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Interventions for preventing falls in older people in care facilities and hospitals (Review)

Cameron ID, Gillespie LD, Robertson MC, Murray GR, Hill KD, Cumming RG, Kerse N

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[Intervention Review]

Interventions for preventing falls in older people in care facilities and hospitals

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ABSTRACT

Background

Falls in care facilities and hospitals are common events that cause considerable morbidity and mortality for older people. This is an update of a review first published in 2010.

Objectives

To assess the effectiveness of interventions designed to reduce falls by older people in care facilities and hospitals.

Search methods

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (March 2012); *The Cochrane Library* 2012, Issue 3; MEDLINE, EMBASE, and CINAHL (all to March 2012); ongoing trial registers (to August 2012), and reference lists of articles.

Selection criteria

Randomised controlled trials of interventions to reduce falls in older people in residential or nursing care facilities or hospitals.

Data collection and analysis

Two review authors independently assessed risk of bias and extracted data. We used a rate ratio (RaR) and 95% confidence interval (CI) to compare the rate of falls (e.g. falls per person year) between intervention and control groups. For risk of falling we used a risk ratio (RR) and 95% CI based on the number of people falling (fallers) in each group. We pooled results where appropriate.

Main results

We included 60 trials (60,345 participants), 43 trials (30,373 participants) in care facilities, and 17 (29,972 participants) in hospitals.

Results from 13 trials testing exercise interventions in care facilities were inconsistent. Overall, there was no difference between intervention and control groups in rate of falls (RaR 1.03, 95% CI 0.81 to 1.31; 8 trials, 1844 participants) or risk of falling (RR 1.07,

95% CI 0.94 to 1.23; 8 trials, 1887 participants). Post hoc subgroup analysis by level of care suggested that exercise might reduce falls in people in intermediate level facilities, and increase falls in facilities providing high levels of nursing care.

In care facilities, vitamin D supplementation reduced the rate of falls (RaR 0.63, 95% CI 0.46 to 0.86; 5 trials, 4603 participants), but not risk of falling (RR 0.99, 95% CI 0.90 to 1.08; 6 trials, 5186 participants).

For multifactorial interventions in care facilities, the rate of falls (RaR 0.78, 95% CI 0.59 to 1.04; 7 trials, 2876 participants) and risk of falling (RR 0.89, 95% CI 0.77 to 1.02; 7 trials, 2632 participants) suggested possible benefits, but this evidence was not conclusive.

In subacute wards in hospital, additional physiotherapy (supervised exercises) did not significantly reduce rate of falls (RaR 0.54, 95% CI 0.16 to 1.81; 1 trial, 54 participants) but achieved a significant reduction in risk of falling (RR 0.36, 95% CI 0.14 to 0.93; 2 trials, 83 participants).

In one trial in a subacute ward (54 participants), carpet flooring significantly increased the rate of falls compared with vinyl flooring (RaR 14.73, 95% CI 1.88 to 115.35) and potentially increased the risk of falling (RR 8.33, 95% CI 0.95 to 73.37).

One trial (1822 participants) testing an educational session by a trained research nurse targeting individual fall risk factors in patients at high risk of falling in acute medical wards achieved a significant reduction in risk of falling (RR 0.29, 95% CI 0.11 to 0.74).

Overall, multifactorial interventions in hospitals reduced the rate of falls (RaR 0.69, 95% CI 0.49 to 0.96; 4 trials, 6478 participants) and risk of falling (RR 0.71, 95% CI 0.46 to 1.09; 3 trials, 4824 participants), although the evidence for risk of falling was inconclusive. Of these, one trial in a subacute setting reported the effect was not apparent until after 45 days in hospital. Multidisciplinary care in a geriatric ward after hip fracture surgery compared with usual care in an orthopaedic ward significantly reduced rate of falls (RaR 0.38, 95% CI 0.19 to 0.74; 1 trial, 199 participants) and risk of falling (RR 0.41, 95% CI 0.20 to 0.83). More trials are needed to confirm the effectiveness of multifactorial interventions in acute and subacute hospital settings.

Authors' conclusions

In care facilities, vitamin D supplementation is effective in reducing the rate of falls. Exercise in subacute hospital settings appears effective but its effectiveness in care facilities remains uncertain due to conflicting results, possibly associated with differences in interventions and levels of dependency. There is evidence that multifactorial interventions reduce falls in hospitals but the evidence for risk of falling was inconclusive. Evidence for multifactorial interventions in care facilities suggests possible benefits, but this was inconclusive.

PLAIN LANGUAGE SUMMARY

Interventions for preventing falls in older people in care facilities and hospitals

Falls by older people in residential or nursing care facilities and hospitals are common events that may cause loss of independence, injuries, and sometimes death as a result of injury. Effective interventions to prevent falls are important as they will have significant health benefits.

This review included 60 randomised controlled trials involving 60,345 participants. Forty-three trials (30,373 participants) were in care facilities, and 17 (29,972 participants) in hospitals. Despite the large number of trials, there was limited evidence to support any one intervention.

In care facilities, the prescription of vitamin D reduced the number of falls, probably because residents have low vitamin D levels. Results from 13 trials testing exercise interventions in care facilities were inconsistent and overall did not show a benefit. It may be that exercise programmes increase falls in frail residents and reduce falls in less frail residents. Interventions targeting multiple risk factors may be effective in reducing the number of falls.

Additional physiotherapy reduced the number of people falling in hospital rehabilitation wards and interventions targeting multiple risk factors reduced falls in hospital.

BACKGROUND

Description of the condition

Falls incidence in nursing homes are reported to be about three times that in the community, equating to rates of 1.5 falls per bed per year (range 0.2 to 3.6) (Rubenstein 1994). In a prospective one-year study in 528 nursing homes in Bavaria, Germany, about 75% of falls occurred in the residents' rooms or in bathrooms; 41% occurred during transfers and 36% when walking (Becker 2012). The fall rate was higher in men (2.8 falls per person year) than women (1.49 falls per person year), and falls were less common in people requiring the least and highest levels of care. Lord 2003 also found that fall rates were lower in frailer people who were unable to rise from a chair or stand unaided. In this group, increased age, male sex, higher care classifications, incontinence, psychoactive medication use, previous falls and slow reaction times were associated with an increase in falls (Lord 2003).

In hospital settings, an incidence of 3.4 falls per person year has been reported in geriatric rehabilitation wards, and 6.2 falls per person year in psychogeriatric wards (Nyberg 1997). Systematic reviews have shown that risk factors for falls in hospital inpatients are gait instability, agitated confusion, urinary incontinence, falls history and psychotropic medication (Oliver 2004). For older patients in rehabilitation hospital settings, risk factors include carpet flooring, vertigo, being an amputee, confusion, cognitive impairment, stroke, sleep disturbance, anticonvulsants, tranquillisers, antihypertensive medications, previous falls and need for transfer assistance (Vieira 2011).

There is considerable mortality and morbidity associated with falls in care facilities and hospitals. A study in both these settings (Nurmi 2002) reported an incidence of 533 per 1000 person years for all injuries, 20 per 1000 person years for hip fracture, and 270 per 1000 person years for head injuries for which 13% (14/107) required medical attention (Nurmi 2002). Overall, men were 1.5 times more likely to be injured than women. Older people who sustain a hip fracture while in hospital have been shown to have poor outcomes compared with age matched controls sustaining similar fractures in the community (Murray 2007).

Description of the intervention

The majority of falls are caused by complex combinations of factors operating at the time of each fall event. Interventions may target risk factors in participants or target staff and clinicians with the aim of improving clinical practice or the organisation of care. In some studies single interventions have been evaluated; in others, interventions with more than one component have been used. Delivery of multiple-component interventions may be based on individual assessment of risk (a multifactorial intervention) or the same components are provided to all participants (a multiple intervention). A taxonomy has been developed to describe and classify the types of intervention (Lamb 2007; Lamb 2011).

Why it is important to do this review

A systematic review is required to summarise the evidence on fall prevention in care facilities and hospitals because falls are common in these settings and result in increased mortality and morbidity. Results will inform healthcare professionals, researchers, policy makers, informal care givers and consumers. This review is an update of a Cochrane review first published in 2010 (Cameron 2010).

OBJECTIVES

To assess the effects of interventions designed to reduce the incidence of falls in older people in care facilities and hospitals.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised trials were considered for inclusion, including quasi-randomised trials (for example, alternation), and trials in which treatment allocation was inadequately concealed.

Types of participants

We included trials of interventions to prevent falls in older people, of either sex, in care facilities or hospitals. We considered trials for inclusion if the majority of participants were over 65 years or the mean age was over 65 years, and the majority were living in residential or nursing care facilities or were patients in hospital. Trials with participants resident in the community and in care facilities were either included in this review or the Cochrane review of interventions for preventing falls in older people living in the community (Gillespie 2012), depending on the proportion of participants in each setting. They would have been included in both reviews if data were provided for subgroups based on setting. Inclusion in either review was determined by discussion between the authors of both reviews.

We have subdivided care facilities based on level of care provided. We defined high level care facilities as "establishments that are primarily engaged in providing inpatient nursing and rehabilitative

services for long-term care patients. The care is generally provided for an extended period of time to individuals requiring nursing care. These establishments have a permanent core staff of registered or licensed practical nurses that, along with other staff, provide nursing care in combination with personal care" (OECD 2011). We defined intermediate care facilities as "Institutions which provide health-related care and services to individuals who do not require the degree of care which hospitals or skilled nursing facilities provide, but because of their physical or mental condition require care and services above the level of room and board" (NLM 2012). Some facilities provided both these levels of care.

For trials in hospitals, participants included staff or in-patients. We excluded interventions that took place in emergency departments, outpatient departments or where hospital services were provided in community settings. We subdivided hospitals into those providing acute, and those providing subacute care. We defined subacute care as "Medical and skilled nursing services provided to patients who are not in an acute phase of an illness but who require a level of care higher than that provided in a long-term care setting" (NLM 2012).

Types of interventions

Any intervention designed to reduce falls in older people compared with any other intervention, usual care or placebo.

Types of outcome measures

We included only trials that reported raw data or statistics relating to rate or number of falls, or number of participants sustaining at least one fall during follow-up (fallers). Trials that reported only those participants who had more than one fall were included. Trials that reported only specific types of fall (e.g. injurious falls) were not included. Trials that focused on intermediate outcomes such as improved balance or strength, and did not report falls or falling as an outcome, were excluded.

Primary outcomes

- Rate of falls
- Number of fallers

Secondary outcomes

- Number of participants sustaining fall-related fractures
- Complications of the interventions
- Economic outcomes

Search methods for identification of studies

Electronic searches

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (March 2012), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* 2012, Issue 3), MEDLINE (1946 to March 2012), EMBASE (1980 to March 2012), and CINAHL (1982 to March 2012). We searched ongoing trial registers via the World Health Organisation's ICTRP Search Portal (August 2012). No language restrictions were applied.

In MEDLINE (OvidSP) subject-specific search terms were combined with the sensitivity- and precision-maximising version of the MEDLINE trial search strategy (Lefebvre 2011). We modified this strategy for use in *The Cochrane Library,* EMBASE, and CINAHL (*see* Appendix 1 for all strategies).

Searching other resources

We also checked reference lists of articles and further trials were identified by contact with researchers in the field. For the first version of this review, we identified trials in care facilities and hospitals included in Gillespie 2003.

Data collection and analysis

Selection of studies

From the title, abstract, or descriptors, one author screened all abstracts to identify potentially relevant trials for full review. From the full text, two review authors independently assessed potentially eligible trials for inclusion and resolved disagreement by discussion. We contacted trial authors for additional information if necessary.

Data extraction and management

Pairs of review authors independently extracted data using a pretested data extraction form. Disagreement was resolved by third party adjudication.

Assessment of risk of bias in included studies

Pairs of review authors independently assessed risk of bias. Assessors were not blinded to author and source institution. Review authors did not assess their own trials. Disagreement was resolved by consensus, or third party adjudication.

Risk of bias was assessed using two methods. Random sequence generation (selection bias), allocation concealment (selection bias), and blinding of outcome assessment (detection bias) for falls and fallers were assessed following the recommendations in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011a). Other sources of bias were assessed using an adaptation

of the scoring system devised by the Cochrane Bone, Joint and Muscle Trauma Group (Appendix 2).

Measures of treatment effect

We have reported the treatment effect for rate of falls as a rate ratio (RaR) and 95% confidence interval. For number of fallers and number of participants sustaining fall-related fractures we have reported a risk ratio (RR) and 95% confidence interval. We used results reported at discharge from hospital for trials that continued to monitor falls after discharge.

Rate of falls

The rate of falls is the total number of falls per unit of person time that falls were monitored (e.g. falls per person year). The rate ratio compares the rate of falls in any two groups during each trial.

We used a rate ratio (for example, incidence rate ratio or hazard ratio for all falls) and 95% confidence interval if these were reported in the paper. If both adjusted and unadjusted rate ratios were reported we have used the unadjusted estimate, unless the adjustment was for clustering. If a rate ratio was not reported but appropriate raw data were available, we used Excel to calculate a rate ratio and 95% confidence interval. We used the reported rate of falls (falls per person year) in each group and the total number of falls for participants contributing data, or we calculated the rate of falls in each group from the total number of falls and the actual total length of time falls were monitored (person years) for participants contributing data. In cases where data were only available for people who had completed the study, or where the trial authors had stated there were no losses to follow up, we assumed that these participants had been followed up for the maximum possible period.

Risk of falling

For number of fallers, a dichotomous outcome, we used a risk ratio as the treatment effect. The risk ratio compares the number of people who fell once or more (fallers).

We used a reported estimate of risk (hazard ratio for first fall, risk ratio (relative risk), or odds ratio) and 95% confidence interval if available. If both adjusted and unadjusted estimates were reported we used the unadjusted estimate, unless the adjustment was for clustering. If an odds ratio was reported, or an effect estimate and 95% confidence interval was not, and appropriate data were available, we calculated a risk ratio and 95% confidence interval using the *csi* command in Stata. For the calculations we used the number of participants contributing data in each group if this was known; if not reported we used the number randomised to each group.

Secondary outcomes

For the number of participants sustaining one or more fall-related fractures, we used a risk ratio as described in 'Risk of falling' above.

Unit of analysis issues

For trials which were cluster randomised, for example by care facility or ward, we performed adjustments for clustering (Higgins 2011b) if this was not done in the published report. We used intracluster correlation coefficients reported by Dyer 2004 (falls per person year 0.100, number of residents falling 0.071, and residents sustaining a fracture 0.026).

For trials with multiple intervention groups, we either combined the groups or included only one pair-wise comparison (intervention versus control) in any analysis in order to avoid the same group of participants being included twice.

Assessment of heterogeneity

We assessed heterogeneity within a pooled group of trials using a combination of visual inspection of the graph along with consideration of the Chi² test (with statistical significance set at $P < 0.10$), and the I^2 statistic (Higgins 2003).

Data synthesis

We classified interventions into those taking place in care facilities and those taking place in hospitals, and pooled these separately because participant characteristics and the environment may warrant different types of interventions in the different settings, possibly implemented by people with different skill mixes.

We grouped interventions using the fall prevention classification system (taxonomy) developed by the Prevention of Falls Network Europe (ProFaNE) (Lamb 2011). Interventions have been grouped by combination (single, multiple, or multifactorial), and then by the type of intervention (descriptors). The possible intervention descriptors are: exercises, medication (drug target, i.e. withdrawal, dose reduction or increase, substitution, provision), surgery, management of urinary incontinence, fluid or nutrition therapy, psychological interventions, environment/assistive technology, social environment, interventions to increase knowledge, other interventions. Full details are available in the ProFaNE taxonomy manual (Lamb 2007).

Within these categories we grouped the results of trials with comparable interventions and participant characteristics, and compiled forest plots using the generic inverse variance method in Review Manager. This method enabled pooling of the adjusted and unadjusted treatment effect estimates (rate ratios or risk ratios) that were reported in the paper or we had calculated from data presented in the paper (*see* Measures of treatment effect). The generic inverse variance option in Review Manager requires entering the natural logarithm of the rate ratio or risk ratio and its standard error for each trial; we calculated these in Excel.

We calculated pooled rate ratios for falls and pooled risk ratios for fallers and fractures with 95% confidence intervals using the fixed-effect model. Where there was substantial statistical or clinical heterogeneity we pooled the data using the random-effects model.

Subgroup analysis and investigation of heterogeneity

We minimised heterogeneity as much as possible by grouping trials as described previously. We explored heterogeneity by carrying out subgroup analyses based on level of care and level of cognition at enrolment in care facilities.

