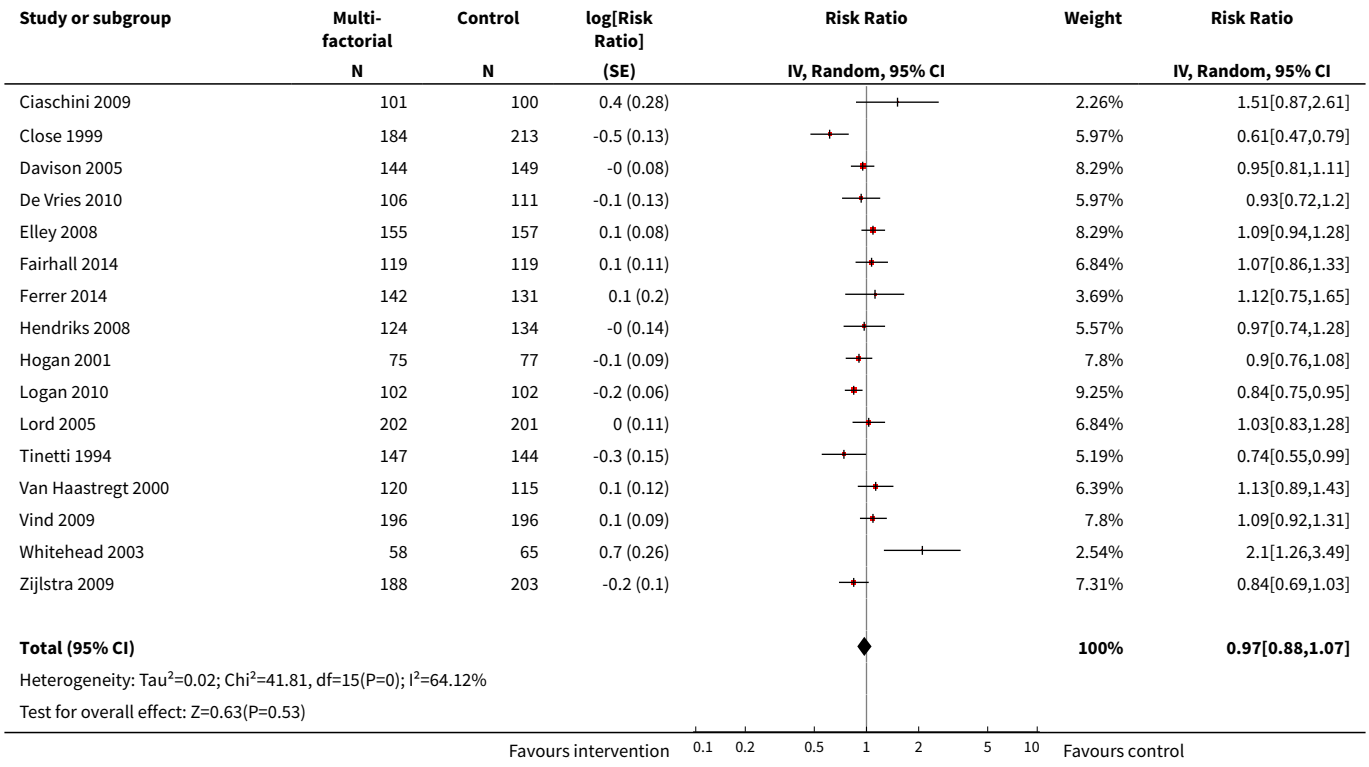
| Outcome or subgroup title | No. of studies | No. of partici-pants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 12 | 3718 | Rate Ratio (Random, 95% CI) | 0.78 [0.66, 0.91] |
| 2 Number of people sustaining one or more falls | 16 | 4380 | Risk Ratio (Random, 95% CI) | 0.97 [0.88, 1.07] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 10 | 3033 | Risk Ratio (Random, 95% CI) | 0.89 [0.73, 1.08] |

**Analysis 9.1. Comparison 9 Multifactorial intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 1 Rate of falls (falls per person years).**

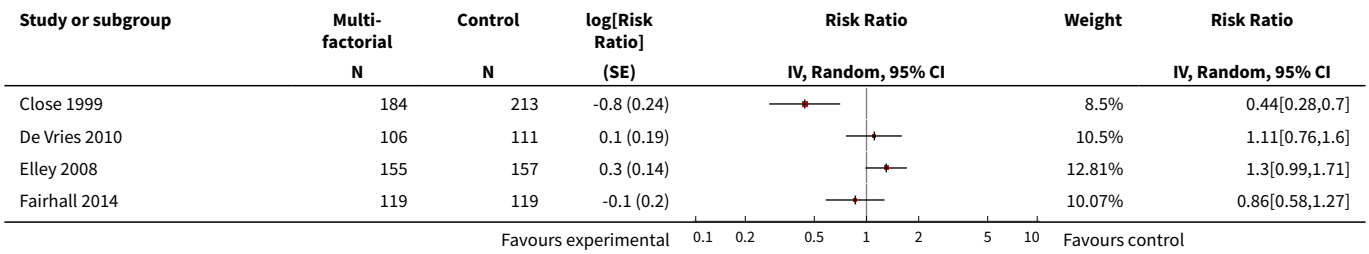
| Study or subgroup | Multi-factorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Davison 2005 | 144 | 149 | -0.4 (0.06) | | 9.56% | 0.64[0.57,0.72] |
| Elley 2008 | 155 | 157 | -0 (0.08) | | 9.21% | 0.96[0.82,1.12] |
| Fairhall 2014 | 107 | 109 | 0.1 (0.19) | | 6.62% | 1.12[0.77,1.62] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.26) | | 5.1% | 0.85[0.51,1.42] |
| Gallagher 1996 | 50 | 50 | -0.2 (0.15) | | 7.6% | 0.81[0.6,1.09] |
| Hogan 2001 | 75 | 77 | -0.2 (0.09) | | 9.01% | 0.79[0.67,0.95] |
| Logan 2010 | 98 | 99 | -0.8 (0.07) | | 9.4% | 0.45[0.39,0.52] |
| Lord 2005 | 192 | 197 | 0 (0.11) | | 8.57% | 1.04[0.84,1.29] |
| Russell 2010 | 344 | 354 | -0.4 (0.04) | | 9.83% | 0.64[0.6,0.7] |
| Tinetti 1994 | 147 | 144 | -0.6 (0.14) | | 7.85% | 0.57[0.43,0.74] |

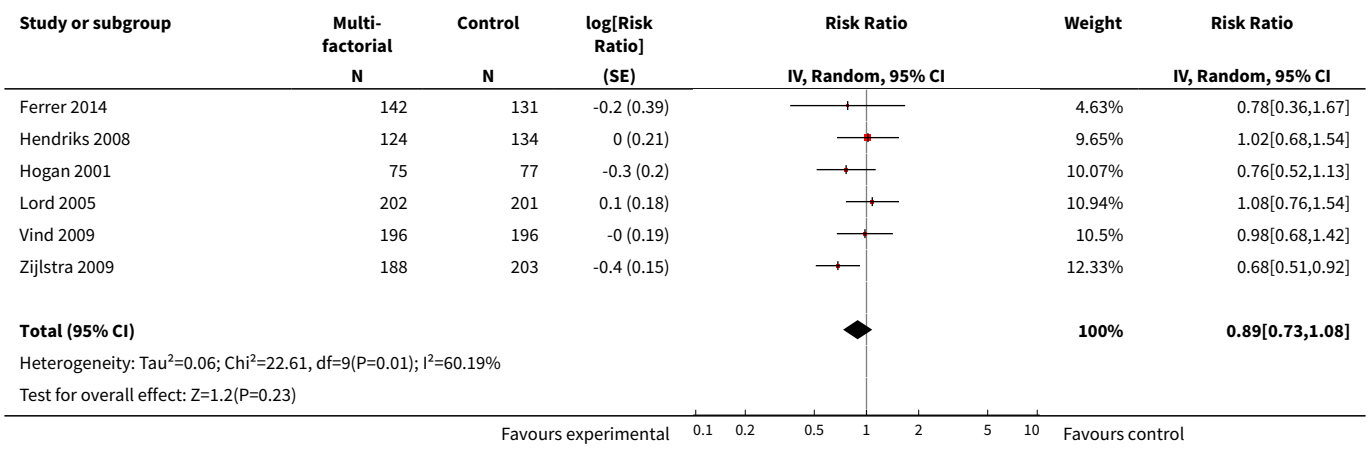



## Analysis 9.2. Comparison 9 Multifactorial intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 2 Number of people sustaining one or more falls.




## Analysis 9.3. Comparison 9 Multifactorial intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

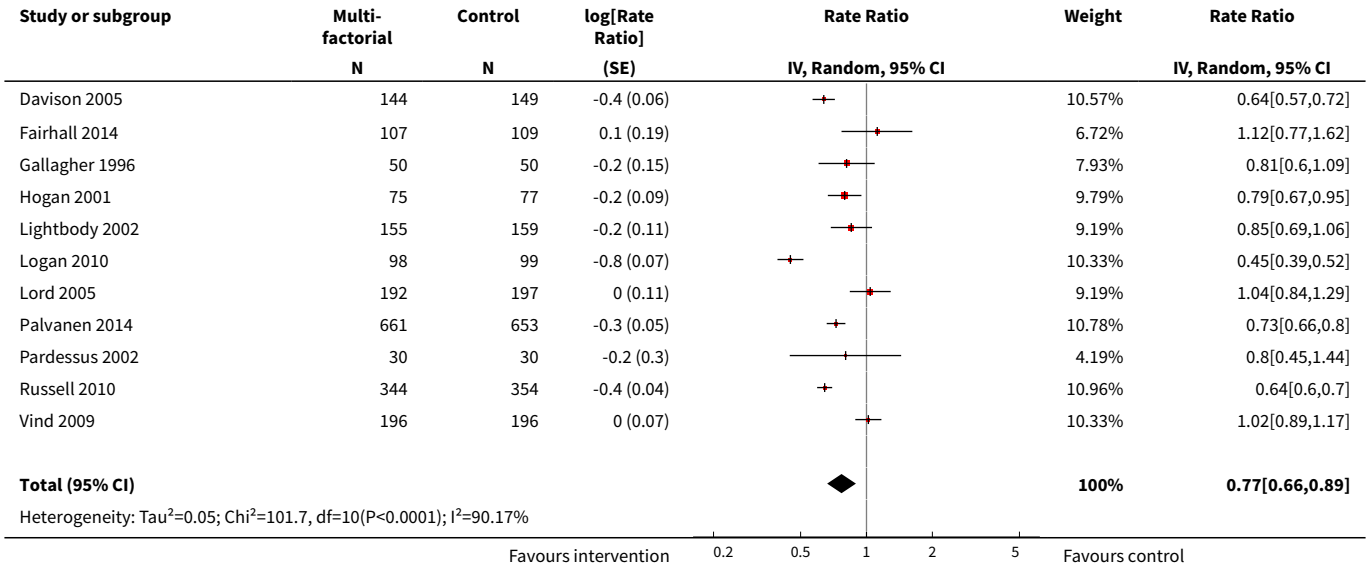




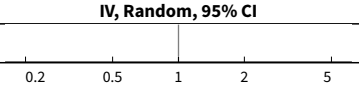

## Comparison 10. Multifactorial intervention vs control: sensitivity analysis by low risk of attrition bias

| Outcome or subgroup title | No. of studies | No. of partici-pants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 11 | 4125 | Rate Ratio (Random, 95% CI) | 0.77 [0.66, 0.89] |
| 2 Number of people sustaining one or more falls | 13 | 4452 | Risk Ratio (Random, 95% CI) | 0.95 [0.88, 1.02] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 5 | 1402 | Risk Ratio (Random, 95% CI) | 0.96 [0.81, 1.13] |

### Analysis 10.1. Comparison 10 Multifactorial intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 1 Rate of falls (falls per person years).



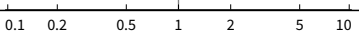
| Study or subgroup | Multi-factorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Test for overall effect: Z=3.4(P=0) | | | | | | |




Favours intervention — Favours control

## Analysis 10.2. Comparison 10 Multifactorial intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 2 Number of people sustaining one or more falls.

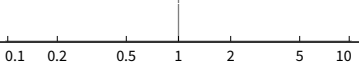
| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Davison 2005 | 144 | 149 | -0 (0.08) | | 11.34% | 0.95[0.81,1.11] |
| De Vries 2010 | 106 | 111 | -0.1 (0.13) | | 5.95% | 0.93[0.72,1.2] |
| Fairhall 2014 | 119 | 119 | 0.1 (0.11) | | 7.6% | 1.07[0.86,1.33] |
| Hogan 2001 | 75 | 77 | -0.1 (0.09) | | 9.89% | 0.9[0.76,1.08] |
| Huang 2005 | 63 | 63 | -0.3 (0.56) | | 0.41% | 0.71[0.24,2.13] |
| Lightbody 2002 | 155 | 159 | -0 (0.19) | | 3.18% | 0.98[0.68,1.42] |
| Logan 2010 | 102 | 102 | -0.2 (0.06) | | 14.97% | 0.84[0.75,0.95] |
| Lord 2005 | 202 | 201 | 0 (0.11) | | 7.6% | 1.03[0.83,1.28] |
| Newbury 2001 | 45 | 44 | -0.4 (0.31) | | 1.3% | 0.69[0.38,1.27] |
| Palvanen 2014 | 661 | 653 | -0.2 (0.06) | | 14.97% | 0.84[0.74,0.94] |
| Pardessus 2002 | 30 | 30 | -0.1 (0.28) | | 1.57% | 0.87[0.5,1.5] |
| Russell 2010 | 320 | 330 | 0.1 (0.08) | | 11.34% | 1.12[0.95,1.31] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 9.89% | 1.09[0.92,1.31] |
| **Total (95% CI)** | | | | | **100%** | **0.95[0.88,1.02]** |
| Heterogeneity: $Tau^2$=0.01; $Chi^2$=18.26, df=12(P=0.11); $I^2$=34.29% | | | | | | |
| Test for overall effect: Z=1.44(P=0.15) | | | | | | |




Favours intervention — Favours control

## Analysis 10.3. Comparison 10 Multifactorial intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| De Vries 2010 | 106 | 111 | 0.1 (0.19) | | 20.33% | 1.11[0.76,1.6] |
| Fairhall 2014 | 119 | 119 | -0.1 (0.2) | | 18.35% | 0.86[0.58,1.27] |
| Hogan 2001 | 75 | 77 | -0.3 (0.2) | | 18.35% | 0.76[0.52,1.13] |
| Lord 2005 | 202 | 201 | 0.1 (0.18) | | 22.65% | 1.08[0.76,1.54] |
| Vind 2009 | 196 | 196 | -0 (0.19) | | 20.33% | 0.98[0.68,1.42] |
| **Total (95% CI)** | | | | | **100%** | **0.96[0.81,1.13]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=2.62, df=4(P=0.62); $I^2$=0% | | | | | | |
| Test for overall effect: Z=0.5(P=0.62) | | | | | | |



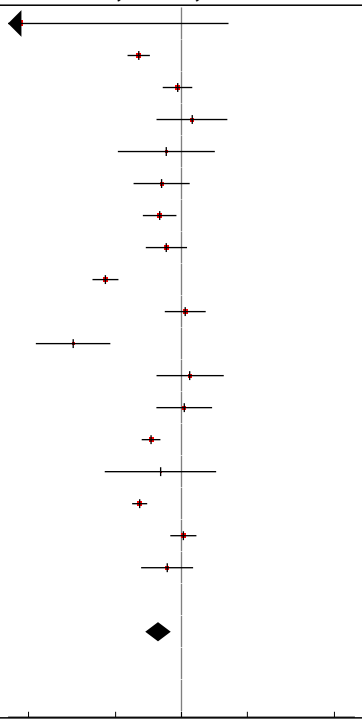

Favours experimental — Favours control

**Comparison 11. Multifactorial intervention vs control: sensitivity analysis by individual randomisation**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 18 | 5562 | Rate Ratio (Random, 95% CI) | 0.78 [0.68, 0.89] |
| 2 Number of people sustaining one or more falls | 26 | 8774 | Risk Ratio (Random, 95% CI) | 0.97 [0.89, 1.04] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 12 | 3368 | Risk Ratio (Random, 95% CI) | 0.87 [0.74, 1.03] |

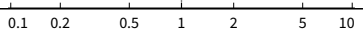
**Analysis 11.1. Comparison 11 Multifactorial intervention vs control: sensitivity analysis by individual randomisation, Outcome 1 Rate of falls (falls per person years).**

| Study or subgroup | Multifactorial N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Beling 2009 | 11 | 8 | -1.7 (1.12) | | 0.36% | 0.18[0.02,1.64] |
| Davison 2005 | 144 | 149 | -0.4 (0.06) | | 7.12% | 0.64[0.57,0.72] |
| Elley 2008 | 155 | 157 | -0 (0.08) | | 6.83% | 0.96[0.82,1.12] |
| Fairhall 2014 | 107 | 109 | 0.1 (0.19) | | 4.77% | 1.12[0.77,1.62] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.26) | | 3.62% | 0.85[0.51,1.42] |
| Gallagher 1996 | 50 | 50 | -0.2 (0.15) | | 5.54% | 0.81[0.6,1.09] |
| Hogan 2001 | 75 | 77 | -0.2 (0.09) | | 6.67% | 0.79[0.67,0.95] |
| Lightbody 2002 | 155 | 159 | -0.2 (0.11) | | 6.31% | 0.85[0.69,1.06] |
| Logan 2010 | 98 | 99 | -0.8 (0.07) | | 6.99% | 0.45[0.39,0.52] |
| Lord 2005 | 192 | 197 | 0 (0.11) | | 6.31% | 1.04[0.84,1.29] |
| Luck 2013 | 118 | 112 | -1.1 (0.2) | | 4.59% | 0.32[0.22,0.47] |
| Markle-Reid 2010 | 49 | 43 | 0.1 (0.18) | | 4.96% | 1.09[0.77,1.56] |
| Möller 2014 | 56 | 50 | 0 (0.15) | | 5.54% | 1.03[0.77,1.38] |
| Palvanen 2014 | 661 | 653 | -0.3 (0.05) | | 7.25% | 0.73[0.66,0.8] |
| Pardessus 2002 | 30 | 30 | -0.2 (0.3) | | 3.08% | 0.8[0.45,1.44] |
| Russell 2010 | 344 | 354 | -0.4 (0.04) | | 7.35% | 0.64[0.6,0.7] |
| Vind 2009 | 196 | 196 | 0 (0.07) | | 6.99% | 1.02[0.89,1.17] |
| Zijlstra 2009 | 196 | 209 | -0.1 (0.14) | | 5.73% | 0.86[0.65,1.13] |
| **Total (95% CI)** | | | | | **100%** | **0.78[0.68,0.89]** |
| Heterogeneity: Tau²=0.06; Chi²=146.95, df=17(P<0.0001); I²=88.43% | | | | | | |
| Test for overall effect: Z=3.61(P=0) | | | | | | |



## Analysis 11.2. Comparison 11 Multifactorial intervention vs control: sensitivity analysis by individual randomisation, Outcome 2 Number of people sustaining one or more falls.

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Ciaschini 2009 | 101 | 100 | 0.4 (0.28) | | 1.59% | 1.51[0.87,2.61] |
| Close 1999 | 184 | 213 | -0.5 (0.13) | | 4.19% | 0.61[0.47,0.79] |
| Davison 2005 | 144 | 149 | -0 (0.08) | | 5.82% | 0.95[0.81,1.11] |
| De Vries 2010 | 106 | 111 | -0.1 (0.13) | | 4.19% | 0.93[0.72,1.2] |
| Elley 2008 | 155 | 157 | 0.1 (0.08) | | 5.82% | 1.09[0.94,1.28] |
| Fabacher 1994 | 100 | 95 | -0.5 (0.31) | | 1.35% | 0.61[0.33,1.11] |
| Fairhall 2014 | 119 | 119 | 0.1 (0.11) | | 4.81% | 1.07[0.86,1.33] |
| Ferrer 2014 | 142 | 131 | 0.1 (0.2) | | 2.6% | 1.12[0.75,1.65] |
| Hendriks 2008 | 124 | 134 | -0 (0.14) | | 3.91% | 0.97[0.74,1.28] |
| Hogan 2001 | 75 | 77 | -0.1 (0.09) | | 5.47% | 0.9[0.76,1.08] |
| Huang 2005 | 63 | 63 | -0.3 (0.56) | | 0.47% | 0.71[0.24,2.13] |
| Kingston 2001 | 51 | 41 | -0.2 (0.98) | | 0.16% | 0.8[0.12,5.48] |
| Lightbody 2002 | 155 | 159 | -0 (0.19) | | 2.78% | 0.98[0.68,1.42] |
| Logan 2010 | 102 | 102 | -0.2 (0.06) | | 6.48% | 0.84[0.75,0.95] |
| Lord 2005 | 202 | 201 | 0 (0.11) | | 4.81% | 1.03[0.83,1.28] |
| Möller 2014 | 80 | 73 | 0.1 (0.16) | | 3.41% | 1.12[0.82,1.53] |
| Newbury 2001 | 45 | 44 | -0.4 (0.31) | | 1.35% | 0.69[0.38,1.27] |
| Palvanen 2014 | 661 | 653 | -0.2 (0.06) | | 6.48% | 0.84[0.74,0.94] |
| Pardessus 2002 | 30 | 30 | -0.1 (0.28) | | 1.59% | 0.87[0.5,1.5] |
| Russell 2010 | 320 | 330 | 0.1 (0.08) | | 5.82% | 1.12[0.95,1.31] |
| Van Haastregt 2000 | 120 | 115 | 0.1 (0.12) | | 4.49% | 1.13[0.89,1.43] |
| Vetter 1992 | 240 | 210 | 0.3 (0.13) | | 4.19% | 1.28[1,1.66] |
| Vind 2009 | 196 | 196 | 0.1 (0.09) | | 5.47% | 1.09[0.92,1.31] |
| Wagner 1994 | 635 | 607 | -0.3 (0.08) | | 5.82% | 0.75[0.64,0.88] |
| Whitehead 2003 | 58 | 65 | 0.7 (0.26) | | 1.79% | 2.1[1.26,3.49] |
| Zijlstra 2009 | 188 | 203 | -0.2 (0.1) | | 5.13% | 0.84[0.69,1.03] |
| **Total (95% CI)** | | | | | **100%** | **0.97[0.89,1.04]** |
| Heterogeneity: Tau²=0.02; Chi²=66.41, df=25(P<0.0001); I²=62.35% | | | | | | |
| Test for overall effect: Z=0.86(P=0.39) | | | | | | |



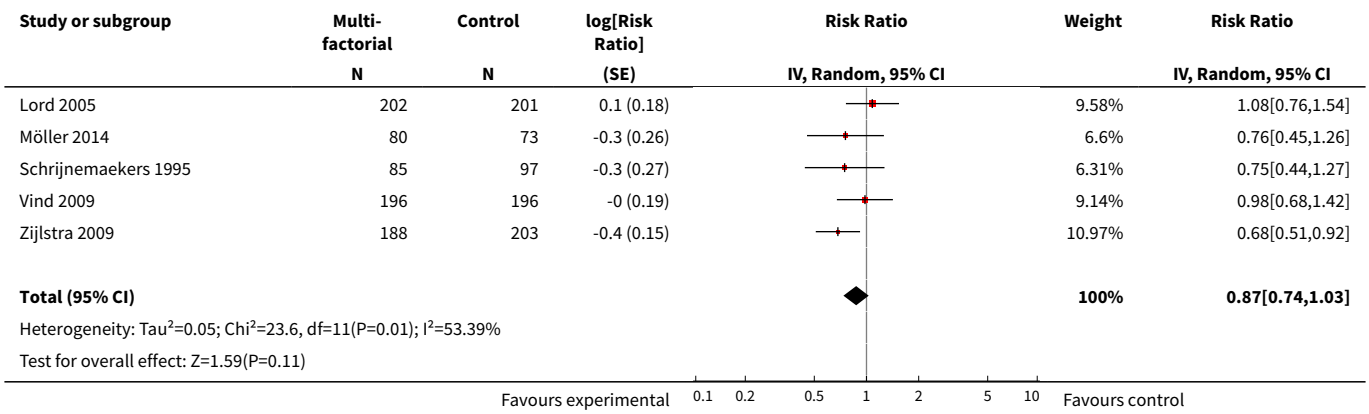

Favours intervention — Favours control

## Analysis 11.3. Comparison 11 Multifactorial intervention vs control: sensitivity analysis by individual randomisation, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).

| Study or subgroup | Multi-factorial N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Close 1999 | 184 | 213 | -0.8 (0.24) | | 7.24% | 0.44[0.28,0.7] |
| De Vries 2010 | 106 | 111 | 0.1 (0.19) | | 9.14% | 1.11[0.76,1.6] |
| Elley 2008 | 155 | 157 | 0.3 (0.14) | | 11.45% | 1.3[0.99,1.71] |
| Fairhall 2014 | 119 | 119 | -0.1 (0.2) | | 8.73% | 0.86[0.58,1.27] |
| Ferrer 2014 | 142 | 131 | -0.2 (0.39) | | 3.78% | 0.78[0.36,1.67] |
| Hendriks 2008 | 124 | 134 | 0 (0.21) | | 8.33% | 1.02[0.68,1.54] |
| Hogan 2001 | 75 | 77 | -0.3 (0.2) | | 8.73% | 0.76[0.52,1.13] |



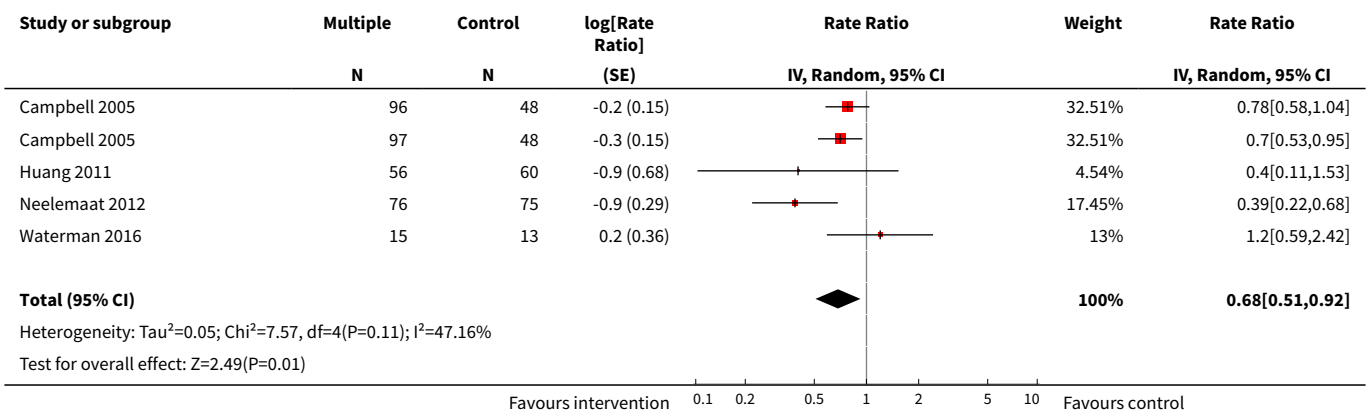

Favours experimental — Favours control



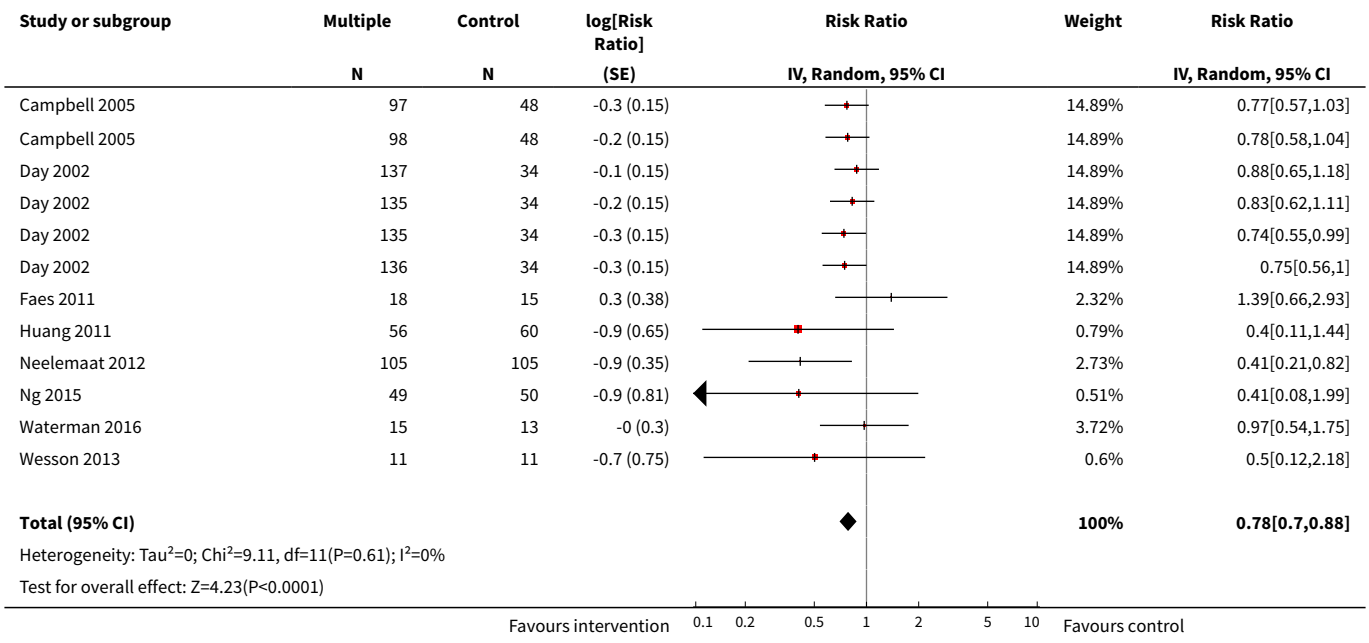

## Comparison 12. Multiple intervention vs control: sensitivity analysis by low risk of selection bias

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 4 | 584 | Rate Ratio (Random, 95% CI) | 0.68 [0.51, 0.92] |
| 2 Number of people sustaining one or more falls | 8 | 1478 | Risk Ratio (Random, 95% CI) | 0.78 [0.70, 0.88] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 3 | 352 | Risk Ratio (Random, 95% CI) | 0.90 [0.62, 1.30] |

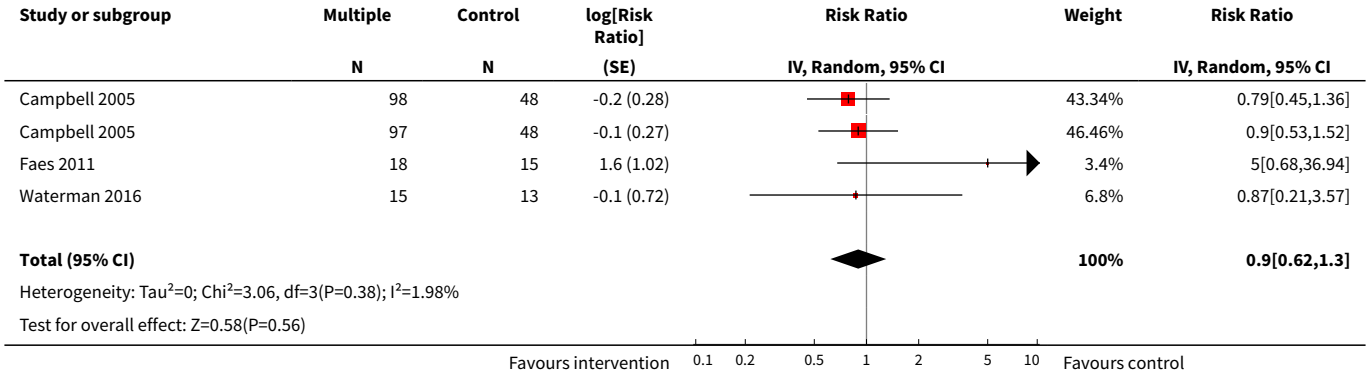
### Analysis 12.1. Comparison 12 Multiple intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 1 Rate of falls (falls per person years).