For the subgroup analyses by level of care, we subdivided the facilities into high or mixed levels versus intermediate levels of care (*see* Types of participants for definitions of high and intermediate level care facilities). These subgroups will include participants with differing levels of disability, and possibly different falls risk (Lord 2003). In addition, there are differences in the type of care provided and in the skill mix of staff.

We grouped trials by level of cognition into those that included only participants with cognitive impairment versus those with no cognitive impairment or a mixed sample at enrolment.

We used the random-effects model to pool data in all subgroup analyses testing for subgroup differences due to the high risk of false-positive results when comparing subgroups in a fixed-effect model (Higgins 2011c). We used the test for subgroup differences available in Review Manager to determine whether there was evidence for a difference in treatment effect between subgroups.

Sensitivity analysis

Where there was substantial statistical heterogeneity we carried out a post-hoc sensitivity analysis to explore the effect of removing trials from the analysis if visual inspection of the graph showed poorly overlapping confidence intervals.

Economics issues

We have noted the results from any comprehensive economic evaluations (cost-effectiveness analysis, cost-utility analysis) incorporated in the included studies. We also extracted from each trial reporting a cost analysis, cost description or analytic model, the type of resource use reported (e.g. delivering the intervention, hospital admissions, medication use) and the cost of the items for each group.

RESULTS

Description of studies

Due to the size of the review, not all links to references have been inserted in the text but can be viewed in Table 1.

Included studies

Twenty additional trials have been included in this update, 13 trials in care facilities and seven in a hospital setting (*see* Table 1). This review now contains 60 trials with 60,345 participants. Details are provided in the Characteristics of included studies, and are briefly summarised below.

Design

In 34 studies participants were individually randomised, and 26 studies used a cluster randomised design (*see* Table 1).

Settings

The included trials were carried out in 15 countries: Australia (N = 12), Canada (N = 2), Finland (N = 1), France (N = 2), Germany (N = 2), Korea (N = 1), Japan (N = 3), The Netherlands (N = 4), New Zealand (N = 2), Singapore (N = 2), Spain (N = 1), Sweden (N = 3), Switzerland (N = 1), United Kingdom (N = 11), USA (N = 13) (*see* Table 1).

Of the 43 studies (30,373 participants) in care facilities, 13 were in high level care facilities, 11 were in intermediate level care facilities and 19 were in facilities with mixed levels of care, or combinations of facilities that included both high and intermediate levels of care.

Of the 17 studies (29,972 participants) in hospital settings, eight were in an acute hospital setting, seven were in subacute settings, and two were in both acute and subacute care settings (*see* Table 1).

Van Gaal 2011a and Van Gaal 2011b have been included as two separate trials although reported in the same paper as the participants were randomised separately in two settings (nursing homes and hospitals) and results are reported by setting.

Participants

The mean age of participants (proportion of women) was 84 years (77% women) in care facilities and 79 years (58% women) in hospitals.

All participants were women in four trials (Bischoff 2003; Chapuy 2002; Jarvis 2007; Sihvonen 2004). Seven studies specifically recruited participants with cognitive impairment (Buettner 2002; Chenoweth 2009; Klages 2011; Mador 2004; Neyens 2009; Shaw 2003; Toulotte 2003). In addition Stenvall 2007 only recruited people with a proximal femoral (hip) fracture.

Interventions

Using the ProFaNE taxonomy, all studies were categorised by intervention and grouped by combination (single, multiple, or multifactorial) as described in Data synthesis (*see* Appendix 3). The first column of Appendix 3 shows the intervention classification (single, multiple, or multifactorial) and setting type (care facility or hospital). The components of included 'Exercises' interventions and 'Environmental/assistive technology' interventions are shown in Appendix 4 and Appendix 5 respectively.

In care facilities, 32 trials tested the effect of a single intervention, one trial tested a multiple intervention and nine trials tested a multifactorial intervention. In addition Sambrook 2012 included two intervention groups, one single and one multiple. In hospitals, 14 trials tested the effect of a single intervention and three tested a multifactorial intervention. Donald 2000 was a 2 x 2 factorial study of supervised exercises and flooring types that has been classified as two single interventions. Faber 2006 compared two single interventions (functional walking exercise; 3D exercises) with usual care. Haines 2011 tested two models of a patient education programme, both single interventions. Nowalk 2001 compared two single interventions (strength and flexibility exercises; Tai Chi) with usual care.

Outcomes

The source of data used for calculating outcomes for each trial for generic inverse variance analysis is shown in Appendix 6. Rate of falls were reported in 18 trials, and could be calculated from a further 23 trials. Data on risk of falling (number of fallers) were available in 18 trials and could be calculated for a further 22. Nineteen trials reported fracture data we could use in the analyses. Eight trials met our inclusion criteria but did not include data that could be included in any analyses. Reported results from these trials are presented in the text. Raw data for rate of falls and number of fallers when available are shown in Appendix 7.

Excluded studies

Fifty-four studies were excluded (*see* Characteristics of excluded studies for reasons for exclusion). Twenty-one trials were excluded because the intervention they tested was not designed to reduce falls, rather falls were measured as a potential adverse outcome of an intervention with a different aim. In 11 trials the majority of participants were living in the community. Eight excluded trials did not provide sufficient data on falls or fallers, seven included participants post stroke, and seven were not randomised.

Studies awaiting classification

There are two studies awaiting publication of full reports containing falls data (*see* Characteristics of studies awaiting classification).

Ongoing studies

We are aware of 13 ongoing studies (*see* Characteristics of ongoing studies for details). A number of these studies may be completed but not yet published.

Risk of bias in included studies

Details of 'Risk of bias' assessment for three items (random sequence generation (selection bias), allocation concealment (selection bias), and blinding of outcome assessment (detection bias)) for each trial are shown in the Characteristics of included studies. Summary results for these items are shown in Figure 1 and Figure 2. In addition, methodological quality assessment scores for eight items (*see* Appendix 2) for each included study are given in Appendix 8.

Figure 1. 'Risk of bias' summary: review authors' judgements about each methodological quality item for each included study.

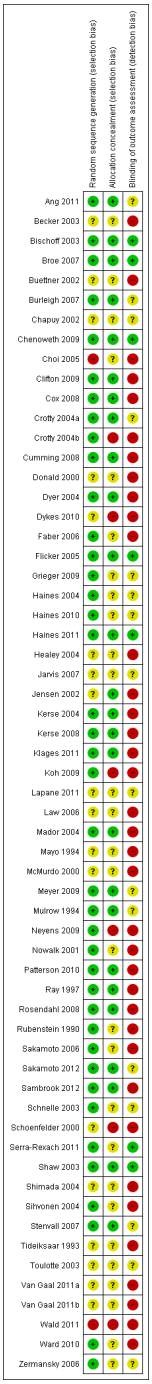

Figure 2. 'Risk of bias' graph: review authors' judgements about each methodological quality item presented as percentages across all included studies.

The assessment of risk of bias relied heavily on the reporting of trials and was unclear in many cases. Potential bias varied within comparison groups and it is difficult to judge whether any bias would result in an over or under-estimation of treatment effect.

Allocation

We assessed risk of bias in sequence generation as low in 67% (40/60), high in 3% (2/60), and unclear in the remaining 30% (18/60) of included trials.

We judged methods for concealment of allocation prior to group assignment to carry low risk of bias in 43% (26/60), high in 10% (6/60), and to be unclear in the remaining 47% of trials (28/60) (*see* Figure 2).

Blinding

The likelihood of detection bias in relation to the ascertainment of falls by outcome assessors was low in 12% of trials (7/60), high in 62% (37/60), and unclear in the remaining 27% (16/60) (*see* Figure 2).

Other potential sources of bias

Individual scores for the remaining methodological quality assessment criteria are shown in Appendix 8. Only 57% of trials stated the number and reasons for withdrawals and carried out an intention-to-treat analysis (item A). Most trials reported good comparability of groups at baseline or results were adjusted for confounding (item B 42/60, 70%). Usually, participants and treatment providers were not blind to group allocation (item C 87%, item D 80% respectively). Only 52% of trials provided enough detail to show that care programmes (apart from the active intervention) were clearly identical (item E). Usually, inclusion and exclusion criteria were clearly defined (item F 90%). Fall events were clearly defined to staff collecting and recording these events in 62% of trials (item G), and ascertainment of falls was identical in all groups in the study in 87% of trials (item H).

Effects of interventions

We have presented results by setting (care facilities or hospitals), and whether the combination of interventions were single, multiple, or multifactorial. Settings, combinations, and categories of interventions for each trial are shown in Appendix 3.

Care facilities: single interventions

Single interventions consist of one major category of intervention only and are delivered to all participants in the group.

Exercises

Thirteen trials involved exercises as a single intervention (*see* Table 1). The types of exercise included in each study are shown in Appendix 4.

Overall, pooled data from eight studies with 1844 participants showed no reduction in the rate of falls (Analysis 1.1: rate ratio (RaR) 1.03, 95% confidence interval (CI) 0.81 to 1.31: $I^2 = 70\%$). Pooled data from eight studies with 1887 participants showed no significant difference in risk of falling (Analysis 1.2: risk ratio (RR) 1.07, 95% CI 0.94 to 1.23: $I^2 = 5\%$). We used the random-effects model for both these analyses due to the clinical heterogeneity. We combined the results from the two intervention groups in Faber 2006 in these analyses.

In four trials the reported data were insufficient for pooling with other studies (Buettner 2002; Nowalk 2001; Serra-Rexach 2011; Toulotte 2003).

Subgroup analysis exploring heterogeneity

To explore the heterogeneity in these results, we carried out a post hoc subgroup analysis by level of care (high or mixed levels versus intermediate levels of care). For rate of falls the test for subgroup differences was significant (Analysis 1.1: P = 0.05) indicating a different effect of exercise on fall rates in facilities that included high level nursing care compared with intermediate level care. Separate analyses of the impact of exercise on fall rates revealed a trend towards an increase in rate of falls in facilities that included high level nursing care and a trend towards a decrease in intermediate level care facilities. The same trend was apparent for risk of falling, although there was no significant difference between these two subgroups (Analysis 1.2: test for subgroup differences P = 0.21).

In Faber 2006, the authors carried out a post-hoc subgroup analysis and reported that the intervention in frail participants resulted in a significantly increased risk of falling (hazard ratio (HR) 2.95, 95% CI 1.64 to 5.32), while in the pre-frail subgroup there was a non-significant reduction (HR 0.62, 95% CI 0.29 to 1.33) (test for subgroup difference P $\leq$ 0.10).

These analyses suggest that participants with greater disability might be less likely to benefit from exercise interventions.

Subgroup analysis by types of exercise

Five trials primarily tested gait, balance and functional training (Faber 2006 "Functional Walking"; Kerse 2008; Shimada 2004; Sihvonen 2004; Sakamoto 2006) and two tested Tai Chi (Choi 2005; Nowalk 2001) (*see* Appendix 4 for details).

Shimada 2004 and Sihvonen 2004 both tested balance training using mechanical apparatus: perturbed walking exercise using a bilateral separated treadmill (Shimada 2004), and balance training on a force platform with a visual feedback screen (Sihvonen 2004). Pooled data from these two studies (53 participants) showed a statistically significant reduction in rate of falls (Analysis 2.1.1: RaR 0.45, 95% CI 0.24 to 0.85: I^2 = 0%) but not in risk of falling (Analysis 2.2.1: RR 0.72, 95% CI 0.43 to 1.19: I^2 = 0%).

Sakamoto 2006 (527 participants) studied standing balance exercises on one leg. Results showed a possible benefit for rate of falls (Analysis 2.1.2: RaR 0.82, 95% CI 0.65 to 1.04) but no significant reduction in risk of falling (Analysis 2.2.2: RR 0.90, 95% CI 0.65 to 1.23).

The "Functional Walking" programme, consisting mainly of functional balance training, tested in Faber 2006 (154 participants), significantly increased rate of falls (Analysis 2.1.3: RaR 1.32, 95% CI 1.09 to 1.61) but not risk of falling (Analysis 2.2.3: RR 1.31, 95% CI 0.87 to 1.98).

In Kerse 2008 (639 participants) the intervention consisted of "goal setting and individualised activities of daily living activity programme" by a gerontology nurse. There was no significant difference in rate of falls (Analysis 2.1.4: (RaR 1.11, 95% CI 0.84 to 1.45) or risk of falling (Analysis 2.2.4: RR 1.19, 95% CI 0.94 to 1.50).

Two trials (Choi 2005; Nowalk 2001 "Living and Learning/Tai Chi") tested a Tai Chi intervention. Choi 2005 (59 participants) showed no significant difference in risk of falling (Analysis 2.2.5: RR 0.60, 95% CI 0.19 to 1.87). Nowalk 2001 ("Living and Learning/Tai Chi") also reported no significant difference in risk of falling.

Eight trials tested the effect of a combination of exercise categories (Buettner 2002; Faber 2006 "In Balance"; Mulrow 1994; Nowalk 2001 "Fit NB Free"; Rosendahl 2008; Schoenfelder 2000; Serra-Rexach 2011; Toulotte 2003). The combinations of categories for each trial are provided in Appendix 4). Pooled data from four trials (561 participants) showed no significant difference in rate of falls (Analysis 2.1.5: RaR 1.24, 95% CI 0.84 to 1.83: I^2 = 73%), and three trials (545 participants) showed no difference in risk of falling (Analysis 2.2.6: RR 1.12, 95% CI 0.92 to 1.37: I^2 = 0%). Buettner 2002 (27 participants) reported that falls were reduced but the treatment effect estimate and confidence interval were not reported in the published study or research monograph. In Nowalk 2001 (110 participants) there was no significant difference in risk of falling in the "Fit NB Free" group. Serra-Rexach 2011 (40 participants) reported that "The mean number of falls per participant recorded over the study period was 1.2 fewer in the intervention group than in the control group (95% CI = 0.0-3.0, P =.03)." Toulotte 2003 (20 participants) reported that falls were reduced but a falls rate could not be determined from the published data.

Medication (drug target) interventions

Medication review

Two studies investigated the effect of medication review by a pharmacist with recommendations to participants' family physicians (Patterson 2010; Zermansky 2006). Results from these two studies were conflicting and have not been pooled because of the substantial statistical heterogeneity (P < 0.00001, I^2 = 96%).

In Patterson 2010 (334 participants), the intervention targeted psychoactive medication prescribing and included monthly medication reviews for one year. The authors reported a significant reduction in the use of psychoactive medications but the rate of falls was significantly increased (Analysis 3.1: RaR 1.43, 95% CI 1.07 to 1.92).

Zermansky 2006 (661 participants) investigated the impact of a single clinical medication review which resulted in a significant reduction in rate of falls (Analysis 3.1: RaR 0.62, 95% CI 0.53 to 0.72).

Crotty 2004a assessed the effect of using a pharmacist transition coordinator for patients discharged from a hospital to a long term

care facility for the first time. Crotty 2004b studied a pharmacist-led outreach programme of audit and feedback, and education of staff regarding medications and falls risk, and Lapane 2011 tested the effect of GRAM software for decision support for prescribing practices. Pooled results from these three trials and Zermansky 2006 showed no evidence of effect on risk of falling (Analysis 3.2: RR 1.00, 95% CI 0.91 to 1.10: I^2 = 47%).

Vitamin D supplementation

Five trials tested the effect of vitamin D supplementation on falls (Bischoff 2003; Broe 2007; Chapuy 2002; Flicker 2005; Law 2006), and one tested a multivitamin supplement that included vitamin D plus calcium (Grieger 2009).

Overall, pooled data from five studies (4603 participants) (Bischoff 2003; Broe 2007; Flicker 2005; Grieger 2009; Law 2006) showed a statistically significant reduction in rate of falls (Analysis 4.1: RaR 0.63, 95% CI 0.46 to 0.86: I^2 = 72%). Pooled data from all six studies (5186 participants) did not show a reduction in the risk of falling (Analysis 4.2: RR 0.99, 95% CI 0.90 to 1.08: I^2 = 12%). Average serum vitamin D levels at baseline appeared to be low or very low in all six studies (*see* Characteristics of included studies), therefore these results are only applicable to residents with low vitamin D levels.

Four trials reported the number of people sustaining a fracture (Bischoff 2003; Chapuy 2002; Flicker 2005; Law 2006). As different fractures were reported, results have not been pooled. None demonstrated a statistically significant reduction in the number of people sustaining a fracture (Analysis 4.3). For a more comprehensive systematic review of the effect of vitamin D supplementation on fractures, see Avenell 2009.