**Analysis 12.2. Comparison 12 Multiple intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 2 Number of people sustaining one or more falls.**




**Analysis 12.3. Comparison 12 Multiple intervention vs control: sensitivity analysis by low risk of selection bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**




**Comparison 13. Multiple intervention vs control: sensitivity analysis by low risk of detection bias**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 5 | 969 | Rate Ratio (Random, 95% CI) | 0.75 [0.60, 0.93] |
| 2 Number of people sustaining one or more falls | 5 | 1518 | Risk Ratio (Random, 95% CI) | 0.81 [0.73, 0.89] |

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 3 | 629 | Risk Ratio (Random, 95% CI) | 0.79 [0.61, 1.02] |

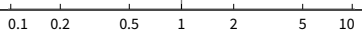
**Analysis 13.1. Comparison 13 Multiple intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 1 Rate of falls (falls per person years).**

| Study or subgroup | Multiple N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 96 | 48 | -0.2 (0.15) | | 21.55% | 0.78[0.58,1.04] |
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 21.55% | 0.7[0.53,0.95] |
| Clemson 2004 | 157 | 153 | -0.4 (0.17) | | 19.42% | 0.69[0.5,0.96] |
| Neelemaat 2012 | 76 | 75 | -0.9 (0.29) | | 10.47% | 0.39[0.22,0.68] |
| Uusi-Rasi 2015 | 96 | 95 | -0 (0.17) | | 19.42% | 0.99[0.71,1.38] |
| Waterman 2016 | 15 | 13 | 0.2 (0.36) | | 7.59% | 1.2[0.59,2.42] |
| **Total (95% CI)** | | | | | **100%** | **0.75[0.6,0.93]** |
| Heterogeneity: $Tau^2$=0.04; $Chi^2$=10.03, df=5(P=0.07); $I^2$=50.15% | | | | | | |
| Test for overall effect: Z=2.58(P=0.01) | | | | | | |



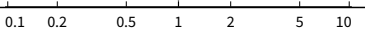

**Analysis 13.2. Comparison 13 Multiple intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 2 Number of people sustaining one or more falls.**

| Study or subgroup | Multiple N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 11.52% | 0.77[0.57,1.03] |
| Campbell 2005 | 98 | 48 | -0.2 (0.15) | | 11.52% | 0.78[0.58,1.04] |
| Clemson 2004 | 157 | 153 | -0.1 (0.1) | | 25.91% | 0.9[0.74,1.09] |
| Day 2002 | 136 | 34 | -0.3 (0.15) | | 11.52% | 0.75[0.56,1] |
| Day 2002 | 135 | 34 | -0.2 (0.15) | | 11.52% | 0.83[0.62,1.11] |
| Day 2002 | 135 | 34 | -0.3 (0.15) | | 11.52% | 0.74[0.55,0.99] |
| Day 2002 | 137 | 34 | -0.1 (0.15) | | 11.52% | 0.88[0.65,1.18] |
| Neelemaat 2012 | 105 | 105 | -0.9 (0.35) | | 2.12% | 0.41[0.21,0.82] |
| Waterman 2016 | 15 | 13 | -0 (0.3) | | 2.88% | 0.97[0.54,1.75] |
| **Total (95% CI)** | | | | | **100%** | **0.81[0.73,0.89]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=6.15, df=8(P=0.63); $I^2$=0% | | | | | | |
| Test for overall effect: Z=4.16(P<0.0001) | | | | | | |



**Analysis 13.3. Comparison 13 Multiple intervention vs control: sensitivity analysis by low risk of detection bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**

| Study or subgroup | Multiple N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 97 | 48 | -0.1 (0.27) | | 23.15% | 0.9[0.53,1.52] |
| Campbell 2005 | 98 | 48 | -0.2 (0.28) | | 21.52% | 0.79[0.45,1.36] |
| Clemson 2004 | 157 | 153 | -0.3 (0.18) | | 52.08% | 0.74[0.52,1.05] |
| Waterman 2016 | 15 | 13 | -0.1 (0.72) | | 3.25% | 0.87[0.21,3.57] |
| **Total (95% CI)** | | | | | **100%** | **0.79[0.61,1.02]** |
| Heterogeneity: Tau²=0; Chi²=0.36, df=3(P=0.95); I²=0% | | | | | | |
| Test for overall effect: Z=1.83(P=0.07) | | | | | | |

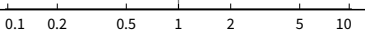



## Comparison 14. Multiple intervention vs control: sensitivity analysis by low risk of attrition bias

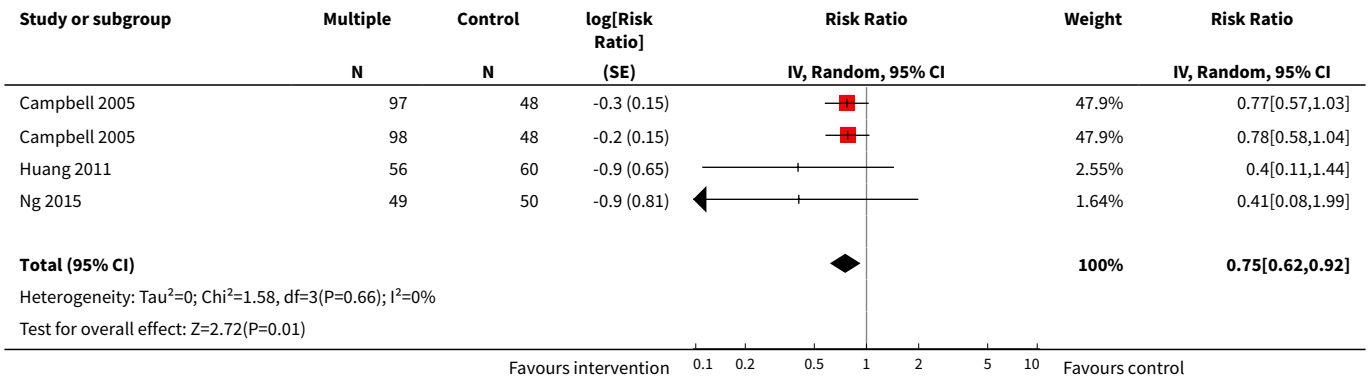
| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 3 | 596 | Rate Ratio (Random, 95% CI) | 0.79 [0.66, 0.96] |
| 2 Number of people sustaining one or more falls | 3 | 506 | Risk Ratio (Random, 95% CI) | 0.75 [0.62, 0.92] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 1 | 291 | Risk Ratio (Random, 95% CI) | 0.84 [0.57, 1.23] |

**Analysis 14.1. Comparison 14 Multiple intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 1 Rate of falls (falls per person years).**

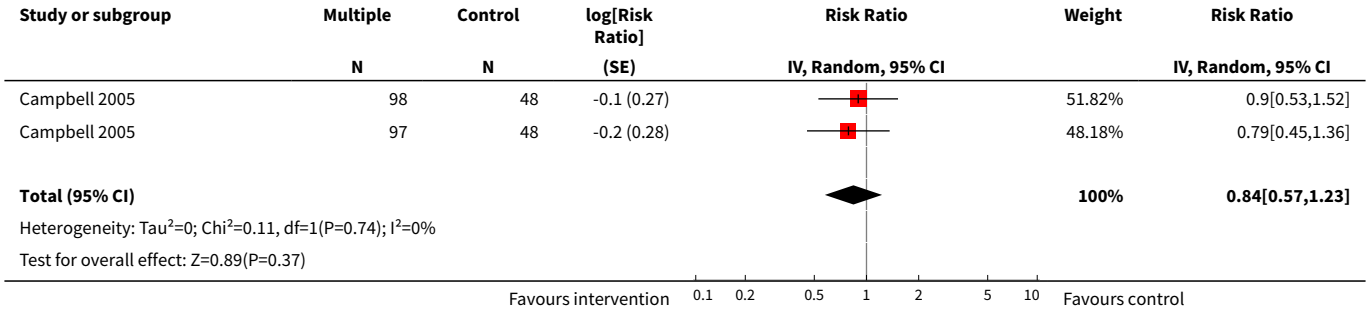
| Study or subgroup | Multiple N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 96 | 48 | -0.2 (0.15) | | 34.94% | 0.78[0.58,1.04] |
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 34.94% | 0.7[0.53,0.95] |
| Huang 2011 | 56 | 60 | -0.9 (0.68) | | 1.98% | 0.4[0.11,1.53] |
| Uusi-Rasi 2015 | 96 | 95 | -0 (0.17) | | 28.13% | 0.99[0.71,1.38] |
| **Total (95% CI)** | | | | | **100%** | **0.79[0.66,0.96]** |
| Heterogeneity: Tau²=0; Chi²=3.33, df=3(P=0.34); I²=9.98% | | | | | | |
| Test for overall effect: Z=2.4(P=0.02) | | | | | | |



**Analysis 14.2. Comparison 14 Multiple intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 2 Number of people sustaining one or more falls.**




**Analysis 14.3. Comparison 14 Multiple intervention vs control: sensitivity analysis by low risk of attrition bias, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**

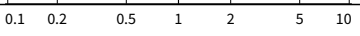



**Comparison 15. Multiple intervention vs control: sensitivity analysis by individual randomisation**

| Outcome or subgroup title | No. of studies | No. of participants | Statistical method | Effect size |
|---|---|---|---|---|
| 1 Rate of falls (falls per person years) | 6 | 1085 | Rate Ratio (Random, 95% CI) | 0.74 [0.60, 0.91] |
| 2 Number of people sustaining one or more falls | 10 | 1877 | Risk Ratio (Random, 95% CI) | 0.81 [0.74, 0.90] |
| 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period) | 4 | 662 | Risk Ratio (Random, 95% CI) | 0.81 [0.63, 1.05] |

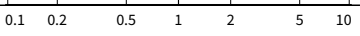
## Analysis 15.1. Comparison 15 Multiple intervention vs control: sensitivity analysis by individual randomisation, Outcome 1 Rate of falls (falls per person years).

| Study or subgroup | Multiple N | Control N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 97 | 48 | -0.2 (0.15) | | 21.12% | 0.78[0.58,1.04] |
| Campbell 2005 | 96 | 48 | -0.3 (0.15) | | 21.12% | 0.7[0.53,0.95] |
| Clemson 2004 | 157 | 153 | -0.4 (0.17) | | 18.97% | 0.69[0.5,0.96] |
| Huang 2011 | 56 | 60 | -0.9 (0.68) | | 2.4% | 0.4[0.11,1.53] |
| Neelemaat 2012 | 76 | 75 | -0.9 (0.29) | | 10.11% | 0.39[0.22,0.68] |
| Uusi-Rasi 2015 | 96 | 95 | -0 (0.17) | | 18.97% | 0.99[0.71,1.38] |
| Waterman 2016 | 15 | 13 | 0.2 (0.36) | | 7.3% | 1.2[0.59,2.42] |
| **Total (95% CI)** | | | | | **100%** | **0.74[0.6,0.91]** |
| Heterogeneity: $Tau^2$=0.03; $Chi^2$=10.88, df=6(P=0.09); $I^2$=44.85% | | | | | | |
| Test for overall effect: Z=2.78(P=0.01) | | | | | | |



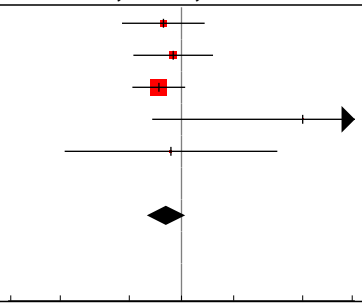

## Analysis 15.2. Comparison 15 Multiple intervention vs control: sensitivity analysis by individual randomisation, Outcome 2 Number of people sustaining one or more falls.

| Study or subgroup | Multiple N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 97 | 48 | -0.3 (0.15) | | 10.93% | 0.77[0.57,1.03] |
| Campbell 2005 | 98 | 48 | -0.2 (0.15) | | 10.93% | 0.78[0.58,1.04] |
| Clemson 2004 | 157 | 153 | -0.1 (0.1) | | 24.59% | 0.9[0.74,1.09] |
| Day 2002 | 137 | 34 | -0.1 (0.15) | | 10.93% | 0.88[0.65,1.18] |
| Day 2002 | 135 | 34 | -0.3 (0.15) | | 10.93% | 0.74[0.55,0.99] |
| Day 2002 | 135 | 34 | -0.2 (0.15) | | 10.93% | 0.83[0.62,1.11] |
| Day 2002 | 136 | 34 | -0.3 (0.15) | | 10.93% | 0.75[0.56,1] |
| Faes 2011 | 18 | 15 | 0.3 (0.38) | | 1.7% | 1.39[0.66,2.93] |
| Huang 2011 | 56 | 60 | -0.9 (0.65) | | 0.58% | 0.4[0.11,1.44] |
| Neelemaat 2012 | 105 | 105 | -0.9 (0.35) | | 2.01% | 0.41[0.21,0.82] |
| Ng 2015 | 49 | 50 | -0.9 (0.81) | | 0.37% | 0.41[0.08,1.99] |
| Olsen 2014 | 47 | 42 | 0.1 (0.35) | | 2.01% | 1.05[0.53,2.09] |
| Waterman 2016 | 15 | 13 | -0 (0.3) | | 2.73% | 0.97[0.54,1.75] |
| Wesson 2013 | 11 | 11 | -0.7 (0.75) | | 0.44% | 0.5[0.12,2.18] |
| **Total (95% CI)** | | | | | **100%** | **0.81[0.74,0.9]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=11.01, df=13(P=0.61); $I^2$=0% | | | | | | |
| Test for overall effect: Z=4.15(P<0.0001) | | | | | | |



**Analysis 15.3. Comparison 15 Multiple intervention vs control: sensitivity analysis by individual randomisation, Outcome 3 Number of people sustaining recurrent falls (defined as two or more falls in a specified time period).**

| Study or subgroup | Multiple N | Control N | log[Risk Ratio] (SE) | Risk Ratio IV, Random, 95% CI | Weight | Risk Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Campbell 2005 | 97 | 48 | -0.2 (0.28) | | 21.18% | 0.79[0.45,1.36] |
| Campbell 2005 | 98 | 48 | -0.1 (0.27) | | 22.78% | 0.9[0.53,1.52] |
| Clemson 2004 | 157 | 153 | -0.3 (0.18) | | 51.25% | 0.74[0.52,1.05] |
| Faes 2011 | 18 | 15 | 1.6 (1.02) | | 1.6% | 5[0.68,36.94] |
| Waterman 2016 | 15 | 13 | -0.1 (0.72) | | 3.2% | 0.87[0.21,3.57] |
| **Total (95% CI)** | | | | | **100%** | **0.81[0.63,1.05]** |
| Heterogeneity: $Tau^2$=0; $Chi^2$=3.59, df=4(P=0.46); $I^2$=0% | | | | | | |
| Test for overall effect: Z=1.62(P=0.11) | | | | | | |




## ADDITIONAL TABLES

**Table 1. Multifactorial interventions: study design, setting and trial size**

| Study ID | Study design | No. arms | Study centres | Length of follow-up | Setting | No. randomised | No. analysed | % lost to follow-up |
|---|---|---|---|---|---|---|---|---|
| Beling 2009 | Parallel | 2 | Single | 3 months | USA | 23 | 19 | 17% |
| Carpenter 1990 | Parallel | 2 | Multiple | 36 months | United Kingdom | 539 | 367 | 32% |
| Carter 1997 | Parallel | 3 | Unclear | 12 months | Australia | 657 | 457 | 30% |
| Ciaschini 2009 | Parallel | 2 | Single | 12 months | Canada | 201 | 176 | 12% |
| Close 1999 | Parallel | 2 | Unclear | 12 months | United Kingdom | 397 | 304 | 23% |
| Coleman 1999 | Cluster | 2 | Multiple | 12 months | USA | 169 | 142 | 16% |
| Davison 2005 | Parallel | 2 | Unclear | 12 months | United Kingdom | 313 | 282 | 10% |
| De Vries 2010 | Parallel | 2 | Multiple | 12 months | The Netherlands | 217 | 187 | 14% |
| Elley 2008 | Parallel | 2 | Multiple | 12 months | New Zealand | 312 | 280 | 10% |
| Fabacher 1994 | Parallel | 2 | Single | 12 months | USA | 254 | 195 | 23% |
| Fairhall 2014 | Parallel | 2 | Single | 12 months | Australia | 241 | 216 | 10% |
| Ferrer 2014 | Parallel | 2 | Single | 12 months | Spain | 328 | 273 | 17% |
| Gallagher 1996 | Parallel | 2 | Unclear | 6 months | Canada | 100 | 100 | 0% |
| Hendriks 2008 | Parallel | 2 | Single | 12 months | The Netherlands | 333 | 258 | 23% |
| Hogan 2001 | Parallel | 2 | Unclear | 24 months | Canada | 163 | 139 | 15% |

**Table 1. Multifactorial interventions: study design, setting and trial size** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Huang 2005 | Parallel | 2 | Single | 3 months | Taiwan | 141 | 126 | 11% |
| Imhof 2012 | Parallel | 2 | Single | 9 months | Switzerland | 461 | 413 | 10% |
| Jitapunkul 1998 | Parallel | 2 | Unclear | 36 months | Thailand | 160 | 116 | 28% |
| Kingston 2001 | Parallel | 2 | Single | 3 months | United Kingdom | 109 | 92 | 16% |
| Lightbody 2002 | Parallel | 2 | Single | 6 months | United Kingdom | 348 | 314 | 10% |
| Logan 2010 | Parallel | 2 | Unclear | 12 months | United Kingdom | 204 | 157 | 23% |
| Lord 2005 | Parallel | 3 | Single | 12 months | Australia | 620 | 578 | 7% |
| Luck 2013 | Parallel | 2 | Multiple | 18 months | Germany | 305 | 230 | 26% |
| Markle-Reid 2010 | Parallel | 4 | Multiple | 6 months | Canada | 109 | 92 | 16% |
| Metzelthin 2013 | Cluster | 2 | Multiple | 24 months | The Netherlands | 346 | 270 | 22% |
| Möller 2014 | Parallel | 2 | Multiple | 12 months | Sweden | 153 | 106 | 31% |
| Newbury 2001 | Parallel | 2 | Multiple | 12 months | Australia | 100 | 89 | 11% |
| Palvanen 2014 | Parallel | 2 | Multiple | 12 months | Finland | 1314 | 1145 | 13% |
| Pardessus 2002 | Parallel | 2 | Single | 12 months | France | 60 | 51 | 15% |
| Rubenstein 2007 | Parallel | 2 | Single | 12 months | USA | 792 | 694 | 12% |
| Russell 2010 | Parallel | 2 | Multiple | 12 months | Australia | 712 | 650 | 9% |

**Table 1. Multifactorial interventions: study design, setting and trial size** *(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Schrijnemaekers 1995** | Parallel | 2 | Single | 36 months | The Netherlands | 222 | 182 | 18% |
| **Sheffield 2013** | Parallel | 2 | Single | 3 months | USA | 90 | 60 | 33% |
| **Shyu 2010** | Parallel | 2 | Single | 12 months | Taiwan | 162 | 122 | 25% |
| **Spice 2009** | Cluster | 3 | Multiple | 12 months | United Kingdom | 516 | 422 | 18% |
| **Tinetti 1994** | Cluster | 2 | Multiple | 12 months | USA | 301 | 291 | 3% |
| Ueda 2017[a] | Parallel | 2 | Single | 1 month | Japan | 60 | 51 | 15% |
| **Van Haastregt 2000** | Parallel | 2 | Multiple | 18 months | The Netherlands | 316 | 235 | 26% |
| **Van Rossum 1993** | Parallel | 2 | Unclear | 36 months | The Netherlands | 580 | 493 | 15% |
| **Vetter 1992** | Parallel | 2 | Single | 48 months | United Kingdom | 674 | 450 | 33% |
| **Vind 2009** | Parallel | 2 | Single | 12 months | Denmark | 392 | 364 | 7% |
| **Wagner 1994** | Parallel | 3 | Multiple | 24 months | USA | 1559 | Not reported | Not reported |
| **Whitehead 2003** | Parallel | 2 | Single | 6 months | Australia | 140 | 123 | 12% |
| **Zijlstra 2009** | Parallel | 2 | Multiple | 14 months | The Netherlands | 540 | 405 | 25% |

[a]Only trial with an active comparator (exercise)

**Table 2. Multifactorial interventions: participants, intervention approach, comparator and compliance**

| Study ID | Age (mean) | % Women | High risk of falls | Active /referral | Comparator | Compliance assessed |
|---|---|---|---|---|---|---|
| Beling 2009 | 80 | 42% | Yes | Active | Usual care | No |
| Carpenter 1990 | ≥ 75 years | 65% | No | Referral | Usual care | No |
| Carter 1997 | 34% >80 years | 66% | No | Referral | Usual care | Yes |
| Ciaschini 2009 | 72 | 94% | Yes | Referral | Usual care | Yes |
| Close 1999 | 78 | 68% | Yes | Active | Usual care | No |
| Coleman 1999 | 77 | 49% | No | Active | Usual care | Yes |
| Davison 2005 | 77 | 72% | Yes | Active | Usual care | Yes |
| De Vries 2010 | 80 | 71% | Yes | Active | Usual care | Yes |
| Elley 2008 | 81 | 69% | Yes | Referral | Attention control | Yes |
| Fabacher 1994 | 73 | 2% | No | Referral | Usual care | Yes |
| Fairhall 2014 | 83 | 68% | Yes | Active | Usual care | Yes |
| Ferrer 2014 | 81 | 62% | Yes | Active | Usual care | Yes |
| Gallagher 1996 | 75 | 80% | Yes | Referral | Usual care | Yes |
| Hendriks 2008 | 75 | 68% | Yes | Referral | Usual care | Yes |
| Hogan 2001 | 78 | 72% | Yes | Referral | Usual care | Yes |
| Huang 2005 | 77 | 69% | Yes | Active | Usual care | No |
| Imhof 2012 | 85 | 73% | Yes | Active | Usual care | No |
| Jitapunkul 1998 | 76 | 65% | No | Referral | Usual care | No |
| Kingston 2001 | 72 | 100% | Yes | Referral | Usual care | No |
| Lightbody 2002 | Median 75 (IQR 70 to 81) | 74% | Yes | Referral | Usual care | No |
| Logan 2010 | Median 83 (IQR 77 to 86) | 65% | Yes | Active | Usual care | No |
| Lord 2005 | 80 | 66% | Yes | Active and Referral | Usual care | Yes |
| Luck 2013 | 85 | 69% | No | Active | Usual care | Yes |

**Table 2. Multifactorial interventions: participants, intervention approach, comparator and compliance** *(Continued)*

| | | | | | | |
|---|---|---|---|---|---|---|
| **Markle-Reid 2010** | Range 75 to 84 | 72% | Yes | Active | Usual care | Yes |
| **Metzelthin 2013** | 77 | 58% | Yes | Referral | Usual care | No |
| **Möller 2014** | 82 | 67% | No | Active | Usual care | No |
| **Newbury 2001** | Median 79 | 63% | No | Referral | Usual care | No |
| **Palvanen 2014** | 77 | 86% | Yes | Referral | Attention control | Yes |
| **Pardessus 2002** | 83 | 78% | Yes | Referral | Usual care | Yes |
| **Rubenstein 2007** | 75 | 3% | Yes | Referral | Usual care | Yes |
| **Russell 2010** | ≥75 (51%) | 70% | Yes | Referral | Usual care | Yes |
| **Schrijnemaekers 1995** | >77 | 70% | Yes | Referral | Usual care | Yes |
| **Sheffield 2013** | 82 | 80% | No | Active | Usual care | No |
| **Shyu 2010** | 78 | 69% | Yes | Active | Usual care | No |
| **Spice 2009** | 82 | Not reported | Yes | Active | Usual care | Yes |
| **Tinetti 1994** | 79 | 69% | Yes | Active | Usual care | Yes |
| Ueda 2017[a] | 76 | 69% | Yes | Active | Exercise | No |
| **Van Haastregt 2000** | 77 | 66% | Yes | Referral | Usual care | No |
| **Van Rossum 1993** | Range 75 to 84 | 58% | No | Referral | Usual care | No |
| **Vetter 1992** | > 70 | Not reported | No | Referral | Usual care | Yes |
| **Vind 2009** | 74 | 74% | Yes | Active | Usual care | No |
| **Wagner 1994** | 72 | 59% | No | Referral | Usual care | Yes |
| **Whitehead 2003** | 78 | 71% | Yes | Referral | Usual care | Yes |
| **Zijlstra 2009** | 75 | 72% | No | Active | Usual care | Yes |

[a]Only trial with an active comparator (exercise).

**Table 3. Multifactorial interventions: key components of the interventions[a]**

| Study ID | Referral / active | Exercise | Medication (drug target) | Medication (review) | Surgery | Management of urinary incontinence | Fluid or nutrition therapy | Psychological intervention | Environment/assistive technology (external) |
|---|---|---|---|---|---|---|---|---|---|
| **Beling 2009** | Active | Balance training to address risk factors | - | Medication review | - | - | - | - | Home assessment for falls risk with written recommendations |
| **Carpenter 1990** | Referral | - | - | - | - | - | - | Referral to psychogeriatric day hospital or nursing services | Referral for aids to daily living, e.g. bath seat |
| **Carter 1997 (group 1)** | Referral | - | - | - | - | - | - | - | Home assessment for falls risk with written summary of hazards |
| **Carter 1997 (group 2)** | Referral | - | - | Medication review | - | - | - | - | Home assessment for falls risk with written summary of hazards and referral to local services to make changes |
| **Ciaschini 2009** | Referral | Referral to physiotherapy (strengthening, gait and balance training, referral to activities such as Tai Chi) | - | Medication review | - | - | - | Referral to occupational therapy (cognitive assessment) | Referral to occupational therapy (home environmental assessment) |
| **Close 1999** | Active | - | - | Medication review | - | - | - | Cognition and depression assessment | Occupational therapy home visit assessing environmental hazards with home modifications |
| **Coleman 1999** | Active | Problem solving on physical activity | - | Session with pharmacist addressing polypharmacy and medications associated with | - | - | Problem-solving on nutrition | Self-management skills and group problem-solving | |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | functional decline | | | | | |
| **Davison 2005** | Active | Physiotherapist assessment of gait and balance, functional training programme | Medication to achieve target blood pressure | Medication review | - | - | - | Neurological examination | Occupational therapy home visit assessing environmental hazards with home modifications and assistive devices |
| **De Vries 2010** | Active | Balance and strength exercises | Vitamin D | Medication review | - | - | - | - | Home hazard reduction |
| **Elley 2008** | Referral | Strength and balance exercise programme | Vitamin D and calcium | Medication review | - | - | - | - | Home hazard assessment with home modifications or referral to occupational therapy service |
| **Fabacher 1994** | Referral | Gait and balance assessment | - | Medication review | - | - | - | Mental status examination | Home hazard assessment |
| **Fairhall 2014** | Active | Physiotherapy visits, strength and balance training | - | - | - | Referral to urinary incontinence clinic | Nutrition assessment and management | - | Home hazard assessment with home modifications, mobility aids and safety advice, referral to occupational therapist |
| **Ferrer 2014** | Referral | Gait and balance assessment, referral for physical therapy | - | Medication review, recommendations to discuss medication with physician | - | - | Malnutrition screening, nutrition or vitamin supplementation | Cognitive screening, education, referral to physician for further cognitive testing | Home hazard assessment with home modifications and recommendations |
| Gallagher 1996[2] | Referral | - | - | - | - | - | - | - | |
| **Hendriks 2008** | Referral | Assessment by rehabilitation physician | - | - | - | - | - | - | Home hazard assessment with home modi- |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | fications, mobility aids and safety advice |
| **Hogan 2001** | Referral | Balance and gait assessment, referral to exercise class, recommendations for home exercise | - | Medication review | - | - | - | Neurologic screening | Home hazard assessment with recommendations, advice on assistive devices |
| **Huang 2005** | Active | Assessment of rehabilitation facility needs | - | Education on medication | - | - | - | - | Education on environmental safety, assistance devices |
| **Imhof 2012** | Active | Mobility assessment | Pain assessment | - | - | - | Nutrition and bladder control assessments | Cognitive screening | |
| **Jitapunkul 1998** | Referral | Nurse-provided rehabilitation programme | Medication prescription | - | - | - | - | - | Assistive aids |
| **Kingston 2001** | Referral | Advice on exercise to strengthen muscles and joints | Pain control advice, medication | Advice on risk factors related to drugs | - | - | Advice on diet and vitamin supplementation | - | Education on environmental risks in the home |
| **Lightbody 2002** | Referral | Balance and mobility assessment, referral to physiotherapy, advised on simple exercises | - | Medication review | - | - | - | Cognitive screening, referral to GP | Home hazard assessment with home modifications and recommendations |
| **Logan 2010** | Active | Strength and balance training | - | Medication review | - | - | - | - | Home hazard assessment with home modifications and recommendations |
| **Lord 2005** | Active | Strength and balance exercise programme | - | - | Referral for cataract surgery | - | - | - | Advice on environmental risks |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Luck 2013** | Active | - | - | - | - | - | Consultation with nutritionist | - | |
| **Markle-Reid 2010** | Active | Home support exercise program | Advice to consider vitamin D and calcium supplementation | Medication review and modification | - | Incontinence assessment, referral to GP, education on pelvic floor exercises | Nutrition assessment, referral to dietician | Cognitive assessment, referral to physician or community mental health services | Home hazard assessment with home modifications and recommendations |
| **Metzelthin 2013** | Referral | Assessment by physiotherapist, advice on daily physical activity | - | - | - | - | - | - | Assessment by occupational therapist, recommendations on environmental adaptations |
| **Möller 2014** | Active | Tailored exercise program, referral to physical therapist | - | - | - | - | - | - | Home hazard assessment with home modifications and recommendations, referral to occupational therapist |
| Newbury 2001[b] | Referral | - | - | - | - | | - | - | |
| **Palvanen 2014** | Referral | Physical activity prescription, individually tailored or group exercise | - | Medication review | Referral for cataract surgery | - | Nutritional advice | - | Home hazard assessment with home modifications and recommendations, referral to occupational therapist |
| **Pardessus 2002** | Referral | Physical therapy (both arms) | - | Medication review (both arms) | - | - | - | Cognitive assessment (both arms) | Home hazard assessment with home modifications and recommendations |
| **Rubenstein 2007** | Referral | Physiotherapy assessment of falls and gait impairment | - | - | - | Urinary inconti- | - | Cognitive assessment, refer- | |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | nence assessment, treatment overseen by expert geriatrician | | ral for mental health support, referral to geriatric psychiatrist | |
| **Russell 2010** | Referral | Referral to physiotherapy | - | Medication review, referral to GP | - | - | Referral to dietetics | - | Referral to occupational therapy, advice on minor home improvements |
| **Schrijnemaekers 1995** | Referral | Referral to physiotherapy | Advice to stop / start medication | Medication review | - | - | Advice on diet | Referral to psychologist | |
| **Sheffield 2013** | Active | - | Training in medication management | - | - | - | - | - | Home hazard assessment with home modifications and recommendations, provision of assistive devices |
| **Shyu 2010** | Active | Rehabilitation plan including exercise to increase physical fitness and home exercise sessions by nurses | Suggestions on antibiotics | Medication review | Suggestions to surgeon regarding time of hip fracture surgery | Suggestions on urinary tract management | Nutrition assessment, suggestions on nutrition management | Cognitive assessment, suggestions on delirium management and prevention | |
| **Spice 2009 (primary care setting)** | Active | Mobility assessment, referral to occupational therapist or physiotherapist | Medication changes, e.g. add calcium and vitamin D | Medication review, referral to GP | - | - | - | - | Environmental hazard screening, referral to occupational therapist or council-run home hazard assessment with home modifications |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Spice 2009 (secondary care setting)** | Active | Mobility assessment, referral to occupational therapist or physiotherapist | Medication changes, e.g. add calcium and vitamin D | Medication review, referral to GP | - | - | - | - | Environmental hazard screening, referral to occupational therapist |
| **Tinetti 1994** | Active | Home visits for physical therapy, balance and strengthening exercises | Recommendation to adjust medication | Medication review | - | - | - | - | Environmental hazard screening, home modifications, training in transfer skills |
| Ueda 2017[c] | Active | Exercise (both arms) | - | - | - | - | - | - | Home hazard assessment with recommendations |
| **Van Haastregt 2000** | Referral | Mobility assessment, advice on improving mobility | - | Medication review, referral to GP | - | - | Nutrition assessment, advice on diet | Cognitive assessment, advice on psychiatric symptoms, referral to mental health care | Home hazard assessment with recommendations |
| **Van Rossum 1993** | Referral | - | - | Medication review, referral to GP | - | - | - | - | |
| **Vetter 1992** | Referral | Fitness classes | - | Medication review | - | - | Dietary advice | - | Home hazard assessment with home modifications |
| **Vind 2009** | Active | Strength and balance training | Drug modification, correction of vitamin deficiency | Medication review | - | - | - | Neurological screening, referral to neurologist | |

**Table 3. Multifactorial interventions: key components of the interventions[a]** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Wagner 1994** | Referral | Exercise orientation class | Recommendation to adjust medication | Medication review | - | - | - | - | Home hazard assessment with recommendations |
| **Whitehead 2003** | Referral | Exercise programme | - | Medication review, referral to GP | - | - | - | - | Home hazard assessment with recommendations |
| **Zijlstra 2009** | Active | Low intensity physical exercises | - | - | - | - | - | Cognitive behavioural group intervention | Home environment changes to reduce falls risk |

[a]Multifactorial interventions classified according to the taxonomy developed by the Prevention of Falls Network Europe (ProFANE) (Lamb 2007; Lamb 2011), with some modifications that primarily reflect categorisation in Gillespie 2012.
[b]Details of the component(s) of the multifactorial intervention were not reported.
[c]Only trial with an active comparator (exercise).