Vitamin D3 plus calcium versus calcium

Bischoff 2003 investigated oral vitamin D3 plus calcium, while Flicker 2005 investigated oral vitamin D2 plus calcium. The control group in both trials received calcium supplementation. Pooled results from these two trials (747 participants) showed a statistically significant reduction in rate of falls (Analysis 4.1.1: RaR 0.71, 95% CI 0.56 to 0.90: I^2 = 0%) but not risk of falling (Analysis 4.2.1: RR 0.85, 95% CI 0.69 to 1.05: I^2 = 0%).

Vitamin D3 plus calcium versus placebo

Chapuy 2002 (583 participants) investigated 800IU oral vitamin D3 plus 1200 mg elemental calcium in two different formulations versus matching placebo. There was no significant reduction in risk of falling (Analysis 4.2.2: RR 1.03, 95% CI 0.90 to 1.18).

Vitamin D2 versus usual care or placebo

Law 2006 (3717 participants) compared 2.5 mg oral vitamin D2 every three months with usual care (no placebo). Broe 2007 compared four different vitamin D2 doses (200 IU, 400 IU, 600 IU or 800 IU daily) with placebo for five months. We have pooled the comparisons between the placebo group and 800 IU group only because that dose was most comparable to the daily equivalent dose of 1100 IU in Law 2006. Pooled data from Broe 2007 and Law 2006 (3765 participants) showed no significant reduction in rate of falls (Analysis 4.1.2: RaR 0.55, 95% CI 0.19 to 1.64: I^2 = 80%) or in risk of falling (Analysis 4.2.3: RR 0.80, 95% CI 0.38 to 1.71: I^2 = 58%).

Multivitamins (including vitamin D3 plus calcium) versus placebo

In a placebo-controlled trial, Grieger 2009 (91 participants) investigated the effect of daily multivitamin supplementation which included 400 IU of vitamin D3 and 360 mg calcium carbonate. After six months there was a significant reduction in rate of falls (Analysis 4.1.3: RaR 0.38, 95% CI 0.20 to 0.71), but not in risk of falling (Analysis 4.2.4: RR 0.82, 95% CI 0.40 to 1.66).

Environment/assistive technology

In a cross-over trial, Clifton 2009 (43 participants) tested a wireless position-monitoring device and found no significant reduction in the rate of falls (Analysis 5.1: RR 0.65, 95% CI 0.33 to 1.27).

Social environment

These interventions target staff or caregivers and changes in the organisational system in which an intervention is delivered, rather than targeting patients directly.

Staff training

Cox 2008 (5637 participants) studied a half day education programme on fall and fracture prevention for managers, nurses and health care assistants, given by specialist osteoporosis nurses. There was no difference in rate of falls (Analysis 6.1: RaR 1.19, 95% CI 0.92 to 1.53). The reported incidence rate ratio (IRR) was not significant for all fractures (IRR 0.94, 95% CI 0.71 to 1.26) or hip fractures (IRR 0.86, 95% CI 0.63 to 1.18).

The intervention in Van Gaal 2011a (392 participants) consisted of education to implement a patient-safety programme directed at falls, urinary tract infection, and pressure ulcers based on available guidelines. There was no significant reduction in rate of falls (Analysis 6.1: RaR 0.63, 95% CI 0.34 to 1.16).

Service model change

Meyer 2009 (1125 participants) compared use of a fall risk assessment tool with nurses' judgement alone. There was no significant difference in rate of falls (Analysis 6.1: RaR 0.96, 95% CI 0.84 to 1.10), risk of falling (Analysis 6.2: RR 0.99, 95% CI 0.85 to 1.16), and number of people sustaining a fracture (Analysis 6.3: RR 0.96, 95% CI 0.57 to 1.63).

Chenoweth 2009 reported that "... at follow-up there were fewer falls with dementia-care mapping than in usual care (p=0·02) and more falls in person-centred care than in usual care (p=0·03)."

Ward 2010 (5391 participants) employed a practice nurse to encourage the adoption of best practice strategies and reported "0.13 fewer falls per 100 beds per month; 95% CI, −0.36 to 0.10; P = 0.259" for the intervention period. There was no difference in risk of hip fracture between intervention and control groups during the 17 months of intervention (Analysis 6.3.2).

Other single interventions

For one year, Sakamoto 2012 (145 participants) tested the effect of lavender olfactory stimulation by applying lavender patches or placebo patches to the neck daily. This intervention showed a possible benefit for rate of falls (Analysis 7.1: RaR 0.57, 95% CI 0.32 to 1.01) but did not achieve a statistically significant reduction in risk of falling (Analysis 7.2: RR 0.67, 95% CI 0.40 to 1.12).

In Sambrook 2012 (395 participants), there was no effect of increased sunlight exposure on rate of falls (Analysis 7.1: RaR 1.05, 95% CI 0.71 to 1.56), risk of falling (Analysis 7.2: RR 1.09, 95% CI 0.88 to 1.36) or risk of fracture (Analysis 7.3: RR 1.07, 95% CI 0.53 to 2.17).

Klages 2011 (24 participants) compared the effect of multisensory stimulation in a Snoezelen room with control activities in people with dementia and reported that the "Group membership did not alter falls frequency".

Care facilities: multiple interventions

In multiple interventions, the same combination of single categories of intervention are delivered to all participants in the group.

In Schnelle 2003, participants engaged in supervised exercises and were offered fluids and regular toileting. The rate ratio was 0.62 (95% CI 0.38 to 1.01; Analysis 8.1), and the risk of falling was 0.62 (95% CI 0.36 to 1.05; Analysis 8.2), indicating a possible benefit from this approach. There was no significant difference in risk of fracture (Analysis 8.3: RR 4.26, 95% CI 0.48 to 37.55).

One intervention group in Sambrook 2012 tested the effect of increased sunlight exposure plus calcium supplementation and found no significant reduction in rate of falls (Analysis 8.1: RaR 1.03, 95% CI 0.85 to 1.25), risk of falling (Analysis 8.2: RR 0.96, 95% CI 0.77 to 1.19) or risk of fracture (Analysis 8.3: RR 0.78, 95% CI 0.36 to 1.67).

Care facilities: multifactorial interventions

In multifactorial interventions two or more categories of intervention are given, and these are linked to each individual's risk profile. An initial assessment is usually carried out by one or more health professionals and an intervention is then provided or recommendations given or referrals made for further action.

Nine trials in care facilities studied multifactorial interventions (Becker 2003; Dyer 2004; Jensen 2002; Kerse 2004; McMurdo 2000; Neyens 2009; Ray 1997; Rubenstein 1990; Shaw 2003). Seven of these were cluster randomised.

We have analysed these trials as one group because there were several intervention components within each trial, and too many different combinations of components to allow grouping of trials with similar interventions (*see* Appendix 3 for intervention categories in each trial).

Pooled data from seven trials (2876 participants) for rate of falls (Analysis 9.1: RaR 0.78, 95% CI 0.59 to 1.04: I^2 = 84%) and seven trials (2632 participants) for risk of falling (Analysis 9.2: RR 0.89, 95% CI 0.77 to 1.02: I^2 = 43%) showed a possible benefit, but this evidence was not conclusive. Pooled results from three trials (1639 participants) showed a reduction in the number of people sustaining a hip fracture (Analysis 9.3: RR 0.48, 95% CI 0.24 to 0.98: I^2 = 0%). For these analyses we used the random-effects model due to the clinical heterogeneity.

Individually, only two of these multifactorial trials showed a statistically significant reduction in rate of falls (Becker 2003; Dyer 2004), and two had statistically significant reductions in risk of falling (Becker 2003; Jensen 2002). Conversely, Kerse 2004 had a statistically significant increase in rate of falls. Ray 1997 (482 participants) only recorded the number of people having two or more falls during follow-up (recurrent fallers) and reported a statistically significant difference in the proportion of recurrent fallers (difference 19%, 95% CI 2% to 36%: P = 0.03).

Subgroup analyses exploring heterogeneity

To explore the heterogeneity in these results, we carried out a subgroup analysis by levels of care in the included facilities (high or mixed levels versus intermediate levels of care). The test for subgroup differences showed no significant difference between subgroups for both rate of falls (Analysis 10.1: P = 0.19, I^2 = 42%) or risk of falling (Analysis 10.2: P = 0.11, I^2 = 61%). Statistical heterogeneity remained high in the group including high level nursing care facilities (Analysis 10.1.1: P < 0.0001, I^2 = 86%).

We also carried out a subgroup analysis comparing trials recruiting people with cognitive impairment versus trials with participants with no cognitive impairment (based on inclusion/exclusion criteria) or a mixed sample. Two trials recruited residents with cognitive impairment only (Neyens 2009; Shaw 2003). In addition, Jensen 2002 and Becker 2003 carried out pre-planned subgroup analyses by levels of cognition which are reported in Jensen 2003 and Rapp 2008 respectively. Cognitive impairment was defined

differently in all four studies (see footnotes to Analysis 11.1 and Analysis 11.2).

There was no evidence of difference in treatment effect between those with higher versus those with lower or mixed levels of cognition for both rate of falls (Analysis 11.1: test for subgroup differences P = 0.81, I^2 = 0%) and risk of falling (Analysis 11.2: test for subgroup differences P = 0.29, I^2 = 11%).

These subgroup analyses indicated that neither level of care nor cognitive impairment accounted for the statistical heterogeneity in the multifactorial interventions.

Sensitivity analysis exploring heterogeneity

Visual inspection of the graph in Analysis 9.1 showed that Kerse 2004 had a different direction of effect and the confidence interval had poor overlap with the remaining six trials. Removing this result from the analysis reduced the I^2 from 84% to 69% and the pooled result showed a significant reduction in the rate of falls (analysis not shown: RaR 0.70, 95% CI 0.55 to 0.90, 2329 participants).

Hospitals: single interventions

Exercises

Two trials tested the effect of additional physiotherapy in rehabilitation wards (Donald 2000; Jarvis 2007). There was no significant reduction in rate of falls in Donald 2000 (54 participants) (Analysis 12.1: RaR 0.54, 95% CI 0.16 to 1.81); however, pooled data from these two trials (83 participants) showed a significant reduction in risk of falling (Analysis 12.2: RR 0.36, 95% CI 0.14 to 0.93: I^2 = 0%).

Medication (drug target) interventions

Burleigh 2007 investigated whether 800 IU of vitamin D plus 1200 mg of calcium supplements reduced falls compared with 1200 mg calcium supplements alone in participants with a median length of stay of 30 days. There was no significant difference in risk of falling (Analysis 13.1: RR 0.82, 95% CI 0.59 to 1.14) or fractures (Analysis 13.2: RR 0.34, 95% CI 0.04 to 3.05).

Environment/assistive technology interventions

Furnishing/adaptations

Donald 2000, in a factorial design with 54 participants, found that carpeted floors compared with existing vinyl floors in subacute hospital wards resulted in a statistically significant increase in rate of falls (Analysis 14.1: RaR 14.73, 95% CI 1.88 to 115.35) and a potential but not conclusive increase in risk of falling (Analysis 14.2: RR 8.33, 95% CI 0.95 to 73.37).

In Haines 2010 (11,099 participants), the intervention consisted of providing one low-low bed per 12 existing beds in acute and subacute wards. This had no effect on rate of falls (Analysis 14.1: RaR 1.39, 95% CI 0.22 to 8.78).

Communication aids

Mayo 1994 (134 participants) studied the effect of wearing a blue identification bracelet on falls in high-risk patients in a subacute hospital setting. There was no significant reduction in rate of falls (Analysis 14.1: RaR 1.15, 95% CI 0.72 to 1.84) or risk of falling (Analysis 14.2: RR 1.34, 95% CI 0.76 to 2.36). In this study there was no reduction in risk of falling in the subgroup with a MMSE score $\leq$ 9 or the subgroup with MMSE score > 9.

Tideiksaar 1993 (70 participants) studied bed exit alarms for preventing falls in hospital. During the nine-month evaluation period, "There was no significant difference in the number of bed-falls between the two groups (p = 1.00)."

Social environment

These interventions target staff members and changes in the organisational system, rather than targeting patients directly.

Staff training

Koh 2009 (1122 patients) compared multifaceted fall prevention guideline implementation with routine dissemination in acute care hospitals and found no significant difference in rate of falls (Analysis 15.1.1: RaR 1.82, 95% CI 0.23 to 14.55). The implementation of three guidelines (falls, urinary tract infection, pressure ulcers) in Van Gaal 2011b (2201 patients) targeted nursing staff in acute care hospital wards. There was no difference in rate of falls (Analysis 15.1.2: RaR 0.67, 95% CI 0.17 to 2.59).

Service model change

Dykes 2010 (5264 patients) tested the effect of a computer-based fall prevention tool kit which did not result in a significant difference in rate of falls or risk of falling (Analysis 15.1.3: RaR 0.55, 95% CI 0.02 to 16.29 and Analysis 15.2.1: RR 0.91, 95% CI 0.06 to 14.21 respectively). There was no significant reduction in rate of falls in Wald 2011 (217 patients) which compared a unit providing an acute care for the elderly service with usual care in general medical wards (Analysis 15.1.4: RaR 0.72, 95% CI 0.10 to 5.10). A new behavioural advisory service for people with confusion (Mador 2004: 71 patients) did not change the number of people falling (Analysis 15.2.2: RR 2.44, 95% CI 0.85 to 7.02).

Knowledge interventions

Ang 2011 (1822 participants), testing an educational session by a trained research nurse targeting individual fall risk factors in patients at high risk of falling, achieved a significant reduction in risk of falling (Analysis 16.2: RR 0.29, 95% CI 0.11 to 0.74). Haines 2011 (1206 participants) evaluated two forms of multimedia patient education compared with usual care in a mixture of acute and subacute wards. One intervention consisted of written and video-based materials plus one-on-one bedside follow-up from a trained health professional (complete programme) and the other intervention group received educational materials only. Neither intervention reduced rate of falls (Analysis 16.1) or risk of falling (Analysis 16.2). In a post-hoc subgroup analysis the authors reported that falls were less frequent in people who were cognitively intact receiving the complete programme, compared with those in the materials only group (adjusted hazard ratio (HR) 0.51, 95% CI 0.28 to 0.93) and the control group (adjusted HR 0.43, 95% CI 0.24 to 0.78) (test for subgroup differences $P < 0.05$). There were no differences between the three groups in the proportion of participants with cognitive impairment who fell.

Hospitals: multifactorial interventions

Four trials tested the effect of multifactorial interventions in a hospital setting (Cumming 2008; Haines 2004; Healey 2004; Stenvall 2007). The categories of interventions for each trial are shown in Appendix 3 and further details are provided in the Characteristics of included studies.

We have analysed these trials as one group because there were several intervention components within each trial, and too many different combinations of components to allow grouping of trials with similar interventions. For this reason we used the random-effects model for pooling data.

Overall, results showed a reduction in rate of falls (Analysis 17.1: RaR 0.69, 95% CI 0.49 to 0.96: I^2 = 59%) and risk of falling (Analysis 17.2: RR 0.71, 95% CI 0.46 to 1.09: I^2 = 43%) but the evidence for risk of falling was not conclusive. There was no reduction in number of people sustaining a fracture (Analysis 17.3: RR 0.43, 95% CI 0.10 to 1.78: I^2 = 0%). We have shown whether the settings were acute or subacute in the footnotes of these analyses.

Two of the interventions tested in these four trials were effective. The multidisciplinary intervention in Haines 2004 (626 participants) took place in three subacute wards. It consisted of four individually targeted components: falls risk alert card and information brochure, exercise programme, education programme, and hip protectors. The rate of falls was significantly reduced (Analysis 17.1: RaR 0.70, 95% CI 0.54 to 0.90) but not risk of falling (Analysis 17.2: RR 0.78, 95% CI 0.57 to 1.07). The authors reported that the difference in falls between the two groups was "most obvious after 45 days of observation", suggesting that this programme benefited people staying longer in hospital.

Stenvall 2007 (199 participants) compared post-operative care in a ward providing a comprehensive geriatric service with usual care in an orthopaedic ward following surgery for hip fracture. Intervention components included comprehensive geriatric assessment and treatment of falls risk factors by a multidisciplinary team. Both intervention and control group patients were transferred to a geriatric rehabilitation unit if they required further rehabilitation. This intervention achieved a statistically significant reduction in the rate of falls (Analysis 17.1: RaR 0.38, 95% CI 0.19 to 0.74) and in the risk of falling (Analysis 17.2: RaR 0.41, 95% CI 0.20 to 0.83) at discharge, even in patients with dementia.

Complications of the interventions

No complications of the interventions (such as sprains, strains, and adverse effects of vitamin D) were reported.

Economic evaluations

One study reported a cost-effectiveness analysis of dementia care mapping and person centred care in dementia care units with the results expressed in terms of incremental cost per dementia compromised behaviour avoided (Chenoweth 2009; Norman 2008). A further seven reported healthcare cost items related to the intervention, six in care facilities and one in a hospital setting (*see* Appendix 9).

One author reported healthcare cost savings from a two-month recreation programme in a small trial of residents with dementia in nursing care facilities (Buettner 2002) and another from using a motion sensor in skilled nursing care facilities (Clifton 2009). Application of a fall risk assessment tool did not result in better clinical outcomes or offset implementation costs compared with nurses' judgement alone (Meyer 2009). A physiotherapy programme delivered to very frail residents for four months showed an improvement in physical disability scores compared with friendly visits, but no reduction in the rate of falls or differences in healthcare costs (Mulrow 1994). An exercise and incontinence programme significantly improved functional outcomes but did not reduce falls or the costs of treating the acute episodes that the intervention aimed to prevent (Schnelle 2003). Recommendations by a pharmacist resulted in an increase in changes of medications and a significant reduction in the rate of falls, with no change in the cost of medications (Zermansky 2006).

An acute hospital care service for frail elderly inpatients may improve care processes with no increase in healthcare resource use, but did not improve clinical outcomes (Wald 2011).

DISCUSSION

Summary of main results

Despite the addition of 20 trials (35,270 participants) many of the results from the pooled analyses remain inconsistent.

Exercises

Thirteen trials in care facilities and two in hospitals investigated exercise as a single intervention.

In care facilities overall, there was no reduction in rate of falls or risk of falling. However, there appeared to be a trend towards an increase in rate of falls in facilities including high level nursing care and a trend towards a decrease in intermediate level care facilities. Of the various exercise components tested, only balance training using mechanical apparatus in intermediate level care facilities reduced rate of falls, but the adoption of these interventions may be problematic. Our subgroup analysis by level of care plus the subgroup analysis in Faber 2006, suggested that frail participants might be less likely to benefit from exercise interventions.

In hospitals there is some evidence that additional physiotherapy in subacute wards reduced risk of falling.

In summary, within each setting results relating to the effectiveness of exercise are inconsistent. This may relate to the type and intensity of exercise, differences in study populations, or possibly variation in methodological quality.

Medication (drug target)

Medication review by a pharmacist

Five studies investigated the effect of medication review by a pharmacist in care facilities and none in hospitals.

In care facilities, results from two studies reporting rate of falls were conflicting. One trial (Patterson 2010) with monthly medication reviews for one year resulted in a significant reduction in the use of psychoactive medications but a significant increase in falls. The second trial (Zermansky 2006) investigated the impact of a single clinical medication review which resulted in a significant reduction in falls. Four studies testing pharmacist-led interventions showed no difference in risk of falling. These interventions included a pharmacist transition coordinator for patients discharged from hospital to a long term care facility, an intensive pharmacist-led outreach programme, the effect of computer software for decision support for prescribing practices, and a single clinical medication review.

These results are inconsistent and there is currently little evidence to support pharmacist-led medication review for reducing falls in these settings.

Vitamin D supplementation

Five studies tested vitamin D supplementation in care facilities, and one in a hospital. In addition, one placebo-controlled trial in a care facility investigated the effect of daily multivitamin supplementation which included vitamin D and calcium.

In care facilities, results showed a significant reduction in the rate of falls (five trials) but not risk of falling (six trials). Average serum vitamin D levels at baseline appeared to be low or very low in all six studies (*see* Characteristics of included studies), indicating that these results relate to the low vitamin D levels in residents of care facilities.

In hospital, one trial in an acute geriatric unit found no effect of vitamin D supplementation on risk of falling, despite the low levels of vitamin D at baseline. The median length of stay was only 30 days.

These results suggest that vitamin D supplementation in people living in care facilities is effective.

Environment/assistive technology

In one trial in a high level nursing care facility there was no effect on rate of falls from using a wireless position-monitoring patch (Clifton 2009).

Four trials in hospitals investigated environment/assistive technology interventions. Carpet flooring in a subacute ward appeared to significantly increase falls compared with vinyl flooring. There was no effect on falls of low-low beds or using identification bracelets for patients at high risk.

Social environment

Five trials in care facilities and five in hospitals targeted staff training or implemented a service model change.

None of the interventions in care facilities reduced falls. These interventions included staff education on fall and fracture prevention, guideline implementation (falls, urinary tract infection, and pressure ulcers), and a risk assessment tool versus nurses' judgement.

Trials in the hospital setting tested guideline implementation, fall prevention toolkit software, a new acute care service for elderly patients, and a new behavioural advisory service for people with confusion. None of these approaches reduced falls.

Knowledge

One trial in acute medical wards testing an educational session based on identified risk factors and usual fall prevention care reduced risk of falling compared with the usual fall prevention interventions only (Ang 2011). In a mixture of acute and subacute wards, educational materials alone and educational materials with professional follow-up failed to reduce falls overall (Haines 2011). However, the authors reported a significant reduction of falls in participants with no cognitive impairment receiving the educational materials with professional follow-up.

Other single interventions

Although the results were not conclusive, one trial in intermediate care facilities that tested the use of lavender or placebo patches as an intervention to reduce falls achieved a 43% reduction in falls (Sakamoto 2012). There was no effect from increased sunlight exposure in residents of intermediate care facilities (Sambrook 2012).

Multiple interventions

An intervention for incontinent residents in high level nursing care facilities that included exercise, offering regular fluids and toileting, reduced falls by 38% suggesting possible benefits, but this evidence was not conclusive. Increased sunlight exposure plus calcium supplementation failed to achieve a reduction in falls.

Multifactorial interventions

This review included nine multifactorial trials in care facilities and four in hospitals.

In care facilities pooled results for rate of falls and risk of falling showed a possible benefit, although this was not conclusive. Individually, three trials demonstrated a significant reduction in rate of falls (Becker 2003; Dyer 2004) and risk of falling (Becker 2003; Jensen 2002), whereas one intervention (Kerse 2004) *increased* falls. The study design of these multifactorial trials did not allow evaluation of their individual components.

Overall, the multifactorial interventions reduced the rate of falls in hospitals. In a subacute setting, risk assessment and targeted interventions (exercise, educational sessions from an occupational therapist, hip protectors) reduced falls (Haines 2004); this was reported as being most obvious after 45 days in hospital. In an effective approach immediately after proximal femoral fracture surgery, a multidisciplinary team provided a comprehensive geriatric service in a geriatric ward, compared with usual care in an orthopaedic ward (Stenvall 2007).

The interpretation of the multifactorial interventions is complex because of the variation in components, frailty of the sample, duration and intensity of the intervention, and how the interventions were implemented. More trials are needed to evaluate the effectiveness of multifactorial interventions in care facilities, and to confirm their effectiveness in hospitals.

Economic evaluations

No conclusions can be drawn from the nine trials reporting economic outcomes.

Overall completeness and applicability of evidence

Although we have included 60 trials in this review, these have tested a very wide variety of interventions in various types of facility. The addition of 20 trials in this update has not improved the robustness of the results compared with the previous version of this review. The evidence relating to reduction of medications deemed inappropriate was conflicting, therefore more trials are required. Only one trial assessed the benefit of using a validated falls risk assessment tool in a care facility (Meyer 2009) and none did in hospital, although this approach is widely used in both settings. None of the trials included a cost-effectiveness evaluation in terms of falls prevented so that no information was available on the value for money for any of the interventions tested. Few trials incorporated interventions relating to the circumstances of falls, e.g. assistance with toileting, rather than targeting individual risk factors, as in the continuous quality improvement model used to develop a fall prevention programme in Lohse 2012.

In this review we have reported results from care facilities and hospitals separately to improve applicability of the interventions to each setting. Careful consideration of the context of effective interventions is required. As Becker 2010 points out, the type of care provided in care facilities differs between countries and health care systems. Also consideration needs to be taken of cultural and organisational contexts when generalising the results from this review. Unfortunately, the level of care and case mix in each facility in this review was often not defined. In addition there is striking variability in type, targeting, intensity and duration of the falls prevention programmes that were studied.

Quality of the evidence

This review containing 60 trials (60,345 participants) does not provide robust evidence regarding effective interventions for reducing falls. Not all studies met the contemporary standards of the extended CONSORT statement (Altman 2001), including the extensions for cluster randomised trials (Campbell 2004), non-pharmacological trials (Boutron 2008), and pragmatic randomised trials (Zwarenstein 2008). The included studies illustrated the wider problems of variation in the methods of ascertaining, recording, analysing, and reporting falls described in Hauer 2006. For example, 19 trials did not report usable data for rate of falls and 20 trials for risk of falling.

Studies in this review varied widely in quality. Risk of bias for sequence generation was judged to be low in 40 of the 60 trials. For concealment of allocation prior to group assignment risk of bias was low in 26 (43%) and unclear in 28 (47%). For some aspects of study design, minimisation of bias is difficult. For example, it is not possible to blind participants and treatment providers for exercise interventions.

Potential biases in the review process

We attempted to minimise publication bias in the review by searching multiple databases, and drew on the handsearch results published in the Cochrane Central Register of Controlled Trials in *The Cochrane Library*. We also contacted authors of studies identified in trials registers that were completed, but for which full reports had not been identified. We placed no foreign language restrictions in our search strategy, but all trials included in this review were published in English. We excluded 21 trials reporting falls as adverse effects, although in some instances the intervention might plausibly have reduced falls. Increased publication of protocols in trials registers will make it easier to establish whether the aim of the study was to prevent falls, thus making it eligible for inclusion in this review.

We did not explore the possibility of publication bias by constructing funnel plots because we had no analysis containing more than 10 data points.

Using the generic inverse variance method in this review enabled us to pool results as reported by trial authors with our own calculated from raw data, and results adjusted for clustering.

The ProFaNE falls prevention taxonomy enabled us to pool similar interventions in the analyses using a systematic approach.

Agreements and disagreements with other studies or reviews

We searched MEDLINE and EMBASE for systematic reviews of falls prevention initiatives in care facilities and hospitals published since 2009. We compared our review results with the Cochrane review 'Interventions for preventing falls in older people living in the community' (Gillespie 2012), and identified five other systematic reviews (Bischoff-Ferrari 2009; Neyens 2011; Nyman 2011; Stern 2009; Verrue 2009).

Comparison with trials in community-living older people

In contrast to the findings in this review for residents of care facilities and hospital inpatients, the evidence is very clear that falls can be prevented in older people living in the community (Gillespie 2012). The effectiveness of group and home-based exercise programmes and Tai Chi in particular is well established in the community setting. There is the potential for falls to be reduced in care facilities using the same multiple-component exercise programmes, but despite 13 trials in this review testing exercise programmes, the results were inconsistent. Two small studies did show that additional physiotherapy exercises reduced falls in subacute wards in hospital.

Vitamin D supplementation may reduce falls in community-living people with lower vitamin D levels (Gillespie 2012). This is consistent with the finding in this review that vitamin D is effective in reducing falls in care facilities as most residents have low vitamin D levels (Pilz 2012).

Multifactorial approaches can be effective in all three settings. In the community setting, assessment and multifactorial interventions reduced rate of falls by 25% but not risk of falling (Gillespie 2012). These interventions reduced risk of falling by 10% in care facilities and 27% in hospital wards.

There is some evidence that falls prevention strategies in the community can be cost saving (Gillespie 2012), but there were no economic evaluations conducted within the care facilities or hospital trials to provide information on value for money.

Supplementary review

Nyman 2011 conducted a supplementary review of the 41 trials included in Cameron 2010 with specific reference to people's recruitment, retention in the trial, and adherence to intervention components. Adherence was high for individually targeted and group based exercise (72% to 89%) and for medication interventions (68% to 88%). The authors reported that adherence was related to treatment effectiveness in three studies testing medication and multifactorial interventions in care facilities. They estimated that by 12 months, on average, only a third of care facility residents are likely to be adhering to falls prevention interventions.

Vitamin D supplementation

We identified one systematic review of randomised controlled trials set in the community or nursing homes testing the efficacy of vitamin D for preventing falls in older people (Bischoff-Ferrari 2009). Evidence from the eight included trials published from 1995 to 2008 showed that high dose supplemental vitamin D reduced the risk of falling by 19% (pooled RR 0.81, 95% CI 0.71 to 0.92; N = 1921 from seven trials). The two trials set in nursing homes were included in our review (Bischoff 2003; Broe 2007). The authors concluded that supplemental vitamin D in a dose of 700 to 1000 IU a day was effective, and that doses less than 700 IU or serum 25-hydroxyvitamin D concentrations of less than 60 nmol/L may not reduce the risk of falling among older people.

Other recent systematic reviews

One systematic review included 20 randomised controlled trials in long-term care facilities published at April 2009 (Neyens 2011). The authors concluded that three single interventions (Bischoff 2003; Flicker 2005; Zermansky 2006) and four multifactorial interventions (Becker 2003; Jensen 2002; Neyens 2009; Ray 1997), were effective in reducing falls. All seven trials were included in our review.

Eight controlled trials (seven randomised and one non-randomised) were included in a systematic review of interventions involving pharmacists aimed at improving the quality of prescribing in nursing homes (Verrue 2009). Results were mixed concerning effectiveness of these interventions. Three of the trials included

falls as an outcome and are included in our review (Crotty 2004a; Crotty 2004b; Zermansky 2006).

A systematic review of randomised controlled trials of falls prevention programmes in acute care hospital wards published between 1998 and 2008 (Stern 2009) identified five trials, all included in our review.

Results were descriptive only and there were no pooled analyses in any of these three systematic reviews to compare with our review (Neyens 2011; Stern 2009; Verrue 2009).

AUTHORS' CONCLUSIONS

Implications for practice

We found evidence of effectiveness for several fall prevention interventions in care facilities and hospitals, although for some the evidence was inconsistent.

Care facilities

- Currently, there is no evidence overall that exercise reduces falls in care facilities, but may be more effective in less frail residents. Of the exercise types tested, only balance training using mechanical apparatus in intermediate level care facilities was effective, but the adoption of these interventions may be problematic. These interventions were supervised perturbed gait exercises on a treadmill and balance training using computerised visual feedback.
- Results relating to medication review by pharmacists are equivocal, and we cannot draw any conclusions for clinical practice from this review.
- The prescription of vitamin D in care facilities is effective in reducing falls.
- There is currently no evidence of effect from interventions targeting staff and the organisation of care.
- Some falls prevention programmes that target multiple individual risk factors (classified as multifactorial interventions) may be effective.

Hospitals

- Providing additional physiotherapy in subacute wards may reduce risk of falling.
- There is currently no evidence of effect from interventions targeting staff and the organisation of care.
- Increasing patients' awareness of their falls risk and teaching risk reduction strategies may reduce risk of falling in the acute setting.
- Multifactorial programmes for patients who have longer lengths of stay are effective, but no recommendations can be made regarding any particular component of these programmes.

Implications for research

Aspects of particular interventions to be addressed in future studies include:

- Further research into supervised exercise programmes in both care facilities and hospital settings.
- Further randomised controlled trials to strengthen the evidence for multifactorial interventions in both settings.
- Further trials testing sensor technology to improve staff response when high risk patients start to move from a bed or a chair.
- Trials with interventions incorporating approaches based on the circumstances of falls in addition to individual risk factors, e.g. regular assisted toileting in both care facilities and hospitals (Lohse 2012; Schnelle 2003).
- Further trials testing the routine use of validated falls risk assessment tools.
- Further research is required testing interventions targeting staff, and changes to the organisational system in which an intervention is delivered or the introduction of new healthcare models.

Aspects of research methods that need to be adopted in all future studies include:

- Classification of the components of the fall prevention intervention using the taxonomy developed by the Prevention of Falls Network Europe (ProFaNE) (Lamb 2007; Lamb 2011). This will produce consistency between trials allowing for more effective pooling of data.
- Falls should be collated by a researcher blind to group allocation.
- Fall events should be reported by group as total number of falls, fallers, and people sustaining a fall-related fracture; rate of falls (falls per person year); and number in each analysis.
- Results should be analysed using appropriate, pre-specified methodology (e.g. negative binomial regression, survival analysis) (Robertson 2005). Group comparisons should be expressed as incidence rate ratios and risk ratios with 95% confidence intervals.
- Authors of trials not excluding people with cognitive impairment should plan to report the results by level of cognitive impairment to indicate whether degree of impairment is an effect modifier.
- Design and reporting of trials should meet the contemporary standards of the extended CONSORT statement including those relating to randomised sequence generation and

allocation concealment prior to randomisation (Altman 2001). Pragmatic trials and those testing non-pharmacological interventions should incorporate the requirements defined in Zwarenstein 2008 and Boutron 2008.