**Table 4. Multifactorial interventions: outcomes**

| Study ID | Rate falls | Risk one or more falls | Risk recurrent falls | Risk fall-related fracture | Risk fall-related hospital admission | Risk fall-related medical attention | Health related quality of life | Economic information | Adverse events[a] |
|---|---|---|---|---|---|---|---|---|---|
| **Beling 2009** | Yes | No | No | No | No | No | No | Not reported | Not reported |
| **Carpenter 1990** | Yes | No | No | No | Yes | No | No | Not reported | Not reported |
| **Carter 1997** | No | Yes | Yes | No | No | Yes | No | Not reported | Not reported |
| **Ciaschini 2009** | No | Yes | No | Yes | Yes | No | No | Not reported | Not reported |
| **Close 1999** | Yes | Yes | Yes | No | No | No | Yes | Yes | Not reported |
| **Coleman 1999** | No | Yes | No | No | Yes | No | Yes | Yes | Not reported |
| **Davison 2005** | Yes | Yes | No | Yes | Yes | Yes | No | Not reported | Not reported |

**Table 4. Multifactorial interventions: outcomes** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| De Vries 2010 | No | Yes | Yes | Yes | No | No | Yes | Yes | Not reported |
| Elley 2008 | Yes | Yes | Yes | No | No | No | Yes | Not reported | Not reported |
| Fabacher 1994 | No | Yes | No | No | Yes | No | No | Not reported | Not reported |
| Fairhall 2014 | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes |
| Ferrer 2014 | Yes | Yes | Yes | No | No | No | No | Not reported | Not reported |
| Gallagher 1996 | Yes | No | No | No | No | No | Yes | Not reported | Not reported |
| Hendriks 2008 | No | Yes | Yes | No | No | Yes | Yes | Yes | Not reported |
| Hogan 2001 | Yes | Yes | Yes | Yes | Yes | Yes | No | Not reported | Not reported |
| Huang 2005 | No | Yes | No | No | Yes | No | Yes | Not reported | Not reported |
| Imhof 2012 | No | Yes | No | No | Yes | No | Yes | Yes | Not reported |
| Jitapunkul 1998 | No | Yes | No | No | Yes | Yes | Yes | Not reported | Not reported |
| Kingston 2001 | No | Yes | No | No | No | No | Yes | Not reported | Not reported |
| Lightbody 2002 | Yes | Yes | No | No | No | No | Yes | Yes | Not reported |
| Logan 2010 | Yes | Yes | No | Yes | Yes | No | Yes | Yes | Not reported |
| Lord 2005 | Yes | Yes | Yes | No | No | No | No | Not reported | Not reported |
| Luck 2013 | Yes | No | No | No | No | No | No | Not reported | Not reported |
| Markle-Reid 2010 | Yes | No | No | No | No | No | Yes | Not reported | Not reported |
| Metzelthin 2013 | No | No | No | No | No | No | No | Yes | Not reported |
| Möller 2014 | Yes | Yes | Yes | No | No | Yes | No | Not reported | Not reported |
| Newbury 2001 | No | Yes | No | No | No | No | Yes | Not reported | Not reported |
| Palvanen 2014 | Yes | Yes | No | No | No | No | No | Not reported | Not reported |

**Table 4. Multifactorial interventions: outcomes** *(Continued)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Pardessus 2002** | Yes | Yes | No | No | Yes | No | No | Not reported | Not reported |
| **Rubenstein 2007** | Yes | Yes | No | No | Yes | No | Yes | Not reported | Not reported |
| **Russell 2010** | Yes | Yes | No | Yes | No | No | No | Not reported | Not reported |
| **Schrijnemaekers 1995** | No | No | Yes | No | No | No | No | Not reported | Not reported |
| **Sheffield 2013** | No | No | No | No | No | No | Yes | Yes | Not reported |
| **Shyu 2010** | No | Yes | No | No | Yes | Yes | Yes | Yes | Not reported |
| **Spice 2009** | No | Yes | No | Yes | Yes | No | Yes | Not reported | Not reported |
| **Tinetti 1994** | Yes | Yes | No | No | Yes | Yes | No | Yes | Yes |
| Ueda 2017[b] | Yes | Yes | No | No | No | No | No | Not reported | Not reported |
| **Van Haastregt 2000** | No | Yes | No | No | No | Yes | No | Not reported | Not reported |
| **Van Rossum 1993** | No | No | No | No | Yes | No | No | Yes | Not reported |
| **Vetter 1992** | No | Yes | No | Yes | No | No | No | Not reported | Not reported |
| **Vind 2009** | Yes | Yes | Yes | No | No | Yes | No | Not reported | Not reported |
| **Wagner 1994** | No | Yes | No | No | Yes | Yes | No | Not reported | Not reported |
| **Whitehead 2003** | No | Yes | No | No | No | No | No | Not reported | Not reported |
| **Zijlstra 2009** | Yes | Yes | Yes | No | No | No | No | Not reported | Yes |

[a]Reported information on adverse events which may have been as a result of the intervention.
[b]Only trial with an active comparator (exercise).

**Table 5. Multifactorial and multiple interventions: health economic information**

| Study ID | Country | Recruitment period | Cost information reported | Cost per fall prevented | Cost per QALY gained |
|---|---|---|---|---|---|
| **Multifactorial interventions** | | | | | |
| Close 1999 (cost analysis reported in Close 2000) | UK | December 1995 to June 1996 | No significant difference between the 2 groups for health service costs. Costs reported as GBP 1953 in the intervention group and GBP 2549 in the control group | Not reported | Not reported |
| **Coleman 1999** | USA | Not reported | No significant difference between the 2 groups for pharmacy costs or total health service costs. Cost reported as USD 9535 in the intervention group and USD 10,116 in the control group per year | Not reported | Not reported |
| **De Vries 2010** | The Netherlands | April 2005 to July 2008 | No significant difference between groups. Mean total healthcare costs reported as EUR 7740 in the intervention group and EUR 6838 in the control group. | EUR 226 per percentage reduction in fallers | If EUR 300,000 invested, probability that the intervention would improve quality of life (utility) by 1 point was 0.30 (incremental cost per QALY gained not reported) |
| **Fairhall 2014** | Australia | 2011 | No significant between-group difference in EQ-5D utility scores. The cost for 1 extra person to transition out of frailty was AUD 15,955 (at 2011 prices) | Not reported | Not reported |
| **Hendriks 2008** | The Netherlands | January 2003 to March 2004 | No significant difference between groups. Mean total healthcare costs reported as EUR 4857 in the intervention group and EUR 4991 in the control group | Incremental ratios not calculated as intervention did not reduce falls or result in QALY gains | Not reported |
| **Imhof 2012** | Switerland | 2008 to 2011 | The intervention cost approximately USD 1250 per participant; costs for the control group not reported | Not reported | Not reported |
| **Lightbody 2002** | UK | July 1997 to December 1997 | Total costs not reported. There was a cost saving in the number of fall-related hospital bed days reported (total costs of bed days GBP 11,719 in intervention group and GBP 37,951 in control group) | Not reported | Not reported |
| **Logan 2010 (cost analysis reported** | UK | September 2005 to January 2007 | Mean total healthcare costs reported as GBP 15,266 in the intervention group and GBP 16,818 in the control group per participant | Not reported | Mean QALY per patient was −0.059 (SD: 0.269) in the intervention group |

**Table 5. Multifactorial and multiple interventions: health economic information** *(Continued)*

| | | | | | |
|---|---|---|---|---|---|
| **in Sach 2012)** | | | | | and −0.129 (SD 0.238) in the control group. Mean difference of 0.070 (95% CI −0.010 to 0.150) |
| **Metzelthin 2013 (costs reported in Metzelthin 2015)** | The Netherlands | December 2009 (end date not reported) | Mean total healthcare costs were GBP 26,503 in the intervention group and GBP 20,550 in the control group per participant | Not reported | Not reported |
| **Sheffield 2013** | USA | Not reported | Mean cost of the intervention was USD 1145 per participant | Not reported | Not reported |
| **Shyu 2010** | Taiwan | September 2001 to November 2003 | Estimated cost added by the intervention programme to the current routine care was USD 438 | Not reported | Not reported |
| **Tinetti 1994 (costs reported in Rizzo 1996)** | USA | October 1990 to April 1992 | Mean total healthcare costs reported as USD 8310 in the intervention group and USD 10,439 in the control group | USD 1772 per fall prevented (intervention costs only) | Not reported |
| **Van Rossum 1993** | The Netherlands | Not reported | Mean total healthcare costs reported as NLG 20,080 for the intervention group and NLG 19,321 in the control group per person. | Not reported | Not reported |
| **Multiple component interventions** | | | | | |
| **Campbell 2005** | New Zealand | October 2002 to October 2003 | Home safety programme cost NZD 64,337 to deliver to the 198 participants in 2 centres, or NZD 325 per person (other components not reported) | NZD 650 per fall prevented (home safety programme implementation costs only) | Not reported |
| **Uusi-Rasi 2015 (cost analysis reported in Patil 2016)** | Finland | April 2010 to March 2013 | Mean healthcare reported as costs reported as EUR 188 for in the exercise and vitamin D group and EUR 73.4 in the exercise-only group per participant per year | Cost per fall prevented is EUR 3920 for the exercise and vitamin D group | Not reported |
| **Waterman 2016** | UK | March 2012 to October 2012 | Cost of the home safety and exercise programme was GBP 674 per participant | No difference in number of falls between groups and so cost per fall was not calculated | Not reported |

GBP: United Kingdom pound sterling
EUR: Euro
NLG: Dutch guilder
NZD: New Zealand dollar
USD: US dollar

**Table 6. Multiple interventions: study design, setting and trial size**

| Study ID | Study design | No. study arms | Study centres | Length of follow-up | Setting | No. randomised | No. analysed | % lost to follow-up |
|---|---|---|---|---|---|---|---|---|
| **Campbell 2005** | Factorial | 4 | Multiple | 12 months | New Zealand | 391 | 360 | 8% |
| **Clemson 2004** | Parallel | 2 | Multiple | 14 months | Australia | 310 | 285 | 8% |
| Day 2002[a] | Factorial | 8 | Multiple | 18 months | Australia | 1107 | 1090 | 2% |
| **Faes 2011** | Parallel | 2 | Multiple | 6 months | The Netherlands | 320 | Not reported | Not reported |
| **Freiberger 2012** | Parallel | 4 | Single | 24 months | Germany | 280 | 201 | 28% |
| **Hagovska 2016** | Parallel | 2 | Single | 3 months | Slovakia | 80 | 78 | 3% |
| Huang 2010[a] | Cluster | 4 | Multiple | 18 months | Taiwan | 261 | 163 | 38% |
| **Huang 2011** | Parallel | 3 | Unclear | 5 months | Taiwan | 186 | 176 | 5% |
| **Mendoza-Ruvalcaba 2015** | Parallel | 2 | Multiple | 6 months | Mexico | 72 | 64 | 11% |
| **Neelemaat 2012** | Parallel | 2 | Multiple | 3 months | The Netherlands | 210 | 150 | 29% |
| Ng 2015[a] | Parallel | 5 (3 eligible) | Single | 12 months | Singapore | 147 | 138 | 6% |
| **Olsen 2014** | Parallel | 2 | Single | 12 months | Norway | 89 | 70 | 21% |
| **Serra-Prat 2017** | Parallel | 2 | Multiple | 12 months | Spain | 172 | 133 | 23% |
| Sosnoff 2015[a] | Factorial | 4 | Single | 6 months | Canada | 37 | 34 | 8% |
| Uusi-Rasi 2015[b] | Factorial | 4 | Multiple | 24 months | Finland | 409 | 370 | 10% |
| **Waterman 2016** | Parallel | 3 | Unclear | 6 months | United Kingdom | 49 | 43 | 12% |
| **Wesson 2013** | Parallel | 2 | Single | 3 months | Australia | 22 | 22 | 0% |
| **Wilder 2001** | Parallel | 3 | Unclear | 9 months | USA | 60 | Not reported | Not reported |

[a]Trials also compared with an active comparator (exercise).
[b]Trial only compared with an active comparator (exercise).

**Table 7. Multiple interventions: participants, intervention, comparator and compliance**

| Study ID | Age (mean) | % Women | High risk of falls | Multiple intervention | Comparator | Compliance assessed |
|---|---|---|---|---|---|---|
| **Campbell 2005** | 84 | 68% | Yes | Exercise, home safety and nutrition | Attention control | Yes |
| **Clemson 2004** | 78 | 74% | Yes | Exercise, home safety and vision | Attention control | Yes |
| Day 2002[a] | 76 | 60% | No | Exercise, home safety and vision | Usual care and Exercise | No |
| **Faes 2011** | 79 | 70% | Yes | Exercise and psychological | Usual care | No |
| **Freiberger 2012** | 76 | 44% | Yes | Exercise and education | Usual care | Yes |
| **Hagovska 2016** | 67 | 49% | No | Exercise and psychological | Usual care | No |
| Huang 2010[a] | 71 | 48% | No | Exercise and education | Usual care and Exercise | No |
| **Huang 2011** | Not reported | 59% | No | Exercise and psychological | Usual care | No |
| **Mendoza-Ruvalcaba 2015** | 71 | 90% | No | Exercise, nutrition and psychological | Usual care | No |
| **Neelemaat 2012** | 75 | Not reported | No | Nutrition and psychological | Usual care | Yes |
| Ng 2015[a] | 70 | 61% | Yes | Exercise, nutrition and psychological | Usual care and Exercise | Yes |
| **Olsen 2014** | 71 | 100% | Yes | Exercise and education | Usual care | Yes |
| **Serra-Prat 2017** | 78 | 57% | Yes | Exercise and nutrition | Usual care | Yes |
| Sosnoff 2015[a] | 62 | 65% | Yes | Exercise and education | Usual care and Exercise | Yes |
| Uusi-Rasi 2015[b] | 74 | 100% | Yes | Exercise and nutrition | Exercise | Yes |
| **Waterman 2016** | 81 | 61% | Yes | Exercise and home safety | Usual care | Yes |
| **Wesson 2013** | 76 | 41% | Yes | Exercise and home safety | Usual care | Yes |
| **Wilder 2001** | Not reported | Not reported | No | Exercise and home safety | Usual care | No |

[a]Trials also compared with an active comparator (exercise).
[b]Trial only compared with an active comparator (exercise).

**Table 8. Multiple interventions: outcomes**

| Study ID | Rate falls | Risk one or more falls | Risk re-current falls | Risk fall-related fracture | Risk fall-related hospital admis-sion | Risk fall-related medical atten-tion | Health-related quality of life | Economic information | Adverse events[a] |
|---|---|---|---|---|---|---|---|---|---|
| **Campbell 2005** | Yes | Yes | Yes | No | No | Yes | No | Yes | Yes |
| **Clemson 2004** | Yes | Yes | Yes | No | No | No | Yes | Not reported | Not reported |
| Day 2002[b] | Yes | Yes | No | No | No | No | No | Not reported | Not reported |
| **Faes 2011** | No | Yes | Yes | No | No | No | Yes | Not reported | Not reported |
| **Freiberger 2012** | Yes | No | No | No | No | No | No | Not reported | Yes |
| **Hagovska 2016** | No | No | No | No | No | No | Yes | Not reported | Not reported |
| Huang 2010[b] | No | Yes | No | No | No | No | No | Not reported | Not reported |
| **Huang 2011** | Yes | Yes | No | No | No | No | Yes | Not reported | Not reported |
| **Mendoza-Ruvalcaba 2015** | No | No | No | No | No | No | Yes | Not reported | Not reported |
| **Neelemaat 2012** | Yes | Yes | No | Yes | No | No | No | Not reported | Not reported |
| Ng 2015[b] | No | Yes | No | No | Yes | No | No | Not reported | Yes |
| **Olsen 2014** | No | Yes | No | No | No | No | No | Not reported | Yes |
| **Serra-Prat 2017** | No | Yes | No | No | No | No | Yes | Not reported | Yes |
| Sosnoff 2015[b] | No | Yes | No | No | No | No | No | Not reported | Not reported |
| Uusi-Rasi 2015[c] | Yes | No | No | No | No | No | No | Yes | Yes |
| **Waterman 2016** | Yes | Yes | Yes | No | No | No | Yes | Yes | Yes |
| **Wesson 2013** | No | Yes | No | Yes | No | No | No | Not reported | Yes |
| **Wilder 2001** | No | Yes | No | No | No | No | No | Not reported | Not reported |

[a]Reported information on adverse events which may have been as a result of the intervention.
[b]Trials also compared with an active comparator (exercise).
[c]Trial only compared with an active comparator (exercise).