- Design and reporting of cluster randomised trials should follow contemporary guidance (Campbell 2004) including the reporting of intra-class correlation coefficients.

- Where factorial designs are employed, data for each treatment cell should be reported to allow interpretation of possible interactions between different intervention components (McAlister 2003).

- Economic evaluations should be conducted alongside randomised controlled trials to establish the cost-effectiveness of each intervention being tested. This involves measuring health-related quality of life as an outcome, defining the perspective and timeframe for costs, collecting data on healthcare use, costing healthcare resources, calculating cost-effectiveness ratios (if the intervention is effective in reducing falls), and evaluating uncertainty. Guidelines for carrying out and reporting economic evaluations in falls prevention trials have recently been published (Davis 2011).

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Ang 2011

Methods	RCT (individually randomised)
Participants	Setting: acute care hospital, Singapore N = 1822 Sample: newly admitted patients from 8 medical wards (50% women) Age (years): mean (SD) intervention group 70.3 (14.2), control group 69.7 (14.7) Inclusion criteria: aged ≥ 21; Hendrich II Fall Risk Model score ≥ 5 Exclusion criteria: admitted before start of study; fallen prior to falls risk assessment
Interventions	1. Education + usual care: participants received one educational session (no more than 30 min) based on identified risk factors. Designed to increase awareness of risk of falling during hospitalisation and teach risk-reduction strategies. Relatives of confused participants received the educational session 2. Control: usual care and including usual fall-prevention interventions
Outcomes	1. Number of people falling
Duration of the study	8 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Allocation of the participants to control or intervention groups was determined using block randomization with the aid of a computer program and stratified by ward to ensure an even mix in the ward. "
Allocation concealment (selection bias)	Low risk	Quote: "Sealed, opaque, serially numbered envelopes were produced from the randomization sequence separately for each stratum."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "The research investigator scanned the electronic hospital occurrence report (eHOR) daily during weekday for entries of fall incidences reported by the nurses from the wards and ascertained if the entries were on participants involved in the study." Nursing staff recording falls described as blind to group allocation. Not clear if the research investigator was blind to group allocation

Becker 2003

Methods	RCT (cluster randomised by facility)
Participants	Setting: 6 long-term care facilities (high level nursing care), Germany N = 981 Sample: 79% women Age (years): mean (SD) intervention group 83.5 (7.5), control group 84.3 (6.9) Inclusion criteria: resident of facility Inclusion criteria for exercise programme: able to stand while holding a chair, able to lift one foot Exclusion criteria: none stated
Interventions	1. Fall prevention programme for staff and residents. Residents chose to participate in any combination of interventions for any length of time. Those choosing to participate in fall registration only also received environmental modification and modification of nursing care a. Staff training on risk factors and preventive measures (60 min), audit and monthly feedback re falls and injuries b. Check list of 76 environmental hazards (lighting, chair and bed height, floor surfaces, etc). Feedback to staff and administrators c. Resident education: all received written information, offered personal consultation by study nurse or exercise instructor d. Group exercise programme (progressive balance and resistance training) 75 min, 2 x per wk e. Hip protectors 2. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fractures)
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Cluster randomisation of 6 facilities using sealed envelopes selected by an independent person. Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Allocation in sealed envelopes, but individuals admitted after group allocation by a person who may have been unblinded and may have had knowledge of participant characteristics
Blinding of outcome assessment (detection bias)	High risk	Staff at facilities who recorded falls were likely to be aware of their facility's allocation status

Becker 2003 (*Continued*)

All outcomes		

Bischoff 2003

Methods	RCT (individually randomised)
Participants	Setting: 2 hospitals with long-stay geriatric care units, Basel, Switzerland N = 122 Sample: 100% women Age (years): mean (SD) intervention group 85.4 (5.9), control group 84.9 (7.7) Inclusion criteria: female; aged ≥ 60; able to walk 3 metres Exclusion criteria: primary hyperparathyroidism; hypercalcaemia; hypercalcuria; renal insufficiency; fracture or stroke in last 3 months
Interventions	1. 800 IU oral cholecalciferol (vitamin D3) plus 1200 mg calcium daily for 12 wk 2. Control: 1200 mg calcium daily for 12 wk
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fractures)
Duration of the study	12 weeks
Notes	50% of participants had a baseline serum vitamin level < 30 nmol/L

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "The randomization was performed by an independent statistician."
Allocation concealment (selection bias)	Low risk	Participants randomised in groups of four by an independent statistician
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Patients, nurses, and all investigators were blinded to the treatment assignment throughout the study

Broe 2007

Methods	RCT (individually randomised)
Participants	Setting: 1 long-term care facility (high level care), USA N = 48 included in review (total of 124 in the study) Sample: 73% women Age (years): mean 89 (SD 6)

Broe 2007 (*Continued*)

	Inclusion criteria: life expectancy > 6 months; able to swallow medications; resident for > 3 months Exclusion criteria: taking glucocorticoids; anti-seizure medications; pharmacological doses of vitamin D; calcium metabolism disorders; severe mobility restriction; fracture within previous 6 months
Interventions	1. 200 IU of vitamin D2 daily for 5 months (not included in review) 2. 400 IU of vitamin D2 daily for 5 months (not included in review) 3. 600 IU of vitamin D2 daily for 5 months (not included in review) 4. 800 IU of vitamin D2 daily for 5 months 5. Control: placebo daily for 5 months
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	5 months
Notes	Mean baseline serum vitamin D level for 800 IU group and control group combined was 53 nmol/L

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "... computer-generated randomization list."
Allocation concealment (selection bias)	Low risk	Pharmacy conducted randomisation and supplied medication in blister packs with name and patient identification number only
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Nursing staff completing incident forms blinded to treatment status because blister packs and tablets identical in appearance. Also "a programmer, not involved with this study and not aware of participant study group assignments, created the falls dataset linking the participant identification number with falls reported during the study period

Buettner 2002

Methods	RCT (individually randomised)
Participants	Setting: 3 nursing care facilities, USA (1 high level nursing facility, 1 skilled nursing facility, 1 intermediate level facility) N = 27 Sample: 44% women Age (years): mean 83.3 (range 60 to 98)

Buettner 2002 (*Continued*)

	Inclusion criteria: ≥ 2 falls in past 2 months between 7.00 am to 9 am; MMSE score < 23; aged > 60; walking independently, or with 1 assistant or assistive device Exclusion criteria: not resident for ≥ 60 days; a healing fracture; attending physiotherapy
Interventions	1. Supervised group exercises: walking group daily at 6.30 am; exercise to improve function (balance, strength, and flexibility) 3 x per wk in mid afternoon; sensory air mat therapy (movement, relaxation) 2 x per wk in evenings. Intervention overseen by Certified Therapeutic Recreational Specialist with assistance of staff members. The interventions were scheduled at the time of day when most falls occur and in the locations where the falls occur 2. Control: usual care
Outcomes	1. Number of falls
Duration of the study	2 months
Notes	Published data incomplete. Further data provided by authors could not be analysed

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No description of method of sequence generation
Allocation concealment (selection bias)	Unclear risk	No description of allocation concealment
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff collecting falls data do not appear to have been blinded to allocation status

Burleigh 2007

Methods	RCT (individually randomised)
Participants	Setting: general assessment and rehabilitation wards in an acute geriatric unit, Glasgow, Scotland N = 205 Sample: 59% women Age (years): mean (SD) intervention 82.3 (7.6), control 83.7 (7.6) Inclusion criteria: admitted to a ward in the acute geriatric unit; aged ≥ 65 Exclusion criteria: hypercalcaemia; urolithiasis; renal dialysis; terminal illness; bed bound; reduced Glasgow Coma Score; already prescribed vitamin D and calcium; 'nil by mouth' on admission
Interventions	1. 800 IU oral cholecalciferol (vitamin D3) plus 1200 mg calcium daily until separation from the facility 2. Control: 1200 mg calcium daily until discharge or death

Burleigh 2007 (*Continued*)

Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	Aproximately 9 months. Median length of stay 30 days
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "... randomised using a random numbers table"
Allocation concealment (selection bias)	Low risk	Quote: "Randomisation was known only to the statistician and pharmacist who subsequently issued an appropriate uniquely numbered drug blister pack to each patient's ward."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Staff completing falls data may have been aware of treatment status as there was no placebo in place of vitamin D. Insufficient information to permit judgement

Chapuy 2002

Methods	RCT (individually randomised)
Participants	Setting: 55 intermediate nursing care facilities, France N = 610 Sample: 100% women Age (years): mean 85.2 (SD 7.1) Inclusion criteria: ambulatory; life expectancy > 2 years Exclusion criteria: malabsorption; serum calcium > 2.63 mmol/L; chronic renal failure (serum creatinine >150 μmol/L), taking bone metabolism altering medications within the past year, e.g. corticosteroids, anticonvulsants or high doses of thyroxine; fluoride salts (43 months), bisphosphonates, calcitonin (41 month), calcium (4500 mg/day) and vitamin D (4100 IU/day) during the last 12 months
Interventions	1. 800 IU of vitamin D3 + 1200 mg calcium carbonate fixed combination daily 2. 800 IU of vitamin D3 + 1200 mg calcium carbonate separately daily 3. Control: placebo
Outcomes	1. Number of people falling 2. Number sustaining a fracture (hip fracture)

Chapuy 2002 (*Continued*)

Duration of the study	24 months
Notes	Described as "apartment houses for elderly people" in Chapuy 2002 but provision of drugs supervised by nursing staff "to ensure compliance". Mean baseline serum vitamin D level 22 nmol/L

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Insufficient information about the sequence generation process to permit judgement of 'Low risk' or 'High risk'
Allocation concealment (selection bias)	Unclear risk	Although described as multicenter, randomised, double masked, placebo-controlled, the method of concealment prior to allocation is not described in sufficient detail to allow a definite judgement
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding of treatment status to outcome assessors not mentioned. Participants were asked if they had an adverse event (including falls) in last 3 months. Not clear if the person asking would have known allocation status

Chenoweth 2009

Methods	RCT (cluster randomised by unit)
Participants	Setting: 15 residential dementia care units (high level nursing care), Sydney, Australia N = 289 residents Sample: people with dementia (78% women) Age (years): mean (SD) person-centred care group 83 (7.6), dementia-care mapping group 84 (6.4), usual care group 83 (7.6) Inclusion criteria (facilities): task-focused (not person-centred) care systems Inclusion criteria (residents): dementia and low cognitive function; aged >60; high dependency needs; persistent need-driven dementia compromised behaviours Exclusion criteria (residents): serious co-morbidities complicating or masking dementia; palliative care; unremitting pain; distressing physical symptoms; respite placement
Interventions	1. Person-centred care: one researcher trained 2 care staff per site in allocated method of care (*see* 'Notes'), worked with trained staff to implement care plans, provided two site visits to give ongoing support for staff, then regular telephone contact for 4 months 2. Dementia care mapping: two researchers trained 2 care staff per site in allocated method of care (*see* 'Notes'), carried out "mapping" with trained staff, developed care plans with trained staff, trained staff helped colleagues implement plans, regular telephone contact from researchers for 4 months 3. Usual care: non person-centred care that is task-focused and concerned mostly with

Chenoweth 2009 (*Continued*)

	physical care needs
Outcomes	1. Number of people falling
Duration of the study	8 months
Notes	Person-centred care emphasised social interactions at affective level based on life histories; aimed to preserve personal identity and foster meaningful relationships Dementia-care mapping: "mapping" consisted of observation of each participant for 6 h per day for 2 days to identify factors related to wellbeing

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Allocation was done by the study statistician (MTK), who was unaware of the identity of sites, using an SAS20 program."
Allocation concealment (selection bias)	Low risk	Eligible residents were selected by facility managers or directors before randomisation of sites
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "Treatment allocation was masked to assessors." Three separate research assistants collected outcome data from each cluster of five facilities. Staff of facilities instructed not to inform assessors of interventions

Choi 2005

Methods	RCT (cluster randomised)
Participants	Setting: 2 residential care facilities (intermediate level care), Korea N = 68 Sample: 75% women Age (years): mean 77.9 (range 61 to 91) Inclusion criteria: ambulatory; age > 60; at least one fall risk factor (impaired gait, impaired balance; a fall in the last year; postural hypotension; four or more medications affecting balance) Exclusion criteria: severe dementia; physical illness that may prevent completion of 12-wk course of exercise; involvement in any other exercise
Interventions	1. Supervised Tai Chi: 35 min group sessions with certified Tai Chi leader, 3 x per wk for 12 wk 2. Usual routine activities
Outcomes	1. Number of people falling

Choi 2005 (*Continued*)

Duration of the study	3 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Cluster randomised, described as quasi-experimental design with a non-equivalent control group. Quote: "... two facilities with similar characteristics were selected and randomly assigned to either the experimental or control group by coin tossing."
Allocation concealment (selection bias)	Unclear risk	After first toss the allocation of the second facility would be known. No description of whether individual participant recruitment was undertaken after group allocation by a person who was unblinded and may have had knowledge of participant characteristics
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at facilities who recorded falls were likely to be aware of their facility's allocation status

Clifton 2009

Methods	RCT (individually randomised)
Participants	Setting: 1 veterans skilled nursing facility (high level nursing care), Washingon state, USA N = 43 Sample: 5% women Age (years): mean 82.2 (SD 7.1) Inclusion criteria: expected length of stay > 120 days; high risk of falling (Morse Scale score $\geq$ 50); unable to ambulate or transfer without assistance Exclusion criteria: history of adverse reaction to medical adhesives; mechanobullous disease; skin breakdown on the legs > 10 cm; skin eruption on the legs
Interventions	1. FallSaver system: wireless position-monitoring patch fixed to the thigh. Transmitted signal to receiver/alarm unit when angle of declination reached about 45 degrees from horizontal, indicating the individual was moving into a weight-bearing position 2. No FallSaver use
Outcomes	1. Rate of falls
Duration of the study	Cross-over after 60 days for second 60 day period
Notes	

Clifton 2009 (*Continued*)

Risk of bias		*Risk of bias*
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomisation sequence generated using a web-based programme
Allocation concealment (selection bias)	Low risk	Quote: "Allocation of sequence, performed by the study coordinator, was masked until informed consent was obtained from each respective subject."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Caregivers recorded falls. Not blind to FallSaver use

Cox 2008

Methods	RCT (cluster randomised by Primary Care Organisation (PCO) each containing nursing care facilities)
Participants	Setting: 209 care homes (high and intermediate level care), England and Wales N = 5637 participants Sample: 77% women Age (years): not stated Inclusion criteria (facilities): if local ethics and research governance procedures were swift enough to enable enrolment Exclusion criteria (facilities): if demographic information was not provided
Interventions	1. Half day training sessions for managers, nurses and health care assistants in each PCO. Training delivered by specialist osteoporosis nurses and included information on falls and falls prevention 2. Control group received training 12 months later
Outcomes	1. Number of people falling 2. Number sustaining a fracture (all fractures, hip fractures)
Duration of the study	12 months
Notes	5 of 29 clusters lost to follow up in intervention group compared with 16 of 29 clusters in control group

Risk of bias		*Risk of bias*
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "The PCOs were stratified into two groups, larger PCOs and smaller PCOs

Cox 2008 (*Continued*)

		based on the median number of care homes. Within each stratum, a single block of allocations was undertaken using a computer package to ensure equivalent numbers of PCOs in each group."
Allocation concealment (selection bias)	Low risk	Quote: "All PCO demographic data were forwarded to the Department of Health Science at the University of York for randomisation and allocation." "The allocation was undertaken by an independent researcher."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at facilities who recorded falls were likely to be aware of their facility's allocation status

Crotty 2004a

Methods	RCT (individually randomised)
Participants	Setting: patients awaiting transfer from a hospital to a long term care facility, Australia N = 110 Sample: 61% women Age (years): mean 82.7 (SD 6.4) Inclusion criteria: acute and subacute hospital patients being transferred to nursing care facility; life expectancy greater than a month Exclusion criteria: none stated
Interventions	1. Pharmacist transition coordinator for patients transferring from hospital to a care facility for the first time: medication management transfer summaries from hospitals, timely coordinated medication reviews by accredited community pharmacists, and case conferences with physicians and pharmacists 2. Control: usual hospital discharge process
Outcomes	1. Number of people falling
Duration of the study	12 months. Participants followed-up for 8 wk post discharge
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "The study biostatistician provided a computer-generated allocation sequence that used block randomization and was stratified by hospital."

Crotty 2004a (*Continued*)

Allocation concealment (selection bias)	Low risk	Quote: "Randomization was coordinated by a centralized hospital pharmacy service."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not clear whether staff recording falls were aware of existence of transfer summaries and case conferences

Crotty 2004b

Methods	RCT (cluster randomised) Cluster randomisation of regions such that each metropolitan health area allocated to intervention or control. Facility in an intervention region selected at random and matched to a facility in a control region. Matching facilities not randomised
Participants	Setting: 20 residential care facilities (10 high and 10 low level care), Adelaide, Australia N = 715 participants Sample: 84% women Age (years): mean 84.1 (SD 7.8) Inclusion: none stated Exclusion criteria: none stated
Interventions	1. Pharmacist outreach intervention: intervention physicians received two 30 min academic detailing visits from pharmacist based on evidence-based guidelines, audit of prescribing practice (psychotropic and/or antihypertensive medication, use of aspirin or warfarin) and number of falls in previous 12 months. One nurse per facility received four 2-hour education sessions (change management, management of the behavioural symptoms of dementia, medication management and falls prevention techniques). Pharmacist educated each facility on reducing use of psychotropic drugs 2. Usual care
Outcomes	1. Number of people falling
Duration of the study	7 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "All randomisation was conducted using a computer-generated random allocation program by a person external to the project."
Allocation concealment (selection bias)	High risk	Cluster randomisation of regions. Facility in an intervention region selected at random and matched to a facility in a control

Crotty 2004b (*Continued*)

		region
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at facilities who recorded falls were likely to be aware of their facility's allocation status

Cumming 2008

Methods	RCT (cluster randomised) Cluster randomisation of 12 matched pairs of wards
Participants	Setting: acute and subacute wards in 12 hospitals, Sydney, Australia N = 24 wards, 3999 patients Sample: 59% women Age (years): mean 79.0 (SD 12.8) Inclusion criteria: all admitted patients Exclusion criteria: none stated
Interventions	1. Targeted multifactorial intervention: a nurse and physiotherapist each worked for 25 hours per wk for 3 months in all intervention wards. Provided risk assessment of falls, staff and patient education, drug review, modification of bedside and ward environments, an exercise programme, and sock alarms for selected patients (maximum of 2 per ward) 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	3 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Randomisation of each matched pair of wards was usually done during the week before the study started for that pair of wards. Randomisation involved sealed, opaque envelopes and was supervised by a study investigator ... unaware of ward characteristics."
Allocation concealment (selection bias)	Low risk	Quote: "We included all patients in study wards during each three month study period." "Randomisation of each matched pair of wards was usually done during the

		week before the study started for that pair of wards. Randomisation involved sealed, opaque envelopes and was supervised by a study investigator ... unaware of ward characteristics."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the wards who recorded falls were likely to be aware of their ward's allocation status

Donald 2000

Methods	RCT (2 x 2 factorial design)
Participants	Setting: 1 elderly care rehabilitation (subacute) ward, Gloucester, UK N = 54 Sample: individuals admitted to one elderly care rehabilitation ward over an 8 month period (81% women) Age (years): mean 83 Inclusion criteria: patients admitted for rehabilitation Exclusion criteria: none stated
Interventions	1. Assigned to ward area with vinyl floor covering and conventional physiotherapy (functional based physiotherapy, once or twice daily) 2. As above (1) plus seated leg strengthening exercises (hip flexors and ankle dorsiflexors) 3. Assigned to ward area with carpet and conventional physiotherapy 4. As above (3) plus seated leg strengthening exercises (hip flexors and ankle dorsiflexors)
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	9 months. Follow up of individual patients was duration of admission (mean length of stay 29 days)
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Sequence generation not described. Quote: "Using randomized envelopes for each risk group, patients were assigned a floor group (carpet or vinyl) and a physiotherapy group (conventional physiotherapy or additional exercise)."
Allocation concealment (selection bias)	Unclear risk	Randomised achieved by randomising envelopes. Insufficient information to permit judgement

Donald 2000 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors do not appear to have been blinded to treatment status

Dyer 2004

Methods	RCT (cluster randomised)
Participants	Setting: 20 residential care homes (intermediate level care), UK N = 196 participants Sample: 78% women Age (years): mean (SD) intervention group 87.4 (6.9), control group 87.2 (6.9) Inclusion criteria (facilities): ≥ 5 residents; not specializing in mental illness; without nursing services Inclusion criteria (residents): aged ≥ 60 Exclusion criteria: temporary residents or terminal illness
Interventions	1. Multifactorial, multidisciplinary intervention: Baseline assessments by physiotherapist, nurse and OT and interventions based on these a. Exercise: supervised gait, balance, coordination and functional + strength/resistance + flexibility + general physical exercises. 3 x 40 minute sessions per wk for 3 months. Progressive exercises individually tailored and delivered by exercise assistants supported by physiotherapists. Carried out in groups or individually if residents unable to participate in groups because of frailty or cognitive impairment b. Staff education c. Medical review: baseline assessments screened by geriatrician. Recommendations re medication review, orthostatic hypotension, and osteoporosis prevention sent to participant's GP for GP to implement d. Environmental modification: OT assistant visited facilities to assess and report on falls hazards, with facilities being alerted of major hazards e. Optician and podiatry referrals based on baseline assessment 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Allocation sequence used computer generated random number tables

Dyer 2004 (*Continued*)

Allocation concealment (selection bias)	Low risk	Quote: "The allocation sequence was performed and kept secure by a researcher independent of the study, and blinded to baseline assessment results."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Dykes 2010

Methods	RCT (cluster randomised) randomised 2 units matched on fall rates and patient days within each of 4 hospitals
Participants	Setting: 8 acute medical units, Boston, Massachusetts, USA N = 5264 patients aged ≥ 65 Sample used in this review: patients aged ≥ 65 (% women not available) Age (years): mean 78.8 (SD 8.4) in patients aged ≥ 65 Inclusion criteria (units): fall rates higher than institution's mean rate for previous year; had a match within the institution (unit with similar fall rate and length of stay) Inclusion criteria (patients): all patients admitted to randomised units during study Exclusion criteria (units): involved in other performance improvement efforts relating to fall prevention
Interventions	1. Falls Prevention Tool Kit (FPTK) software with strategies to improve unit-level buy-in: Morse Falls Scale completed using FPTK; software automatically generated evidence-based/feasible interventions, tailored by nurse based on knowledge of patient; software automatically printed bed poster for patients at risk (updated with change in status); software generates tailored handout to educate patient/family (updated with change in status); tailored fall prevention plan automatically generated by software for documentation 2. Control: usual care in relation to fall prevention: Morse Falls Scale (MFS) completed using existing paper or electronic forms; "high risk of falls" signs above beds for patients with MFS >45 points; educate patient/families with booklets or other handouts as needed; document plan manually in paper or electronic record Both groups used Morse Falls Scale to assess risk of falls on admission, daily and with change in status
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	6 months
Notes	Data for participants aged < 65 and ≥ 65 reported separately in Dykes 2010. Only data for participants aged ≥ 65 included in this review

Risk of bias	***Risk of bias***

Dykes 2010 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote "Matched units were randomised" Insufficient information to permit judgement
Allocation concealment (selection bias)	High risk	At each hospital pairs of wards were allocated to intervention and control, then patients admitted to these wards were recruited
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "the intervention was not blinded and falls were reported by unit-based caregivers who implemented fall prevention interventions."

Faber 2006

Methods	RCT (individually randomised) Facilities randomised to one of two interventions, then residents individually randomised to intervention or control group within facilities
Participants	Setting: 15 long-term care residences (combined high and low level care within each), The Netherlands N = 238 Sample: 79% women Age (years): mean 84.9 (range 63 to 98) Inclusion criteria: resident of facility Exclusion criteria: unable to walk 6 m unaided; poor cognition as judged by staff; GP contraindication
Interventions	1. Functional Walking (FW) (7 residences): 10 exercises (gait, balance, and coordination + strength/resistance), 1 session per wk for 4 wk then 2 sessions per wk for 16 wk; 90 min per session. Exercises individually tailored and delivered by an instructor 2. In Balance (IB) (8 residences): 3D exercises (based on Tai Chi). 1 session per wk for 4 wk followed by 2 sessions per wk for 16 wk. 90 minute sessions. Exercises individually tailored and delivered by an instructor 3. Usual care (same 15 residences as above)
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	Only data for combined control groups reported in Faber 2006

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement

Faber 2006 (*Continued*)

Random sequence generation (selection bias)	Low risk	15 centres cluster randomised to one of two exercise regimens using "sealed envelopes". Individuals then randomised into intervention and control within each participating centre using computer generated random numbers
Allocation concealment (selection bias)	Unclear risk	Unclear whether initial randomisation to clusters used envelopes which were sequentially numbered, opaque and sealed. Insufficient information to permit judgement in relation to randomisation of individuals after cluster allocation
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls were likely to be aware of individual's allocation status

Flicker 2005

Methods	RCT (individually randomised)
Participants	Setting: 60 assisted living facilities and 89 nursing homes (intermediate and high level nursing care facilities), urban and rural Australia N = 693 Sample: 95% women Age (years): mean 83.4 Inclusion criteria: serum 25-hydroxyvitamin D between 25 nmol/L and 90 nmol/L Exclusion criteria: use of medications affecting bone and mineral metabolism; thyrotoxicosis within 3 years; primary hyperparathyroidism treated within 3 years; multiple myeloma; Paget's disease of bone, history of malabsorption, intercurrent active malignancy, other disorders affecting bone and mineral metabolism
Interventions	1. 10,000 IU oral ergocalciferol (vitamin D2) weekly (or 1000 IU oral ergocalciferol daily) plus 600 mg calcium carbonate daily 2. Placebo + 600 mg calcium carbonate daily
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	24 months
Notes	58% of participants had a serum vitamin D between 25 nmol/L and 40 nmol/L at baseline

Risk of bias	***Risk of bias***

Flicker 2005 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Subjects were randomized via computer-generated lists," "Within each institution … in blocks of eight."
Allocation concealment (selection bias)	Low risk	Quote: "Subjects were randomized to receive sequentially numbered bottles containing vitamin D supplementation or placebo." Individual not involved in contact with subjects or facilities performed randomisation
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Residential staff recording falls events blinded to whether participants were receiving vitamin D or placebo

Grieger 2009

Methods	RCT (individually randomised)
Participants	Setting: 1 aged care facility (high and intermediate level care), Victoria, Australia N = 115 Sample: 65% women in analysis Age (years): not stated Inclusion criteria: able to consume food orally Exclusion criteria: residents in the dementia, rehabilitation and palliative care wards
Interventions	1. One multivitamin tablet (Heron Women's Multivitamin) daily for 6 months. Tablets included 400 IU vitamin D3 and 360 mg calcium carbonate 2. Control: one placebo tablet daily for 6 months
Outcomes	1. Rate of falls 2. Number of people falling Other outcomes not included in this review
Duration of the study	6 months
Notes	Mean baseline serum vitamin D level 36 nmol/L

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number generator used in Excel
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Double-blind administration of tablets but no mention of maintaining blinding of researchers when falls were extracted from medical histories at the end of the 6 month trial

Haines 2004

Methods	RCT (individually randomised)
Participants	Setting: one hospital (three subacute wards), Melbourne, Australia N = 626 Sample: 67% women Age (years): mean 80 (SD 9) Inclusion criteria: all patients admitted to three subacute wards Exclusion criteria: none stated
Interventions	1. Targeted falls risk prevention programme based on identified falls risk (Peter James Centre Falls Risk Assessment Tool). Potential interventions were: a. Supervised exercise programme: 45 minute sessions 3 x per wk from commencement of intervention until discharge. Exercises comprised gait, balance and coordination + strengthening/resistance + 3D (Tai Chi). Exercises were individually tailored. Exercises were delivered by physiotherapist b. Falls risk alert card c. Up to four educational sessions from OT at bedside to individual participants of up to 30 min duration d. Hip protectors 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	10 months recruitment. Follow-up time was until participants were discharged from hospital
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "We randomly allocated participants by using a random number table held at the centre by one investigator (TPH) who revealed allocation on receipt of written consent."
Allocation concealment (selection bias)	Unclear risk	See above. Insufficient information to permit judgement

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Staff recorded falls on incident report forms likely to be aware of individual's allocation status. Survey of staff indicated they were relatively unaware of participant group allocation

Haines 2010

Methods	RCT (cluster randomisation of pairs of hospital wards matched on rate of falls in preceding 6 months)
Participants	Setting: 18 publicly funded hospital wards (acute and subacute), Queensland, Australia N = 11,099 patients Sample: patients admitted to study wards after October 2007 when beds provided to intervention wards (% women not stated) Age (years): not stated Inclusion criteria: no previous access to or provision of low-low beds Exclusion criteria: none described
Interventions	1. Low-low beds: provision of one low-low bed for every 12 beds on a hospital ward. Lowered bed height 28.5 cm from the ground, highest bed height 64 cm. Written guidance on their use and for prioritising patients at greatest risk of falls 2. Control: usual care Staff on intervention and control wards received falls incident reporting training video
Outcomes	1. Rate of falls
Duration of the study	6 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "...18 wards were then matched into pairs ... and ordered alphabetically within pairs. A research assistant in a separate location and blinded to this ordering flipped a coin to determine whether the first or second listed ward in the pair was to be allocated to the intervention group."
Allocation concealment (selection bias)	Unclear risk	See above, but patients could have been allocated to a specific ward with the knowledge that it was an intervention or control ward

Haines 2010 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Falls recorded by ward staff using routine computer-based incident reporting scheme. Would not be blind to allocation. No mention of blinding in relation to the person extracting data from centrally held database

Haines 2011

Methods	RCT (individually randomised)
Participants	Setting: acute and subacute wards in 2 hospitals, Brisbane and Perth, Australia N = 1206 Sample: patients admitted to acute (orthopedic and acute-respiratory medicine) and subacute (geriatric assessment and rehabilitation) wards of one hospital, and to the acute (medical-surgical) and subacute (restorative-stroke rehabilitation) wards of a second hospital (53% women) Age (years): mean (SD) intervention group (complete programme) 75.3 (11.0), intervention group (materials only programme) 74.7 (11.7), control group 75.3 (10.1) Inclusion criteria: aged > 60; expected to stay at least 3 days (acute wards only) Exclusion criteria: medically too unwell; previously participated in the trial
Interventions	1. Complete programme: multimedia patient education programme involving written and video-based materials combined with physiotherapist follow-up 2. Materials only programme: multimedia patient education materials without physiotherapist follow-up 3. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	22 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "a computer-generated random allocation sequence"
Allocation concealment (selection bias)	Low risk	Quote: "opaque, consecutively numbered envelopes"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "research assistants ... completed weekly falls reviews ... were blind to group allocation"

Healey 2004

Methods	RCT (cluster randomised by ward in matched pairs)
Participants	Setting: 8 elderly care wards (acute and subacute) in 1 hospital, York, UK N = 1654 participants, 32,528 bed days during intervention Sample: approximately 60% women Age (years): mean 81.3 (range 63 to 102) Inclusion criteria: all patients admitted to target wards Exclusion criteria: none specified
Interventions	1. Targeted risk factor reduction care plan for patients with a history of falls or a near fall during admission. Based on assessment (and subsequent referral/action) relating to: eyesight (referral to ophthalmologist); medications check for sedatives, anti-depressants, diuretics, polypharmacy, etc (medical review of benefit vs harm); lying and standing blood pressure (advice to participant and referral to medical staff); ward urine test (mid-stream urine if positive for nitrites, blood or protein); difficulty with mobility (referral to physiotherapist); review of bed rail use; footwear safety (advice on replacement); bed height (kept at lowest height); position in ward (placing high risk patients near nurses' station); environmental causes (act to correct); nurse call bell (explained and in reach) 2. Usual care
Outcomes	1. Rate of falls
Duration of the study	6 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of randomisation not described. Quote: "The study wards were divided into matched pairs. In each pair, one ward was randomly allocated to control or intervention by lottery ..."
Allocation concealment (selection bias)	Unclear risk	Individual study wards aware of their allocation from beginning of study. It is unclear whether knowledge of group status could have influenced admission of new patients during the study
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the wards who recorded falls were likely to be aware of their ward's allocation status