**Table 9. Multifactorial interventions versus control: sensitivity analyses**

| Outcome | Selection bias (low risk) | Detection bias (low risk) | Attrition bias (low risk) | Individually randomised (excluding cluster) | Overall treatment effect |
|---|---|---|---|---|---|
| **Rate of falls** | RaR 0.80 (95% CI 0.66 to 0.98); 8 trials; 3516 participants; $I^2$ = 93% | RaR 0.78 (95% CI 0.66 to 0.91); 12 trials; 3718 participants; $I^2$ = 91% | RaR 0.77 (95% CI 0.66 to 0.89); 11 trials; 4125 participants; $I^2$ = 90% | RaR 0.78 (95% CI 0.68 to 0.89); 18 trials; 5562 participants; $I^2$ = 88% | RaR 0.77 (95% CI 0.67 to 0.87); 19 trials; 5853 participants; $I^2$ = 88% |
| **Risk of sustaining one or more falls** | RR 0.98 (95% CI 0.86 to 1.10); 12 trials; 4692 participants; $I^2$ = 77% | RR 0.97 (95% CI 0.88 to 1.07); 16 trials; 4380 participants; $I^2$ = 64% | RR 0.95 (95% CI 0.88 to 1.02); 13 trials; 4452 participants; $I^2$ = 34% | RR 0.97 (95% CI 0.89 to 1.04); 26 trials; 8774 participants; $I^2$ = 62% | RR 0.96 (95% CI 0.90 to 1.03); 29 trials; 9637 participants; $I^2$ = 60% |
| **Risk of recurrent falls** | RR 0.85 (95% CI 0.62 to 1.15); 6 trials; 1862 participants; $I^2$ = 76% | RR 0.89 (95% CI 0.73 to 1.08); 10 trials; 3033 participants; $I^2$ = 60% | RR 0.96 (95% CI 0.81 to 1.13); 5 trials; 1402 participants; $I^2$ = 0% | RR 0.87 (95% CI 0.74 to 1.03); 12 trials; 3368 participants; $I^2$ = 53% | RR 0.87 (95% CI 0.74 to 1.03); 12 trials; 3368 participants; $I^2$ = 53% |
| **Risk of fall-related fractures** | RR 0.78 (95% CI 0.49 to 1.23); 4 trials; 1521 participants; $I^2$ = 0% | RR 0.47 (95% CI 0.24 to 0.93); 3 trials; 1055 participants; $I^2$ = 0% | RR 0.72 (95% CI 0.48 to 1.08); 6 trials; 1774 participants; $I^2$ = 0% | RR 0.75 (95% CI 0.53 to 1.06); 8 trials; 2425 participants; $I^2$ = 0% | RR 0.73 (95% CI 0.53 to 1.01); 9 trials; 2850 participants; $I^2$ = 0% |
| **Risk of experiencing a fall that required hospital admission** | RR 0.98 (95% CI 0.76 to 1.26); 1 trial; 204 participants | RR 0.94 (95% CI 0.74 to 1.18); 4 trials; 1960 participants; $I^2$ = 0% | RR 1.03 (95% CI 0.92 to 1.14); 7 trials; 2099 participants; $I^2$ = 7% | RR 0.99 (95% CI 0.92 to 1.08); 12 trials; 4433 participants; $I^2$ = 0% | RR 1.00 (95% CI 0.92 to 1.07); 15 trials; 5227 participants; $I^2$ = 0% |
| **Risk of experiencing a fall that required medical attention** | RR 1.08 (95% CI 0.74 to 1.58); 2 trials; 545 participants; $I^2$ = 1% | RR 0.83 (95% CI 0.65 to 1.07); 3 trials; 1947 participants; $I^2$ = 0% | RR 0.96 (95% CI 0.71 to 1.31); 3 trials; 868 participants; $I^2$ = 0% | RR 0.93 (95% CI 0.75 to 1.15); 7 trials; 2831 participants; $I^2$ = 6% | RR 0.91 (95% CI 0.75 to 1.10); 8 trials; 3078 participants; $I^2$ = 0% |
| **Health related quality of life (endpoint scores)** | SMD 0.32 (95% CI 0.08 to 0.55); 2 trials; 554 participants; $I^2$ = 43% | No trials remain | SMD 0.20 (95% CI 0.00 to 0.41); 6 trials; 1602 participants; $I^2$ = 72% | SMD 0.19 (95% CI 0.03 to 0.35); 9 trials; 2373 participants; $I^2$ =70% | SMD 0.19 (95% CI 0.03 to 0.35); 9 trials; 2373 participants; $I^2$ = 70% |

Individual results for prespecified sensitivity analyses for primary and secondary outcomes.

**Table 10. Multiple interventions versus control: sensitivity analyses**

| Outcome | Selection bias (low risk) | Detection bias (low risk) | Attrition bias (low risk) | Individually randomised (excluding cluster) | Overall treatment effect |
|---|---|---|---|---|---|

**Table 10. Multiple interventions versus control: sensitivity analyses** *(Continued)*

| | | | | | |
|---|---|---|---|---|---|
| **Rate of falls** | RaR 0.68 (95% CI 0.51 to 0.92); 4 trials; 584 participants; $I^2$ = 47% | RaR 0.75 (95% CI 0.60 to 0.93); 5 trials; 969 participants; $I^2$ = 50% | RaR 0.79 (95% CI 0.66 to 0.96); 3 trials; 596 participants; $I^2$ = 10% | RaR 0.74 (95% CI 0.60 to 0.91); 6 trials; 1085 participants; $I^2$ = 45% | RaR 0.74 (95% CI 0.60 to 0.91); 6 trials; 1085 participants; $I^2$ = 45% |
| **Risk of sustaining one or more falls** | RR 0.78 (95% CI 0.70 to 0.88); 8 trials; 1478 participants; $I^2$ = 0% | RR 0.81 (95% CI 0.73 to 0.89); 5 trials; 1518 participants; $I^2$ = 0% | RR 0.75 (95% CI 0.62 to 0.92); 3 trials; 506 participants; $I^2$ =0% | (RR 0.81 (95% CI 0.74 to 0.90); 10 trials; 1877 participants; $I^2$ = 0% | RR 0.82 (95% CI 0.74 to 0.90); 11 trials; 1980 participants; $I^2$ = 0% |
| **Risk of recurrent falls** | RR 0.90 (95% CI 0.62 to 1.30); 3 trials; 352 participants; $I^2$ = 1% | RR 0.79 (95% CI 0.61 to 1.02); 3 trials; 629 participants; $I^2$ = 0% | RR 0.84 (95% CI 0.57 to 1.23); 1 trial; 291 participants; $I^2$ = 0% | RR 0.81 (95% CI 0.63 to 1.05); 4 trials; 662 participants; $I^2$ = 0% | RR 0.81 (95% CI 0.63 to 1.05); 4 trials; 662 participants; $I^2$ = 0% |
| **Risk of fall-related fractures** | RR 0.50 (95% CI 0.05 to 5.32); 2 trials; 232 participants; $I^2$ = 0% | RR 0.50 (95% CI 0.02 to 1.73); 1 trial; 210 participants | Both trials were at unclear/high risk of attrition bias | RR 0.50 (95% CI 0.50 to 5.32); 2 trials; 232 participants; $I^2$ = 0% | RR 0.50 (95% CI 0.05 to 5.32); 2 trials; 232 participants; $I^2$ = 0% |
| **Risk of experiencing a fall that required hospital admission** | No trials remain | No trials remain | No trials remain | No trials remain | RR 3.06 (95% CI 0.65 to 14.42); 1 trial; 99 participants |
| **Risk of experiencing a fall that required medical attention** | No trials remain | No trials remain | No trials remain | No trials remain | RR 0.95 (95% CI 0.67 to 1.35); 1 trial; 291 participants |
| **Health-related quality of life (endpoint scores)** | SMD 0.84 (95% CI 0.02 to 1.67); 3 trials; 327 participants; $I^2$ = 92% | No trials remain | SMD 1.15 (95% CI 0.75 to 1.54); 1 trial; 116 participants | SMD 0.77 (95% CI 0.16 to 1.39); 4 trials; 391 participants; $I^2$ = 88% | SMD 0.77 (95% CI 0.16 to 1.39); 4 trials; 391 participants; $I^2$ = 92% |

Individual results for prespecified sensitivity analyses for primary and secondary outcomes

# APPENDICES

## Appendix 1. Search strategies

We carried out the MEDLINE, Embase and CINAHL searches in two stages: the first search was run from 2012 to June 2016 and a top-up search was run from June 2016 to June 2017.

**CENTRAL (CRS Online)**

**March 2012 to June 2017**

#1 MESH DESCRIPTOR Accidental Falls EXPLODE ALL TREES (1167)
#2 (falls or faller*):TI,AB,KY (3872)
#3 #1 or #2 (3872)
#4 MESH DESCRIPTOR Aged EXPLODE ALL TREES (1098)
#5 (senior* or elder* or old* or aged or ag?ing or postmenopausal or community dwelling):TI,AB,KY (426265)

#6 #4 or #5 (426265)
#7 #3 and #6 (2947)
#8 14/03/2012 TO 30/06/2017:DL (400529)
#9 #7 AND #8 (1483)

**MEDLINE (Ovid Interface)**

**2012 to June 2016**

1 Accidental Falls/ (18084)
2 (falls or faller*1).tw. (35089)
3 or/1-2 (43653)
4 exp Aged/ (2586317)
5 (senior*1 or elder* or old* or aged or ag?ing or postmenopausal or community dwelling).tw. (1743445)
6 or/4-5 (3816139)
7 3 and 6 (21745)
8 Randomized controlled trial.pt. (420633)
9 Controlled clinical trial.pt. (90997)
10 randomized.ab. (358562)
11 placebo.ab. (173730)
12 Clinical trials as topic.sh. (177470)
13 randomly.ab. (256508)
14 trial.ti. (156075)
15 8 or 9 or 10 or 11 or 12 or 13 or 14 (1041329)
16 exp Animals/ not Humans/ (4260951)
17 15 not 16 (960106)
18 7 and 17 (2485)
19 (2012* or 2013* or 2014* or 2015* or 2016*).ed,dc. (5462305)
20 18 and 19 (949)

Top up search June 2016 to June 2017: (394)

**Embase (Ovid Interface)**

1 Falling/ (29668)
2 (falls or fallers).tw. (43232)
3 or/1-2 (59763)
4 exp Aged/ (2415181)
5 (senior*1 or elder* or old* or aged or ag?ing or postmenopausal or community dwelling).tw. (2188057)
6 or/4-5 (4022662)
7 3 and 6 (29465)
8 exp Randomized Controlled Trial/ or exp Single Blind Procedure/ or exp Double Blind Procedure/ or Crossover Procedure/ (456331)
9 (random* or RCT or placebo or allocat* or crossover* or 'cross over' or trial or (doubl* adj1 blind*) or (singl* adj1 blind*)).ti,ab. (1513727)
10 8 or 9 (1593780)
11 (exp Animal/ or animal.hw. or Nonhuman/) not (exp Human/ or Human cell/ or (human or humans).ti.) (5531185)
12 10 not 11 (1408433)
13 7 and 12 (4198)
14 (2012* or 2013* or 2014* or 2015* or 2016*).em,dd. (7072579)
15 13 and 14 (1917)

Top-up search June 2016 to June 2017: (253)

**CINAHL (Ebsco)**

S1 (MH "Accidental Falls") (14,885)
S2 TI ( falls or faller* ) OR AB ( falls or faller* ) (19,097)
S3 S1 OR S2 (26,576)
S4 (MH "Aged+") (561,909)
S5 TI ( senior* or elder* or old* or aged or ag?ing or postmenopausal or community dwelling ) OR AB ( senior* or elder* or old* or aged or ag?ing or postmenopausal or community dwelling ) (313,241)
S6 S4 OR S5 (738,634)
S7 S3 AND S6 (13,989)
S8 PT Clinical Trial (79,704)
S9 (MH "Clinical Trials+") (198,945)

S10 TI clinical trial* OR AB clinical trial* (53,785)
S11 TI ( (single blind* or double blind*) ) OR AB ( (single blind* or double blind*) ) (24,624)
S12 TI random* OR AB random* (174,084)
S13 S8 OR S9 OR S10 OR S11 OR S12 (312,167)
S14 S7 AND S13 (1,850)
S15 EM 2012 OR EM 2013 OR EM 2014 OR EM 2015 OR EM 2016 (1,539,278)
S16 S14 AND S15 (602)

Top-up search 2016 to June 2017: (175)

**WHO ICTRP**

1. FALLS and ELDERLY in title

2. FALLS and ELDERLY in title + MULTIPLE and/ or MULTIFACTORIAL in intervention

3. PREVENTION and FALLS in title

4. ELDERLY in condition AND PREVENTION and FALLS in intervention

5. INJURIOUS and FALLS in title, and ELDERLY in condition

(each of the search strings were run separately and then the records combined and duplicates removed)

**ClinicalTrials.gov**

## Appendix 2. 'Risk of bias' assessment tool

| Domain | Criteria for judging risk of bias |
|---|---|
| **Random sequence generation** relating to selection bias (biased allocation to interventions) due to inadequate generation of a randomised sequence | • Judgement of 'low risk' if the trial authors described a random component in the sequence generation, e.g. referring to a random number table; using a computer random number generator; coin tossing; shuffling cards or envelopes; throwing dice; drawing of lots; minimisation.<br>• Judgement of 'high risk' if the trial used a systematic non-random method, e.g. date of admission; odd or even date of birth; case record number; clinician judgement; participant preference; patient risk factor score or test results; availability of intervention.<br>• Judgement of 'unclear' if there is insufficient information about the sequence generation process to permit judgement of 'low risk' or 'high risk'. |
| **Allocation concealment** relating to selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment | • Judgement of 'low risk' in studies using:<br>* individual randomisation if the trial described allocation concealment as by central allocation (telephone, internet-based or pharmacy-controlled randomisation); sequentially-numbered identical drug containers; sequentially-numbered, opaque, sealed envelopes;<br>* cluster randomisation if allocation of all cluster units performed at the start of the study and individual participant recruitment was completed prior to assignment of the cluster, and the same participants were followed up over time or individual participants were recruited after cluster assignment, but recruitment carried out by a person unaware of group allocation and participant characteristics (e.g. fall history) or individual participants in intervention and control arms were invited by mail questionnaire with identical information.<br>• Judgement of 'high risk' in studies using:<br>* individual randomisation if investigators enrolling participants could possibly foresee assignments and thus introduce selection bias, e.g. using an open random allocation schedule (e.g. a list of random numbers); assignment envelopes unsealed, non-opaque, or not sequentially numbered; alternation or rotation; date of birth; case record number; or any other explicitly unconcealed procedure;<br>* cluster-randomisation if individual participant recruitment was undertaken after group allocation by a person who was unblinded and may have had knowledge of participant characteristics.<br>• Judgement of 'unclear' if insufficient information to permit judgement of 'low risk' or 'high risk'. This is usually the case if the method of concealment is not described or not described in sufficient |

(Continued)

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| | detail to allow a definite judgement, e.g. if the use of assignment envelopes is described, but it remains unclear whether envelopes were sequentially numbered, opaque and sealed. |
| **Blinding of participants and personnel** relating to performance bias due to knowledge of the allocated interventions by participants and personnel carrying out the interventions | • Judgement of 'low risk' if blinding of participants and personnel implementing the interventions was ensured, and unlikely that the blinding could have been broken (e.g. control group received matching placebo medication prepared by a pharmacist) OR no blinding or incomplete blinding, but the review authors judge that the outcomes (falls and fractures) are unlikely to be influenced by lack of blinding.<br>• Judgement of 'high risk' if participants or intervention delivery personnel, or both, were not blinded to group allocation (e.g. exercise intervention), and the outcomes (falls and fractures) are likely to be influenced by lack of blinding.<br>• Judgement of 'unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'. |
| **Blinding of outcome assessment** relating to detection bias due to knowledge of the allocated interventions by outcome assessors | • Falls and fallers:<br>* judgement of 'low risk' if falls were recorded/confirmed in all allocated groups using the same method and the personnel recording/confirming falls were blind to group allocation;<br>* judgement of 'high risk' if falls were not recorded/confirmed in all allocated groups using the same method or the personnel recording/confirming falls were NOT blind to group allocation;<br>* judgement of 'unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'.<br>• Fractures:<br>* judgement of 'low risk' if fractures were recorded/confirmed in all allocated groups using the same method and fractures were confirmed by the results of radiological examination or from primary care case records and the personnel recording/confirming fractures were blind to group allocation;<br>* judgement of 'High risk' if fractures were not recorded/confirmed in all allocated groups using the same method or the only evidence for fractures was from self reports from participants or carers;<br>* judgement of 'Unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'.<br>• Hospital admission and medical attention:<br>* judgement of 'low risk' if requiring hospital admission/medical attention as a result of a fall was recorded/confirmed in all allocated groups using the same method (e.g. from primary care records);<br>* judgement of 'high risk' if requiring hospital admission/medical attention as a result of a fall was not recorded/confirmed in all allocated groups using the same method (e.g. from primary care records) or the only evidence for requiring medical attention was from self reports from participants or carers;<br>* judgement of 'unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'. |
| **Incomplete outcome data** relating to attrition bias due to amount, nature or handling of incomplete outcome data | • Judgement of 'low risk' if there are no missing outcome data, or less than 20% of missing outcome data are missing and losses are balanced in numbers across intervention groups with similar reasons for missing data across groups or missing data have been imputed using appropriate methods.<br>• Judgement of 'high risk' if greater than 20% of missing outcome data, or reason for missing outcome data likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across intervention groups, or 'as-treated' analysis done with substantial departure of the intervention received from that assigned at randomisation or potentially inappropriate application of simple imputation.<br>• Judgement of 'unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'. |
| **Selective outcome reporting** relating to bias due to the selective reporting or non reporting of findings | • Judgement of 'low risk' if the study protocol is available and all prespecified study outcomes are reported in the prespecified way or the study protocol is unavailable but it is clear the published repot includes all expected outcomes. |

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|---|---|
| | • Judgement of 'high risk' if not all prespecified study outcomes are reported, or one or more primary outcomes are reported in ways which were not prespecified, or one or more outcomes are reported incompletely or the study fails to include results for a key outcome that would be expected to be reported.<br>• Judgement of 'unclear' if there is insufficient information to make a judgement of 'low risk' or 'high risk'. |
| **Method of ascertaining falls** relating to bias in the recall of falls due to unreliable methods of ascertainment | • Judgement of 'low risk' if the study used some form of concurrent collection of data about falling, e.g. participants given postcards to fill in daily and mail back monthly, calendar to mark etc, with monthly, or more frequent, follow-up by the researchers.<br>• Judgement of 'high risk' if ascertainment relied on participant recall at longer intervals than 1 month during the study or at its conclusion.<br>• Judgement of 'unclear' if there was retrospective recall over a short period only, or if the trial authors did not describe details of ascertainment, i.e. insufficient information was provided to allow a judgement of 'low risk' or 'high risk'. |
| **Cluster randomised trials** bias relating to i) recruitment bias, ii) baseline imbalance, iii) loss of clusters, iv) incorrect analysis and v) comparability with individually-randomised trials, | Specfically for cluster randomised trials bias relating to:<br>i) recruitment bias - judged at 'high risk' if individuals were recruited to the trial after the clusters had been randomised.<br>ii) baseline imbalance - judged at 'high risk' if there was baseline imbalance between randomised groups, in terms of either clusters or individuals, statistical adjustment for balance line imbalance not performed.<br>iii) loss of clusters - judged at 'high risk' if complete clusters were lost from the trial and omitted from the analysis.<br>iv) incorrect analysis - judged at 'high risk' if clustering not taken into account in the analysis.<br>v) comparability with individually-randomised trials - judged at 'high risk' if differences between individually randomised and cluster randomised trials in a meta-analysis.<br>• Judgement of 'low risk' if the study is judged to be at 'low risk' of bias across all of the five biases related to cluster randomised trials.<br>• Judgment of 'high risk' if the study is judged to be a 'high risk' of bias across one or more of the five biases related to cluster randomised trials.<br>• Judgement of 'unclear risk' if there is insufficient information to make a judgment of 'low risk or 'high risk' across one or more of the five biases related to cluster randomised trials. |

We adapted this from Table 8.5.a 'The Cochrane Collaboration's tool for assessing risk of bias' and Table 8.5.d 'Criteria for judging risk of bias in the 'Risk of bias' assessment tool' (Higgins 2011a).

## Appendix 3. Supplementary data table: raw data for rate of falls

| Study ID | Intervention arm: Number of falls | Control arm: Number of falls | Intervention arm: Number of person months | Control arm: Number of person months | Intervention arm: Number of person years | Control arm: Number of person years | Details if 2 or more comparisons |
|---|---|---|---|---|---|---|---|
| **Beling 2009** | 1 | 4 | 33 | 24 | 3 | 2 | - |
| **Campbell 2005 comparison a** | 108 | 76 | 1107 | 548 | 92 | 46 | Intervention 1: Exercise, home safety programme and vitamin D<br>Control: Usual care |
| **Campbell 2005 comparison b** | 120 | 76 | 1112 | 548 | 93 | 46 | Intervention 2: Exercise and vitamin D<br>Control: Usual care |
| **Carpenter 1990** | .- | .- | Data not included since the number of falls was only recorded for a small interval of the total follow-up period (1 month prior to final interview at 3 years) | | | | - |
| **Clemson 2004** | - | - | Reported Rate Ratio 0.69 (95% CI 0.50 to 0.96) | | | | - |
| Close 1999[a] | 183 | 510 | Data not included since the number of person months could not be accurately calculated due to high attrition | | | | - |
| **Davison 2005** | 387 | 617 | 1656 | 1676 | 138 | 140 | - |
| **Day 2002** | | | Data not included since the Hazard Ratio was reported | | | | - |
| **Elley 2008** | 285 | 299 | 1860 | 1884 | 155 | 157 | - |
| Fairhall 2014[a] | 183 | 178 | Reported Incidence Rate Ratio 1.12 (95% CI 0.78 to 1.63) | | | | - |
| Ferrer 2014[a] | 57 | 62 | Reported Incidence Rate Ratio 0.85 (95% CI 0.51 to 1.40) | | | | - |
| **Freiberger 2012** | - | - | Data not included since the number of falls only reported during interval period (12 to 24 months) | | | | - |

*(Continued)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Gallagher 1996** | 85 | 105 | 300 | 300 | 25 | 25 | - |
| **Hogan 2001** | 241 | 311 | 1800 | 1848 | 150 | 154 | - |
| **Huang 2011** | 3 | 8 | 168 | 180 | 14 | 15 | - |
| **Lightbody 2002** | 141 | 171 | 1026 | 1062 | 86 | 89 | - |
| **Logan 2010** | 307 | 649 | 1063 | 1014 | 89 | 85 | - |
| **Lord 2005** | 183 | 175 | 2424 | 2412 | 202 | 201 | - |
| Luck 2013[a] | 260 | 414 | Reported Incidence Rate Ratio 0.32 (95% CI 0.22 to 0.49) (based on change from baseline) | | | | - |
| **Markle-Reid 2010** | 71 | 57 | 294 | 258 | 25 | 22 | - |
| **Möller 2014** | 96 | 85 | 960 | 876 | 80 | 73 | - |
| **Neelemaat 2012** | 16 | 41 | 228 | 225 | 19 | 19 | - |
| **Palvanen 2014** | 608 | 825 | 7932 | 7836 | 661 | 653 | - |
| **Pardessus 2002** | 20 | 25 | 360 | 360 | 30 | 30 | - |
| **Rubenstein 2007** | . | . | Data not included since the number of falls was only recorded for a partial interval of the total follow-up period (12 to 24 months) | | | | - |
| **Russell 2010** | 908 | 1449 | 4128 | 4248 | 344 | 354 | - |
| Tinetti 1994[b] | 80 | 139 | 1495 | 1464 | 125 | 122 | - |
| **Ueda 2017** | 0.5[c] | 4 | 25 | 26 | 2 | 2 | - |
| **Uusi-Rasi 2015 comparison a** | 230 | 241 | 2336 | 2265 | 195 | 189 | Intervention: Vitamin D and exercise |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | Control 1: Exercise |
| Uusi-Rasi 2015 **comparison b**[a] | .- | .- | Reported Incidence Rate Ratio 0.99 (95% CI 0.72 to 1.39) | | | | Intervention: Vitamin D and exercise<br>Control 2: Usual care |
| **Vind 2009** | 422 | 398 | 2289 | 2213 | 191 | 184 | - |
| **Waterman 2016** | 18 | 13 | 90 | 78 | 8 | 7 | - |
| Zijlstra 2009[a] | 302 | 381 | Reported Incidence Rate Ratio 0.86 (95% CI 0.65 to 1.14) | | | | - |

[a]Could not accurately calculate the number of person months.

[b]We performed adjustment for clustering as specified in the methods. The adjusted data are presented.

[c]0.5 used for the purposes of the analysis: zero events

## Appendix 4. Supplementary data table: raw data for number of fallers

| Study ID | Intervention arm: Number of fallers | Control arm: Number of fallers | Intervention arm: Number of participants | Control arm: Number of participants | Details if 2 or more comparisons |
|---|---|---|---|---|---|
| **Campbell 2005 comparison a** | 47 | 30 | 98 | 48 | Intervention 1: Exercise, home safety programme and vitamin D<br><br>Control: Usual care |
| **Campbell 2005 comparison b** | 47 | 30 | 97 | 48 | Intervention 2: Exercise and vitamin D<br><br>Control: Usual care |
| **Ciaschini 2009** | 26 | 17 | 101 | 100 | - |
| Clemson 2004[a] | . | . | 157 | 153 | - |
| **Close 1999** | 59 | 111 | 184 | 213 | - |
| Coleman 1999[b] | 29 | 20 | 67 | 53 | - |
| **Davison 2005** | 94 | 102 | 144 | 149 | - |
| **Day 2002 comparison a** | 66 | 22 | 136 | 34 | Intervention 1: Exercise and vision improvement<br><br>Control 1: Usual care |
| **Day 2002 comparison b** | 72 | 22 | 135 | 34 | Intervention 2: Exercise and home assessment<br><br>Control 1: Usual care |
| **Day 2002 comparison c** | 78 | 22 | 137 | 34 | Intervention 3: Home assessment and vision improvement<br><br>Control 1: Usual care |
| **Day 2002 comparison d** | 65 | 22 | 135 | 34 | Intervention 4: Exercise, home assessment and vision improvement<br><br>Control 1: Usual care |
| **Day 2002 comparison e** | 66 | 19 | 136 | 34 | Intervention 1: Exercise and vision improvement<br><br>Control 2: Exercise |
| **Day 2002 comparison f** | 72 | 19 | 135 | 34 | Intervention 2: Exercise and home assessment |

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| | | | | | |
|---|---|---|---|---|---|
| | | | | | Control 2: Exercise |
| **Day 2002 comparison g** | 78 | 19 | 137 | 34 | Intervention 3: Home assessment and vision improvement<br><br>Control 2: Exercise |
| **Day 2002 comparison h** | 65 | 19 | 135 | 34 | Intervention 4: Exercise, home assessment and vision improvement<br><br>Control 2: Exercise |
| **De Vries 2010** | 55 | 62 | 106 | 111 | |
| **Elley 2008** | 106 | 98 | 155 | 157 | |
| **Fabacher 1994** | 14 | 22 | 100 | 95 | - |
| **Faes 2011** | 10 | 6 | 18 | 15 | - |
| **Fairhall 2014** | 72 | 67 | 119 | 119 | - |
| **Ferrer 2014** | 40 | 33 | 142 | 131 | - |
| **Hendriks 2008** | 55 | 61 | 124 | 134 | - |
| **Hogan 2001** | 54 | 61 | 75 | 77 | - |
| **Huang 2005** | 5 | 7 | 63 | 63 | - |
| Huang 2010 **comparison a**[b] | 2 | 1 | 34 | 29 | Intervention: Education and Tai Chi<br><br>Control 1: Usual care |
| Huang 2010 **comparison b**[b] | 2 | 0.5 | 34 | 19 | Intervention: Education and Tai Chi<br><br>Control 2: Exercise |
| **Huang 2011** | 3 | 8 | 56 | 60 | - |
| Kingston 2001[c] | 2 | 2 | 51 | 41 | - |
| **Lightbody 2002** | 39 | 41 | 155 | 159 | - |
| **Logan 2010** | 81 | 96 | 102 | 102 | - |
| **Lord 2005** | 93 | 90 | 202 | 201 | - |
| **Möller 2014** | 43 | 35 | 80 | 73 | - |
| **Neelemaat 2012** | 10 | 24 | 105 | 105 | - |
| **Newbury 2001** | 12 | 17 | 45 | 44 | - |

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| | | | | | |
|---|---|---|---|---|---|
| **Ng 2015 a** | 2 | 3 | 49 | 48 | Intervention: Physical activity, nutritional supplements and cognitive training<br><br>Control 1: Exercise |
| **Ng 2015 b** | 2 | 5 | 49 | 50 | Intervention: Physical activity, nutritional supplements and cognitive training<br><br>Control 2: Usual care |
| **Olsen 2014** | 13 | 11 | 47 | 42 | - |
| **Palvanen 2014** | 296 | 349 | 661 | 653 | - |
| **Pardessus 2002** | 13 | 15 | 30 | 30 | - |
| **Rubenstein 2007** | Data not included since the number of falls was only recorded for 3 month intervals during the follow up period | | | | - |
| **Russell 2010** | 163 | 151 | 320 | 330 | - |
| Spice 2009 **comparison a**[b,d] | 92 | 52 | 106 | 62 | Intervention 1: Primary care multifactorial intervention<br><br>Control: Usual care |
| Spice 2009 **comparison b**[b,d] | 123 | 52 | 164 | 62 | Intervention 2: Secondary care multifactorial intervention<br><br>Control: Usual care |
| Tinetti 1994[b] | 44 | 58 | 125 | 122 | - |
| **Ueda 2017** | 0.5[e] | 2 | 25 | 26 | - |
| **Van Haastregt 2000** | 68 | 58 | 120 | 115 | - |
| **Vetter 1992** | 95 | 65 | 240 | 210 | - |
| **Vind 2009** | 110 | 101 | 196 | 196 | - |
| **Wagner 1994** | 175 | 223 | 635 | 607 | - |
| **Waterman 2016** | 9 | 8 | 15 | 13 | - |
| **Wesson 2013** | 2 | 4 | 11 | 11 | - |
| **Whitehead 2003** | 28 | 15 | 58 | 65 | - |
| **Zijlstra 2009** | 91 | 117 | 188 | 203 | - |

[a]For Clemson 2004, we used the reported risk ratio (0.90, 95% CI 0.73 to 1.10).

[b]We performed adjustment for clustering as specified in the Methods. The adjusted data are presented.

*(Continued)*

[c]Study article states the proportion of fallers were 4% and 5% and thus we used 2 as the number of fallers in each group in the analysis. However, a second point in the article refers to 9 fallers, raising concern on the accuracy of this data.

[d]We used the conservative analysis for Spice 2009 presented in the main trial report in the meta-analysis. This assumed those who were lost to follow-up had a fall during the follow-up period. In meta-analysis, the control arm was incorrectly not adjusted for clustering.

[e]0.5 used for the purposes of the analysis: zero events.

## Appendix 5. Supplementary data table: raw data for number of recurrent fallers

| Study ID | Intervention arm: Number of recurrent fallers | Control arm: Number of recurrent fallers | Intervention arm: Number of participants | Control arm: Number of participants | Details if 2 or more comparisons |
|---|---|---|---|---|---|
| **Campbell 2005 comparison a** | 24 | 15 | 98 | 48 | Intervention 1: Exercise, home safety programme and vitamin D<br>Control: Usual care |
| **Campbell 2005 comparison b** | 27 | 15 | 97 | 48 | Intervention 2: Exercise and vitamin D<br>Control: Usual care |
| Clemson 2004[a] | - | - | 157 | 153 | - |
| **Close 1999** | 21 | 55 | 184 | 213 | - |
| **De Vries 2010** | 37 | 35 | 106 | 111 | - |
| **Elley 2008** | 69 | 54 | 155 | 157 | - |
| **Faes 2011** | 6 | 1 | 18 | 15 | - |
| **Fairhall 2014** | 32 | 37 | 119 | 119 | - |
| **Ferrer 2014** | 11 | 13 | 142 | 131 | - |
| **Hendriks 2008** | 32 | 34 | 124 | 134 | - |
| **Hogan 2001** | 26 | 35 | 75 | 77 | - |
| **Lord 2005** | 49 | 45 | 202 | 201 | - |
| **Möller 2014** | 19 | 23 | 80 | 73 | - |
| **Schrijnemaekers 1995** | 17 | 26 | 85 | 97 | - |
| **Vind 2009** | 43 | 44 | 196 | 196 | - |

(Continued)

| | | | | | |
|---|---|---|---|---|---|
| Waterman 2016 | 3 | 3 | 15 | 13 | - |
| Zijlstra 2009 | 48 | 76 | 188 | 203 | - |

[a]For Clemson 2004, we used the reported risk ratio (0.74, 95% CI 0.52 to 1.04).

## Appendix 6. Supplementary data table: raw data for number of people sustaining a fracture

| Study ID | Intervention arm: Number of people sustaining a fracture | Control arm: Number of people sustaining a fracture | Intervention arm: Number of participants | Control arm: Number of participants | Details given if 2 or more comparisons and outcome reported |
|---|---|---|---|---|---|
| Ciaschini 2009 | 1 | 6 | 101 | 100 | - |
| Davison 2005 | 6 | 11 | 159 | 154 | - |
| De Vries 2010 | 5 | 5 | 106 | 111 | - |
| Fairhall 2014[a] | 13 | 12 | 119 | 119 | - |
| Hogan 2001 | 3 | 5 | 75 | 77 | - |
| Logan 2010 | 3 | 6 | 102 | 102 | - |
| Neelemaat 2012 | 0.5[b] | 1 | 105 | 105 | - |
| Russell 2010 | 8 | 15 | 320 | 330 | - |
| Spice 2009 **comparison a**[c] | 5 | 4 | 89 | 52 | Intervention 1: Primary care multifactorial intervention<br>Control: Usual care |
| Spice 2009 **comparison b**[c] | 5 | 4 | 138 | 52 | Intervention 2: Secondary care multifactorial intervention<br>Control: Usual care |
| Vetter 1992 | 16 | 14 | 240 | 210 | - |
| Wesson 2013 | 0.5[2] | 1 | 11 | 11 | - |

[a]Outcome data from Fairhall 2014 measures the number of people sustaining a fall with a fracture, which may not relate to the total number of people with fractures.