Jarvis 2007

Methods	RCT (individually randomised)
Participants	Setting: 1 elderly care rehabilitation ward (subacute), Leicester, UK N = 29 Sample: 100% women Age (years): not stated Inclusion criteria: female patients admitted for rehabilitation Exclusion criteria: acute stroke; Parkinson's disease; Abbreviated Mental Test Score ≤ 5; severe cardiac, lung or kidney disease; severe osteoarthritis or rheumatoid arthritis
Interventions	1. Intervention group: physiotherapy x 10 sessions per wk. Once a week physiotherapy treatment at home after discharge. 8 wk intervention 2. Control group: physiotherapy x 3 sessions per wk. Some seen 1 x per wk in day hospital or no treatment after discharge. 8 wk intervention Physiotherapy consisted of stretches, lower limb exercises, and balance and gait activities in both groups
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	8 weeks
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "... randomly assigned, using sealed envelopes ..." Insufficient information about the sequence generation process to permit judgement of 'Low risk' or 'High risk'
Allocation concealment (selection bias)	Unclear risk	Quote: "The elderly women fallers were randomly assigned, using sealed envelopes, to either a control group or intervention group." Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Physiotherapy team responsible for measurement of outcomes reported to be blinded of intervention. Some chance of unblinding of assessors

Jensen 2002

Methods	RCT (cluster randomised)
Participants	Setting: 9 residential care facilities (intermediate care), Umeå, Sweden N = 402 Sample: 72% women Age (years): mean (range) intervention group 83 (65 to 97), control group 84 (65 to100) Inclusion criteria: facilities with ≥ 25 residents; residents aged ≥ 65 Exclusion criteria: none stated
Interventions	1. Multidisciplinary programme including general and resident-specific tailored interventions for 11 wk: supervised exercises, medication review, modifying environmental hazards, supplying and repairing aids, hip protectors, education of staff, post fall problem solving conferences and staff guidance. Individually tailored supervised exercises (gait, balance, coordination and functional + strength/resistance) 2 to 3 x per wk. Intervention delivered by registered nurses, physician and physiotherapists 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fracture)
Duration of the study	34 wk follow-up
Notes	Eight extra physiotherapists employed for intervention period (a total of 200 h/wk) and three during the follow-up period (total of 10 h/wk)

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Cluster randomised study in nine facilities, divided into groups A and B (control or intervention). Quote: "Two sealed, dark envelopes" were used. Carried out by a person not connected with the study. Insufficient information to permit judgement
Allocation concealment (selection bias)	Low risk	Randomisation achieved by using by sealed dark envelopes by a person with no knowledge of study. Particiating individuals underwent baseline assessment prior to the randomisation of facilities
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Kerse 2004

Methods	RCT (cluster randomised)
Participants	Setting: 14 mixed level dependency residential care homes (intermediate and high level care), New Zealand N = 617 residents Sample: 72% women Age (years): mean 83.2 (SD 10.6) Inclusion criteria: resident in one of the included residential care homes Exclusion criteria: none stated but data excluded if enrolled in the study for < 2 days and had > 2 falls in one of those days
Interventions	1. Falls risk management programme of 12 months duration a. Falls coordinator in each home (carried out fall-risk assessment of all residents using tool, developed specific recommendations and care plans, co-ordinated with other healthcare professionals, and ensured that recommendations were followed) b. Evidence-based risk assessment tool + detailed management strategies relating to mobility impairments, mental impairments, medications, continence, sensory impairments c. Tailored care plan based on assessment + OT, PT, medical and specialist referrals d. Logo on high-risk residents walls + colour coded dots showing fall-prevention strategies e. Manual containing the risk assessment form, information for strategies, high-risk fall logos, all forms, and educational information for nurses, doctors, physiotherapists and OTs 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "... homes were stratified by type, and an independent researcher, not involved in the study, block randomized them into intervention or control group using computer-generated random numbers."
Allocation concealment (selection bias)	Low risk	See above, and 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
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Kerse 2008

Methods	RCT (cluster randomised)
Participants	Setting: 41 low level dependency residential care homes (intermediate level care), New Zealand. N = 682 residents Sample: 74% women Age (years): mean 84.3 (SD 7.2) Inclusion criteria: able to engage in conversation about a goal; remember the goal; participate in a programme to achieve the goal Exclusion criteria: unable to communicate to complete the study measures; anxiety as main diagnosis; acutely unwell; terminally ill
Interventions	1. Promoting independence in residential care (PIRC) intervention: a. Goal setting: resident + gerontology nurse (GN) set meaningful goal to promote progressive increase in activity. New goals set when one achieved b. Functional assessment by GN and individualized programme developed to improve physical function. Physical activities based on repetitions of ADL, e.g. rising from a chair, additional walking, or repeated transfers. Exercise activities at least once a day. Physiotherapist and OT available to help achieve goal. Presciptive plan to increase independence in patient's file and above bed c. GN trained health care assistants who helped implement programme, supervised by nursing staff d. GN provided weekly staff support for 1 month, then monthly support Six month intervention but staff expected to continue encouraging residents to activate after that. 2. Control: usual care + 2 social visits
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "After recruitment of all homes and residents and collection of baseline data, a biostatistician not involved in recruitment randomised homes to the intervention or control group by using computer generated random numbers. "
Allocation concealment (selection bias)	Low risk	Allocation of all cluster units performed at the start of the study. Individual participant recruitment was completed prior to assignment of the cluster, and the same participants were followed up over time

Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Klages 2011

Methods	RCT (individually randomised)
Participants	Setting: 1 long-term care home (appears to be high and intermediate level care), Ontario, Canada N = 24 Sample: 68% women in the analysis Age (years): mean (SD) intervention group 84 (6.6), control group 89 (3.2) Inclusion criteria: cognitively impaired (MMSE score < 25); able to follow simple walking instructions; able to walk with minimal assistance; no Snoezelen room attendance in 3 months prior to study Exclusion criteria: history of seizures; legal blindness; profound hearing loss; history of limb fractures; extrapyramidal system disruptions (inability to remain motionless or to initiate movement)
Interventions	1. Multisensory stimulation in a Snoezelen room: individual 30-minute sessions of stimulation and relaxation, 2 x per wk for 6 wk, with at least 2 days between sessions 2. Control: individual visits from volunteers (same frequency and duration): listening to readings of the newspaper, looking at magazines, playing cards or a board game, and talking
Outcomes	1. Number of falls
Duration of the study	3 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "A total of 24 eligible residents were recruited. Prior to the commencement of the study a computer-based random number generator was used to randomly select 12 numbers out of 24. These numbers were assigned to the intervention group. The remaining 12 numbers were allotted to participants in the control group."
Allocation concealment (selection bias)	Low risk	Quote: "As multiple recruitment packages were sent out simultaneously, and the participants were assigned a number in chronological order when a signed consent document was received, recruitment order

Klages 2011 (*Continued*)

		and group allocation were unpredictable."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Nursing staff recording falls were not blind to group allocation and "The investigator [reviewing charts] . .. was not blind to group allocation."

Koh 2009

Methods	RCT (cluster randomised)
Participants	Setting: two acute care hospitals, Singapore N = 1122 patients Sample: 641 nurses in medical, surgical and geriatric units in the two hospitals (% female patients not stated) Age (years) patients: mean 68 Inclusion criteria: all patients Exclusion criteria: none stated
Interventions	1. Multifaceted strategy for implementation of Ministry of Health Fall Prevention Clinical Practice Guideline (CPG) a. Revision of hospital's fall prevention policy in line with CPG b. Identification of change champions from within staff c. Educational sessions for staff aimed at promoting and supporting the adoption of the recommendations d. Reminders and identification systems, e.g. mandatory fall risk assessment tool in nursing assessment notes, posters in ward toilets, high-risk patients identified by pink name card above the bed, pink stickers on clinical/nursing notes, and pink identification bracelets e. Audit and feedback on incidence of falls and compliance with use of risk assessment tool 2. Control: routine dissemination strategies for implementation of CPG
Outcomes	1. Rate of falls
Duration of the study	6 months
Notes	Intervention targeted nursing staff. Age of patients not stated in Koh 2009. Obtained by personal communication with author

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "The two study hospitals were randomly allocated either to the "intervention" site... or the "control" site". Author states carried out by supervised coin toss; heads gets the intervention

Allocation concealment (selection bias)	High risk	No concealment. After first site randomised, second site automatically becomes the control group
Blinding of outcome assessment (detection bias) All outcomes	High risk	Quote: "Fall incidence and fall-associated injury rates were obtained from the hospitals' fall incidence database"

Lapane 2011

Methods	RCT (cluster randomised)
Participants	Setting: 25 nursing homes (appear to be high and intermediate level care), Ohio, USA N = 3321 residents Sample: 73% women Age (years): no overall age available Inclusion criteria (facilities): facilities serviced by one of two Omincare pharmacies and with stable contracts; Medicare and Medicaid certified; ≥ 50 geriatric beds; few short-stay residents Exclusion criteria: none stated
Interventions	1. Clinical informatics tool (Geriatric Risk Assessment MedGuide (GRAM)) to assist consultant pharmacists and nursing staff identify residents at risk for delirium and falls based on prescribed medications, implement proactive monitoring plans as appropriate, and provide reports to assist consultant pharmacists conducting monthly medication review. Detailed instruction of staff on medications implicated in falls and delirium, use of reports, care plans and flow charts etc. Detailed instruction of consultant pharmacists providing targeted medication review for all high-risk residents 2. Control: usual care including monthly medication review by consultant pharmacist
Outcomes	1. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "Homes were randomised ..." Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Insufficient information to permit judgement, although clinical staff recording falls would have been aware of allocation of the nursing home

Law 2006

Methods	RCT (cluster randomised by unit)
Participants	Setting: 118 homes for elderly people (intermediate and high level care), throughout the UK N = 223 units, 3717 residents Sample: 76% women Age (years): mean 85 Inclusion criteria: facility resident; aged ≥ 60 Exclusion criteria: temporary residents; taking vitamin D or calcium supplements or medications to increase bone density; sarcoidosis; malignancy; life threatening illness
Interventions	1. 2.5 mg oral ergocalciferol (vitamin D2) every 3 months (equivalent to 1100 IU/day) 2. Usual care (no placebo)
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (non vertebral fractures)
Duration of the study	Median length of follow up 10 months (interquartile range 7 to 14)
Notes	Mean baseline serum vitamin D level in 1% of the intervention group was 59 nmol/L

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Cluster randomisation by computer. No further information provided
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Mador 2004

Methods	RCT (individually randomised)
Participants	Setting: two metropolitan acute hospitals, South Australia N = 71 Sample: 48% women Age (years): mean 82.5 Inclusion criteria: inpatients on medical and surgical wards; aged ≥ 60; confusion due to either dementia or delirium; problematic behaviour Exclusion criteria: primary psychiatric illness; no next of kin available to give consent

Mador 2004 (*Continued*)

Interventions	1. Participants assessed for causes of confusion and behavioural disturbance by extended practice nurse within 24 hours of referral. Management plan formulated with respect to non pharmacological strategies to help manage problematic behaviour which was discussed with nursing staff. Ongoing support and education provided to carry out strategies 2. Usual care
Outcomes	1. Number of people falling
Duration of the study	11 months. Median length of stay 12 days for intervention group and 9 days for control group
Notes	Potential contamination as staff receiving training were also caring for controls

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Sequential sealed opaque envelopes were prepared by a person who was external to the study in blocks of ten stratified for the two hospitals, using a computer-generated table of random numbers."
Allocation concealment (selection bias)	Low risk	Quote: "Sequential sealed opaque envelopes were prepared by a person who was external to the study..." Randomised by the Repatriation Hospital Pharmacy Department
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors were not blinded

Mayo 1994

Methods	RCT (individually randomised)
Participants	Setting: rehabilitation (subacute) hospital, Canada N = 134 Sample: 46% women Age (years): mean (SD) intervention 70.9 (12.6), control 72.9 (11.8) Inclusion criteria: one or more of the following: admission diagnosis of stroke or ataxia; an episode of incontinence; a history of multiple falls; aged $\geq$ 80; using topical eye medication, anticonvulsants, vitamin supplements or anti-ulcer medications Exclusion criteria: unable to understand what was being asked of them; participated in this study during a previous admission

Mayo 1994 (*Continued*)

Interventions	All participants selected as being high risk of falling 1. Blue identification bracelet. Told to use bracelet as reminder to be careful when moving around hospital 2. Usual care: no blue bracelet
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months. Median lengths of stay 75 days (intervention group), 65 days (control group)
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "Subjects were interviewed to obtain baseline information ... and were then randomly assigned to either the intervention group or the control group."
Allocation concealment (selection bias)	Unclear risk	Insufficient information on process of allocation to permit judgement of 'Low risk' or 'High risk'
Blinding of outcome assessment (detection bias) All outcomes	High risk	Falls ascertained through incident reports. Staff completing incident reports would have been aware of whether or not participant was wearing a blue bracelet

McMurdo 2000

Methods	RCT (cluster randomised)
Participants	Setting: residential care facilities (intermediate level care), Dundee, Scotland, UK N = 9 facilities, 133 residents Sample: 81% women Age (years): mean 84 (SD 7) Inclusion criteria: aged ≥ 70 Exclusion criteria: MMSE score < 12
Interventions	1. Multifactorial, multidisciplinary intervention: a. Falls risk assessment and modification performed for each participant including medication review. Recommendations sent to participant's GP, optometrist review if indicated, and review of lighting levels b. Supervised exercises to improve balance, strength and flexibility; 30 minutes 2 x per wk for 6 months. Performed seated because of frailty of participants; not individually tailored. Not specified who delivered the exercise intervention 2. Control: reminiscence therapy

McMurdo 2000 (*Continued*)

Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	12 months. 6 month intervention + 6 months follow-up
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "... allocated at random ..." Insufficient information about the sequence generation process to permit judgement of 'Low risk' or 'High risk'
Allocation concealment (selection bias)	Unclear risk	Insufficient information on process of allocation to permit judgement of 'Low risk' or 'High risk'
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities recording falls in calendar were likely to be aware of their facility's allocation status

Meyer 2009

Methods	RCT (cluster randomised)
Participants	Setting: 58 nursing homes (high level nursing care), Hamburg, Germany N = 1125 residents Sample: 85% women Age (years): mean (SD) intervention group 86 (6), control group 87 (6) Inclusion criteria (facilities): ≥ 30 residents; not using a fall risk assessment tool or willing to stop using a tool Inclusion criteria (residents): ≥ 70 years; able to walk with or without assistance; living in the nursing home for > 3 months Exclusion criteria: none stated
Interventions	1. Use of one fall risk assessment tool (Downton Index) by ward staff 2. Control: no fall risk assessment tool (nurses judgement of risk)
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	12 months
Notes	

Meyer 2009 (*Continued*)

Risk of bias		*Risk of bias*
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Computer-generated randomisation lists were prepared by the biostatistician for concealed allocation of clusters by external central telephone."
Allocation concealment (selection bias)	Low risk	See above
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Nursing staff recorded falls (presumably not blind). External investigator verified completeness of falls data - not clear if blind to group allocation

Mulrow 1994

Methods	RCT (individually randomised)
Participants	Setting: 9 nursing homes (high level nursing care), USA N = 194 Sample: 71% women Age (years): mean (SD) intervention group 79.7 (8.5), control group 81.4 (7.9) Inclusion criteria: aged > 60; resident in nursing home for ≥ 3 months; dependant in ≥ 2 ADLs Exclusion criteria: terminal illness; acute medical condition; MMSE score < 50%, unable to follow two-step command; assaultive behaviour; received physiotherapy within last 2 months
Interventions	1. Tailored exercises 3 x per wk for 30 to 45 minutes, 4 months duration. Exercises comprised gait, balance and coordination + strength/resistance + flexibility exercises. Intervention delivered by physical therapists (one on one) 2. Friendly visit
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	4 months
Notes	

Risk of bias		*Risk of bias*
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Randomization was performed after baseline assessments by calling a central number. Randomization was blocked in groups of four and stratified by

Mulrow 1994 (*Continued*)

		nursing home site."
Allocation concealment (selection bias)	Low risk	Randomisation was performed after baseline assessments by calling a central number. No further description
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Falls recorded in charts and incident reports. Staff recording falls likely to be aware of allocation status. Research assistants examining charts and incident reports were reported to be blinded to allocation status