[b]0.5 used for the purposes of the analysis: zero events.

[c]We performed adjustment for clustering as specified in the Methods. The adjusted data are presented.

## Appendix 7. Supplementary data table: raw data for number of people sustaining a fall requiring hospital admission

| Study ID | Intervention arm: Number of people who experience a fall requiring hospital admission[a] | Control arm: Number of people who experience a fall requiring hospital admission[a] | Intervention arm: Number of participants | Control arm: Number of participants | Details given if 2 or more comparisons and outcome reported |
|---|---|---|---|---|---|
| **Carpenter 1990** | 121 | 107 | 272 | 267 | - |
| **Ciaschini 2009** | 2 | 3 | 101 | 100 | - |
| Coleman 1999[b] | 30 | 21 | 81 | 62 | - |
| **Davison 2005** | 14 | 17 | 159 | 154 | - |
| **Fabacher 1994** | 22 | 23 | 100 | 95 | - |
| **Hogan 2001** | 5 | 6 | 79 | 84 | - |
| **Huang 2005** | 4 | 13 | 63 | 63 | - |
| **Jitapunkul 1998** | 16 | 18 | 57 | 59 | - |
| **Logan 2010** | 53 | 54 | 102 | 102 | - |
| **Ng 2015 comparison a** | 6 | 3 | 49 | 48 | Intervention: Physical activity, nutritional supplements and cognitive training<br>Control 1: Exercise |
| **Ng 2015 comparison b** | 6 | 2 | 49 | 50 | Intervention: Physical activity, nutritional supplements and cognitive training<br>Control 2: Usual care |
| **Pardessus 2002** | 4 | 3 | 30 | 30 | - |
| **Rubenstein 2007** | 210 | 217 | 334 | 360 | - |
| Spice 2009 **comparison a**[b,c] | 23 | 11 | 106 | 63 | Intervention 1: Primary care multifactorial intervention<br>Control: Usual care |
| Spice 2009 **comparison b**[b,c] | 30 | 11 | 164 | 63 | Intervention 2: Secondary care multifactorial intervention<br>Control: Usual care |

(Continued)

| | | | | | |
|---|---|---|---|---|---|
| Tinetti 1994[b] | 27 | 31 | 130 | 125 | - |
| **Van Rossum 1993** | 121 | 133 | 292 | 288 | - |
| **Wagner 1994** | 3 | 5 | 635 | 607 | - |

[a]Due to poor reporting, it was sometimes unclear how many hospital admissions were falls-related. Therefore, we also included outcome data on hospital admissions in general.
[b]We performed adjustment for clustering as specified in the Methods. The adjusted data are presented.

[c]We used the conservative analysis for Spice 2009 presented in the main trial report in the meta-analysis. This assumed those who were lost to follow-up had a hospital admission during the follow-up period.

## Appendix 8. Supplementary data table: raw data for number of people sustaining a fall requiring medical attention

| Study ID | Intervention arm: Number of people who experience a fall requiring medical attention | Control arm: Number of people who experience a fall requiring medical attention | Intervention arm: Number of participants | Control arm: Number of participants | Details given if 2 or more comparisons and outcome reported |
|---|---|---|---|---|---|
| **Campbell 2005 comparison a** | 30 | 16 | 98 | 48 | Intervention 1: Exercise, home safety programme and vitamin D<br>Control: Usual care |
| **Campbell 2005 comparison b** | 32 | 16 | 97 | 48 | Intervention 2: Exercise and vitamin D<br>Control: Usual care |
| **Davison 2005** | 25 | 27 | 159 | 154 | - |
| **Hendriks 2008** | 14 | 20 | 166 | 167 | - |
| **Hogan 2001** | 9 | 8 | 79 | 84 | - |
| **Möller 2014** | 15 | 9 | 80 | 73 | - |
| Tinetti 1994[a] | 18 | 22 | 125 | 122 | - |
| **Van Haastregt 2000** | 21 | 14 | 120 | 115 | - |
| **Vind 2009** | 34 | 35 | 196 | 196 | - |
| **Wagner 1994** | 42 | 57 | 635 | 607 | - |

[a] We performed adjustment for clustering as specified in the Methods. The adjusted data are presented.

## Appendix 9. Supplementary data table: raw data for health-related quality of life (multifactorial interventions)

| Study ID | Included in HRQoL meta-analysis | Outcome measure<br>Range and direction | Mean (SD) | No. pts | Mean (SD) | No. Pts | Effect measure | Summary data |
|---|---|---|---|---|---|---|---|---|
| Close 1999 | Yes | Barthel index<br>Range: 0 - 20; higher is better | 18.6 (2.4) | 184 | 17.3 (3.7) | 213 | MD | 1.30 (0.69 to 1.91) |
| Coleman 1999 | Data only presented separately for physical health-related quality of life | SF-36 physical<br>Range: 0 - 100; higher is better | 37.5 (-) | 78 | 37.5 (-) | 49 | - | (no overall difference observed) |
| De Vries 2010 | Not pooled - change score | EQ-5D<br>Range: 0 - 1; higher is better | 0.01 (0.16) | 106 | 0.07 (0.16) | 106 | MD of change score | −0.06 (−0.10 to −0.02) |
| Elley 2008 | Data only presented separately for physical health-related quality of life | SF-36 physical<br>Range: 0 - 100; higher is better | Median 39.4 (IQR 29.9 - 46.0) | - | Median 37.2 (IQR 29.0 - 45.4) | - | - | Only median and interquartile range reported |
| | | SF-36 mental<br>Range: 0 - 100; higher is better | Median 56.7 (IQR 48.8 - 61.3) | - | Median 57.7 (IQR 49.4 - 61.9) | . | . | Only median and interquartile range reported |
| Fairhall 2014 | Yes | ED-5D VAS<br>Range: 0 - 100; higher is better | 57.5 (20.8) | 107 | 57.7 (19.7) | 108 | MD | −0.20 (−5.62 to 5.22) |
| Gallagher 1996 | Yes | SF-36<br>Range: 0 - 100; higher is better, | 36.8 (5) | 50 | 36.3 (5) | 50 | MD | 0.50 (−1.46 to 2.46) |
| Hendriks 2008 | Yes | EuroQoL | 0.7 (0.25) | 124 | 0.71 (0.28) | 134 | MD | −0.01 (−0.07 to 0.05) |

(Continued)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Range: 0 - 1;<br>higher is better, | | | | | | |
| **Huang 2005** | Yes | SF-36<br>Range: 0 - 100; higher is better | 60.77 (10.5) | 63 | 51.25 (11.63) | 59 | MD | 9.52 (5.58 to 13.46) |
| **Imhof 2012** | Data not usable | WHOQOL-BREF (German)<br>Range: 0-100; higher is better | . | . | . | . | . | Only reports ICC and p-value as part of multivariate analysis (no overall difference observed) |
| **Jitapunkul 1998** | Yes | Barthel index<br>Range: 0 - 20; higher is better | 17.3 (3.6) | 57 | 17.1 (2.7) | 59 | MD | 0.20 (−0.96 to 1.36) |
| **Kingston 2001** | Data not usable | SF-36<br>Range: 0 - 100;<br>higher is better, | - | - | - | - | - | Only reports mean and P value for each domain separately (no overall difference observed) |
| **Lightbody 2002** | Yes | Barthel index<br>Range: 0 - 20; higher is better | 18.5 (2.37) | 155 | 17.8 (3.6) | 159 | MD | 0.70 (0.03 to 1.37) |
| **Logan 2010** | Yes | Barthel index<br>Range: 0 - 20; higher is better | 14.33 (4.69) | 82 | 13.57 (4.79) | 75 | MD | 0.76 (−0.73 to 2.25) |
| **Markle-Reid 2010** | Data only presented separately for mental and physical health-related quality of life | SF-36 physical<br>Range: 0 - 100;<br>higher is better | 54.76 (17.45) | 49 | 55.51 (20.43) | 43 | MD | −0.75 (−8.57 to 7.07) |
| | | SF-36 mental<br>Range: 0 - 100; higher is better | 73.07 (15.33) | 49 | 74 (14.5) | 43 | MD | −0.93 (−7.03 to 5.17) |

*(Continued)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Newbury 2001** | Data not usable | Barthel index<br>Range: 0-20; higher is better | - | - | - | - | - | Only reported physical function (no overall difference observed) |
| **Rubenstein 2007** | Yes | SF-36<br>Range: 0 - 100;<br>higher is better | 36 (12.3) | 334 | 35.5 (11.4) | 360 | MD | 0.50 (−1.27 to 2.27) |
| **Sheffield 2013** | Data not usable | EuroQoL<br>Range: 0 - 1;<br>higher is better | - | - | - | - | Coefficient in regression model | 0.08 (SE 0.04) representing an 8% improvement relative to control |
| **Shyu 2010** | Data only presented separately for mental and physical health-related quality of life | SF-36 physical<br>Range: 0 - 100;<br>higher is better | 64.52 (19.03) | 80 | 55.81 (18.7) | 82 | MD | 18.69 (9.98 to 27.40) |
| | | SF-36 mental<br>Range: 0 - 100;<br>higher is better | 62.19 (28.08) | 80 | 43.5 (28.47) | 82 | MD | 8.71 (2.90 to 14.52) |
| **Spice 2009** | Data not usable | Modified Barthel index<br>Range: 0 - 20; higher is better | - | - | - | - | MD | For primary care intervention: 0.07 (−0.54 to 0.67)<br>For secondary care intervention: 0.63 (0.10 to 1.16) |

## Appendix 10. Supplementary data table: raw data for health-related quality of life (multiple interventions)

| Study ID | Included in HRQoL meta-analysis | Outcome measure<br>Range and direction | Mean (SD) | No. pts | Mean (SD) | No. pts | Effect measure | Summary data |
|---|---|---|---|---|---|---|---|---|
| Clemson 2004 | Not pooled - change score and data only presented separately for mental and physical health-related quality of life | SF-36 physical<br>Range: 0 - 100; higher is better | −0.52 (10) | 125 | 0.01 (9.65) | 133 | MD of change score | 0.53 (−2.95 to 1.88) |
| | | SF-36 mental<br>Range: 0 - 100; higher is better | 0.68 (9.04) | 125 | −0.02 (8.34) | 133 | MD of change score | 0.70 (−2.94 to 1.88) |
| Faes 2011 | Not pooled - change score | EQ-5D VAS<br>Range: 0 - 100; positive change is better | −10.54 (17.19) | 18 | 9.19 (15.64) | 15 | MD of change score | −12.86 (−28.30 to 2.58) |
| Hagovska 2016 | Yes | QL-index<br>Range 0 - 10;<br>higher is better | 9.52 (1.06) | 40 | 7.71 (1.55) | 38 | MD | 1.81 (1.22 to 2.40) |
| Huang 2011 | Yes | WHOQOL-BREF (Taiwanese)<br>Range: 16 - 80; higher is better | 59.7 (5.87) | 56 | 52.27 (6.93) | 60 | MD | 7.43 (5.10 to 9.76) |
| Mendoza-Ruvalcaba 2015 | Yes | Spanish version of Quality of Life Index<br>Range: 0 - 30; higher is better | 26.67 (1.99) | 31 | 25.19 (3) | 33 | MD | 1.48 (0.24 to 2.72) |
| Serra-Prat 2017 | Yes | QoL 0 - 10 VAS<br>Range: 0 - 10; higher is better | 7.2 (1.5) | 61 | 7.1 (1.5) | 72 | MD | 0.10 (−0.41 to 0.61) |
| Waterman 2016 | Yes, data only presented separately for mental and physical health-related quality of life | SF-12 physical<br>Range: 0 - 100; higher is better | 43.21 (8.61) | 15 | 46.03 (11.39) | 13 | MD | −2.82 (−10.39 to 4.75) |

*(Continued)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | SF-12 mental<br><br>Range: 0 - 100; higher is better | 54.35 (6.89) | 15 | 46.72 (11.49) | 13 | MD | 7.63 (0.48 to 14.78) |

## CONTRIBUTIONS OF AUTHORS

SH was involved in screening, data extraction, data analysis, led writing of the review and acted as guarantor of the review.
OA and BC were involved in screening, data extraction, data analysis and contributed to writing the review.
GB was involved in screening, data extraction, and commented on the draft.
SL, CS, LC and JC contributed to writing of the review and commented on the draft.

## DECLARATIONS OF INTEREST

SH has no known conflicts of interest.
OA is funded on a NIHR Research Methods Programme Systematic Review Fellowship funded by the NIHR (NIHR-RMFI-2015-06-63).The views expressed in this publication are those of the protocol authors and not necessarily those of the NHS, the NIHR or the Department of Health.
BC has no known conflicts of interest.
GB has no known conflicts of interest.
CS is an author of several trials considered in this review, including an included trial (Fairhall 2014).
LC is an author of several trials considered in this review, including an included trial (Clemson 2004).
JC is an author of several trials considered in this review, including an included trial (Close 1999).
SL is lead author of the ProFaNE consensus for falls guidance and is an author of one of the trials considered in this review.

No review author was involved in study selection or processing of any trials of which they were or are involved.

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### Internal sources

- No sources of support supplied

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## DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The following changes between the protocol and review are described in the Methods section:

### Outcomes

We noted when trials had performed an economic evaluation and summarised the key findings in a table.

### Search methods for identification of studies

We did not search ClinicalTrials.gov. As ClinicalTrials.gov is included as one of the registers within the WHO ICTRP portal we considered a search of the latter sufficient.

#### Risk of bias assessment

We have added an assessment of risk of bias specifically for cluster-randomised trials. We assessed the risk of additional bias relating to recruitment, baseline imbalance, loss of clusters, incorrect analysis and comparability with individually-randomised trials, as described in Chapter 16 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011).

#### Data synthesis

We planned to make assessments at short-term (less than 12 months) and long-term (12 months or longer) follow-up. However, because of the limited number of studies for some outcomes, we combined both short- and long-term follow-up and reported duration of follow-up for each study in the Characteristics of included studies.

We planned to group multiple component interventions by the combination of interventions (i.e. where the same combination of single categories of intervention are delivered to all participants) and analyse each combination separately. Exercise was a key component in all but one of the 18 multiple component interventions and statistical heterogeneity ($I^2$) was 0%. We therefore decided to present the results for the pooled analyses, in addition to subgroup totals for the different combinations.

### Subgroup analysis

We planned to perform a subgroup analysis for multiple interventions which included a vitamin D component, comparing trials that recruited participants with lower baseline vitamin D levels versus those that did not. However, only four (Campbell 2005; Neelemaat 2012; Ng 2015; Uusi-Rasi 2015) of the 15 trials of multiple interventions included a vitamin D component and none specified the participants' baseline vitamin D level.

We restricted subgroup analyses to primary outcomes and where there were sufficient data.

### Sensitivity analysis

We planned to perform sensitivity analyses based on the choice of statistical model for pooling (fixed-effect versus random-effects). However, due to the heterogeneity in the type of interventions and participants identified, we decided to use only a random-effect model.

We planned to perform sensitivity analyses based on the effect of time on the impact of the intervention (i.e. comparing differences in treatment effect over time: earlier trials versus later trials). However, we did not set a cut-off year beforehand. Moreover, when we ordered studies by year of publication in RevMan, there was no obvious pattern over time and we therefore decided there was insufficient justification for arbitrarily choosing a cut-off year to select a subgroup of more recent trials.

## NOTES

This review provides updated evidence for two of the intervention categories (multifactorial and multiple intervention) covered in the Cochrane Review *Interventions for preventing falls in older people living in the community* (Gillespie 2012). We took some of the wording in several sections of the review protocol, such as Background/Description of the condition, from Gillespie 2012. This reflected shared authorship of the two publications but also attempted to maintain continuity with the Gillespie 2012 review, and links between our review and other reviews that will cover other intervention categories, such as exercise (Sherrington 2016a).

## INDEX TERMS

### Medical Subject Headings (MeSH)

*Exercise; *Independent Living; Accidental Falls [*prevention & control] [statistics & numerical data]; Accidents, Home [*prevention & control]; Fractures, Bone [epidemiology]; Hospitalization [statistics & numerical data]; Randomized Controlled Trials as Topic; Risk Assessment

### MeSH check words

Aged; Aged, 80 and over; Female; Humans; Male; Middle Aged