Neyens 2009

Methods	RCT (cluster randomised by ward)
Participants	Setting: 12 nursing homes (high level nursing care), The Netherlands (6 wards in intervention group and 6 in control group) N = 12 psychogeriatric wards, 518 residents Sample: 68% women Age (years): mean (SD) intervention group 82.1 (7.7), control group 83.3 (7.7) Inclusion criteria (wards): ≥ 25 beds; not using a fall prevention protocol; having the largest number of mobile patients Exclusion criteria: none stated
Interventions	1. Multifactorial, multidisciplinary intervention: a. General medical assessment by medical staff (at start of trial, on admission, if change in medical condition) b. Assessment with fall risk evaluation tool (fall history, medication intake, mobility, use of assistive and protective aids) by multidisciplinary team (physician, 2 nurses, physiotherapist, OT) at start of trial, on admission, after a fall, at request of ward staff, 2 x per year for all residents) c. Team decisions about individually tailored fall-prevention activities, e.g. medication review, individually designed exercise programmes, assessing and providing assistive and protective aids. Fortnightly conferences discussing each assessed resident d. Environmental hazard check on each ward by OT e. Team could implement general fall prevention activities, e.g. staff training 2. Control: usual care
Outcomes	1. Rate of falls
Duration of the study	12 months
Notes	

Risk of bias			***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**	

Neyens 2009 (*Continued*)

Random sequence generation (selection bias)	Low risk	Quote: "At random, using computer techniques, two intervention homes and two control homes were selected from each group [groups based on the mean fall incidence rate of psychogeriatric patients per psychogeriatric bed], resulting in a total of six intervention homes and six control homes. "
Allocation concealment (selection bias)	High risk	One ward per home was chosen after randomisation, based on inclusion criteria
Blinding of outcome assessment (detection bias) All outcomes	High risk	Study was cluster randomised and nursing staff recorded falls

Nowalk 2001

Methods	RCT (individually randomised)
Participants	Setting: 2 long-term care facilities (combined high level nursing care and independent living), USA N = 110 participants Sample: 86% women Age (years): mean 84 Inclusion criteria: aged ≥ 65; cognitively able to be tested; able to ambulate with or without assistive device; able to follow simple directions; cooperative; capable of participating in group sessions Exclusion criteria: unwilling or unable to complete baseline assessments
Interventions	1. "Fit NB Free" (FNBF): supervised exercises consisting of progressive strength training, flexibility, and endurance (treadmill and bicycling exercises), 3 x per wk for 13 to 28 months. Duration of sessions not specified. Exercises were delivered by exercise physiologists. Exercises individually tailored based on exercise capacity of participants 2. "Living and Learning/Tai Chi (LL/TC): Tai Chi 3 x per wk for 13 to 28 months + psychotherapeutic and behavioural methods to reduce fear of falling. Exercises not individually tailored. Tai Chi was delivered by professional instructor. Individualized assessment of participants not part of intervention 3. Usual routine activities Note: all groups also exposed to educational activities
Outcomes	1. Number of people falling
Duration of the study	24 months
Notes	

Risk of bias	***Risk of bias***

Nowalk 2001 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Following completion of all assessments, participants were randomly assigned to one of three groups ... using permuted blocks ..."
Allocation concealment (selection bias)	Unclear risk	Insufficient information on process of allocation to permit judgement of 'Low risk' or 'High risk'
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls on incident report forms were likely to be aware of individual's allocation status

Patterson 2010

Methods	RCT (cluster randomised matched pairs of nursing homes)
Participants	Setting: 22 nursing homes (high and intermediate level care), Northern Ireland N = 334 residents Sample: 73% women Age (years): mean 82.7 (SD 8.4) Inclusion criteria (facilities): > 30 resident beds (including homes for general nursing category residents and for elderly mentally infirm people) Inclusion criteria (residents): aged ≥ 65 Exclusion criteria (facilities): caring exclusively for terminally ill people Exclusion criteria (residents): terminally ill; attending day care only
Interventions	1. Pharmacists visited intervention facilities monthly for 12 months. Reviewed residents' clinical and prescribing information, applied an algorithm to assess appropriateness of psychoactive medication, worked with nurses and prescribers to improve the prescribing of these drugs 2. Usual care
Outcomes	1. Rate of falls
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "randomly assigned ... using a computer generated table of random numbers"

Patterson 2010 (*Continued*)

Allocation concealment (selection bias)	Low risk	An independent researcher blind to the identity of the homes carried out the randomisation (after consent obtained from the homes)
Blinding of outcome assessment (detection bias) All outcomes	High risk	Routinely collected falls data were used. Staff not blinded to group allocation

Ray 1997

Methods	RCT (cluster randomised)
Participants	Setting: 14 nursing homes (high level nursing care), USA N = 499 participants Sample: 78% women Age (years): mean 83 Inclusion criteria: high risk of falls with potential problem in a safety domain; likely to remain in nursing home Exclusion criteria: age < 65; anticipated stay < 6 months; bed bound; no fall in previous year
Interventions	1. Consultation service with individual assessment and recommendations targeting environmental and personal safety, wheelchair use, psychotropic medication use, transferring, and ambulation. Falls coordinator at each site. Intervention delivered by study team 2. Usual care
Outcomes	1. Number having 2 or more falls
Duration of the study	12 months
Notes	No published data on numbers of falls or fallers who had a single fall

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Seven "matched" pairs of facilities participated. Quote: "The statistician ... generated sealed-envelope random assignments for each pair from the SAS function RANUNI (using the clock for the seed)."
Allocation concealment (selection bias)	Low risk	Study author (statistician) generated sealed envelope random number assignments for each pair using the SAS function from RANUNI using the clock for the seed

Ray 1997 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff at the facilities who recorded falls were likely to be aware of their facility's allocation status

Rosendahl 2008

Methods	RCT (cluster randomised)
Participants	Setting: 9 residential care facilities (intermediate and high level nursing care), Sweden N = 191 Sample: 73% women in 34 clusters (cluster equals 3 to 9 participants living on the same floor, wing, or unit) Age (years): mean 84.7 (SD 6.5) Inclusion criteria: aged ≥ 65; dependent in ≥ 1 personal ADLs; able to stand from armchair with help from 1 person; MMSE score ≥ 10; physician approval Exclusion criteria: none stated
Interventions	1. Functional exercise programme: weight-bearing exercises challenging leg strength, postural stability, and gait ability. Physiotherapists selected exercises for each participant according to their functional deficits. High intensity and increasing load encouraged (5 sessions of 45 minutes every fortnight; total of 29 sessions) 2. Control: seated programme developed by OT, e.g. watching films, reading, singing (5 sessions of 45 minutes every fortnight)
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fractures)
Duration of the study	6 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Researchers not involved in the study performed the randomization by using lots in sealed non-transparent envelopes."
Allocation concealment (selection bias)	Low risk	Randomisation by cluster was performed after the inclusion of participants and baseline assessments using sealed nontransparent envelopes
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls were likely to be aware of individual's allocation status

Rubenstein 1990

Methods	RCT (individually randomised)
Participants	Setting: long-term care facility (intermediate and high level nursing care), Los Angeles, USA N = 160 Sample: 85% women Age (years): mean (SD) intervention group 86.8 (0.6), control group 87.9 (0.7) Inclusion criteria: fall within 7 days of nurse receiving fall incident report Exclusion criteria: unable to walk; unable to be evaluated within 7 days of fall due to acute illness or hospitalisation; unable to understand English
Interventions	1. Comprehensive post fall assessment within 7 days of fall. Intervention delivered by nurse: physical examination including visual screening, extended pulse and blood pressure assessments with attention to postural changes, assessment of footwear and foot problems, a quantified gait and balance assessment, laboratory tests, ECG, 24h Holter monitoring, environmental assessment to identify potential hazards. Once only assessment with recommendations given to patient's primary care physician 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	24 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Eligible fallers were ... randomly assigned to either the intervention or control group, using computer generated, randomly sequenced cards in sealed envelopes."
Allocation concealment (selection bias)	Unclear risk	Insufficient information on process of allocation to permit judgement of 'Low risk' or 'High risk'. It is unclear who conducted the randomisation and envelopes not described as opaque and sequentially numbered
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls after intervention were likely to be aware of individual's allocation status

Sakamoto 2006

Methods	RCT (individually randomised)
Participants	Setting: nursing care facilities and rehabilitation outpatient departments (intermediate care), Japan N = 553 Sample: 74% women Age (years): mean 81.6 (SD 9.0) Inclusion criteria: able to stand on their own while holding on to a bar Exclusion criteria: severe dementia
Interventions	1. Single leg stance practice both legs for 1 minute each leg, 3 times daily 2. Usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fractures)
Duration of the study	6 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Randomization of the subjects into an exercise group or a control group was performed by the Department of Information Science of our university. " using a "table of random numbers"
Allocation concealment (selection bias)	Unclear risk	Randomisation by Department of Information Science. Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls were likely to be aware of individual's allocation status

Sakamoto 2012

Methods	RCT (individually randomised)
Participants	Setting: 3 nursing homes (intermediate level care), Aomori, Japan N = 145 Sample: 19% women Age (years): mean (SD) intervention group 84.2 (7.8), control group 84.1 (7.7) Inclusion criteria: aged ≥ 65; able to transfer independently with or without assistive devices Exclusion criteria: non consenting; pica disorder (the desire to eat "unnatural" things) in case they ate the patches

Sakamoto 2012 (*Continued*)

Interventions	1. Lavender olfactory stimulation: commercially available white patch (1 cm x 2 cm, Aromaseal Lavender; Hakujuji Co., Tokyo, Japan) attached to inside of resident's clothing near the neck: continuous olfactory exposure for 24 hours. Patches replaced daily for 1 year. Odour can only be sensed by person wearing the patch 2. Control: placebo patch (1 cm x 2 cm, unscented Aromaseal) replaced daily for 1 year
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "An independent statistician performed resident allocations using computer-generated randomization of numbers at each nursing home."
Allocation concealment (selection bias)	Low risk	Quote: "An independent statistician performed resident allocations ... at each nursing home. Treatment allocation status was delivered to the head nurse at each nursing home, and patches were prepared accordingly."
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Although the staff recording falls were blind to group allocation, the head nurse who "supervised the recording of falls regularly", was not

Sambrook 2012

Methods	RCT (cluster randomised by facility)
Participants	Setting: 51 aged care facilities (intermediate care), North Sydney, Australia N = 602 residents Sample: 71% women Age (years): mean 86.4 (SD 6.6) Inclusion criteria: aged ≥ 70; ambulant; likely to survive for ≥ 12 months Exclusion criteria: taking vitamin D or calcium supplements; history of skin cancer in previous 3 years
Interventions	1. UV: increased sunlight exposure to face, hands and arms, 30 to 40 minutes, 5 days per wk 2. UV+: increased sunlight exposure (as above) + calcium carbonate 600mg daily 3. Control: usual care + brochure on vitamin D deficiency and its treatment

Sambrook 2012 (*Continued*)

Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The random allocation sequence ... was generated by a statistician who was not involved in the recruitment"
Allocation concealment (selection bias)	Low risk	Quote: "... it was concealed from the study co-ordinators until after randomisation."
Blinding of outcome assessment (detection bias) All outcomes	High risk	Study was cluster randomised and nursing staff reported falls. Researchers visited each home two monthly to record falls

Schnelle 2003

Methods	RCT (individually randomised)
Participants	Setting: 4 nursing homes (high level nursing care), USA N = 190 Sample: 85% women Age (years): mean (SD) intervention group 87.3 (8.0), control group 88.6 (6.7) Inclusion criteria: incontinent; no in-dwelling catheter; follows one stage commands; not Medicare Part A for post acute care or terminal; occupying long stay bed Exclusion criteria: none stated
Interventions	1. "FIT": incontinence care and functional exercises delivered by research staff. Every 2 hours from 08.00 to 16.00, 5 days a wk, for 8 months At each session patients prompted to toilet and changed if wet; encouraged to walk (or mobilise in wheel chair if not ambulatory); carried out sit-to-stand exercises with minimal assistance; offered fluids to drink before and after each episode. Upper body resistance training (arm curls and arm raises) at one episode per day. Individually tailored to meet weekly goals (up to 8 sit-to-stands, and up to 10 minutes walking (wheeling) per episode) 2. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)

Schnelle 2003 (*Continued*)

Duration of the study	8 months
Notes	

Risk of bias		***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "... subjects were randomized within NHs by computerized programs into intervention and control groups."
Allocation concealment (selection bias)	Unclear risk	Insufficient information on process of allocation to permit judgement of 'Low risk' or 'High risk'
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Falls recorded in medical records. Staff recording falls were likely to be aware of allocation status. Researchers examining records were blinded to allocation status

Schoenfelder 2000

Methods	RCT (individually randomised)
Participants	Setting: 2 nursing homes (high level nursing care), USA N = 16 Sample: 75% women Age (years): mean 82.8 (range 66 to 95) Inclusion criteria: aged ≥ 65; ambulating independently with or without assistive device; understand English; MMSE score > 20 Exclusion criteria: unstable physical condition; terminal illness; history of acting out or abusive behaviour
Interventions	1. Supervised ankle strengthening exercises followed by up to 10 min of walking, total time 20 min, 3 x per wk for 3 months. Exercises individually tailored. Intervention delivered by research member 2. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	6 months
Notes	

Risk of bias		***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**

Schoenfelder 2000 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	Insufficient information about the sequence generation process to permit judgement of 'Low risk' or 'High risk'. Quote: "... subjects were matched in pairs and assigned randomly within each pair to the intervention or control group."
Allocation concealment (selection bias)	High risk	Allocation concealment not described and researchers changed group allocation of one participant after randomisation
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls after intervention were likely to be aware of individual's allocation status

Serra-Rexach 2011

Methods	RCT (individually randomised)
Participants	Setting: 1 geriatric nursing home (intermediate level care), Madrid, Spain N = 40 Sample: 80% women Age (years): mean 92 (SD 2) Inclusion criteria: aged ≥ 90; planning to stay in the same nursing home during the study; able to ambulate with or without cane, walker, or parallel bars); able to communicate; able and willing to consent Exclusion criteria: acute or terminal illness; myocardial infarction in previous 3 months; unstable medical condition; upper or lower extremity fracture in previous 3 months; severe dementia; neuromuscular disease; using drugs affecting neuromuscular function
Interventions	1. Training group: training sessions 45 to 50 min per day, 3 days per wk for 8 wk (stretching exercises to warm up and cool down + aerobic training on cycle ergometer (up to 15 min), strength training with leg press with variable resistance (2 to 3 sets of 8 to 10 repetitions with rests between), + upper limb resistance training with weights or resistance bands. Also received usual care physiotherapy (mobility exercises, i.e. passive and active stretching of joints, 40 to 45 min per day, 2 days per wk) 2. Control: usual care physiotherapy (mobility exercises, i.e. passive and active stretching of joints, 40 to 45 min per day, 5 days per wk)
Outcomes	1. Number of falls
Duration of the study	12 weeks (8 weeks intervention and further 4 weeks follow-up)
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**

Serra-Rexach 2011 (*Continued*)

Random sequence generation (selection bias)	Low risk	Quote: "computer generated randomization sequence"
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Quote: "The assessment staff was blinded to participant randomization assignment. Participants were... reminded not to discuss their randomization assignment with assessment staff." "An independent researcher was in charge of auditing all nursing and medical records to record the number of falls in each participant over the study period"

Shaw 2003

Methods	RCT (individually randomised)
Participants	Setting: 2 accident and emergency (A&E) departments, Newcastle, UK N = 308 Sample: 79% of participants lived in high and intermediate nursing care facilities (personal communication), (80% women) Age (years): mean 84 (range 71 to 97) Inclusion criteria: presenting to A&E after a fall; age ≥ 65; MMSE score < 24; consent from patient; immediate carer and next of kin Exclusion criteria: unable to walk; medical diagnosis likely to have caused index fall, e.g. stroke; unfit for investigation within 4 months; unable to communicate for reasons other than dementia; living outside of a 15 mile radius of recruitment site; no major informant
Interventions	1. Multifactorial, multidisciplinary assessment and intervention to identify and manage risk factors a. Assessment of feet and footwear, gait and balance (physiotherapist): provision of walking aids and footwear, chiropody referral if required Home-based tailored exercise programme supervised by physiotherapist (gait training, balance, transfer and mobility interventions, functional limb strengthening and flexibility exercises) for 3 months b. Medical intervention comprised investigation and management of untreated medical problems, medication review, vision assessment and referral if indicated and psychogeriatric review if indicated c. Cardiovascular review and advice and/or treatment of identified cardiac risk factors for falls d. OT assessment of environmental fall hazards using a standard checklist, and hazard modification if indicated 2. Multifactorial, multidisciplinary assessment without intervention + usual care
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (hip fractures)

Shaw 2003 (*Continued*)

Duration of the study	12 months
Notes	

Risk of bias		***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "We randomised patients by block randomisation using computer generated random numbers"
Allocation concealment (selection bias)	Low risk	Quote: "Group allocation was performed by a researcher who was independent of the recruitment process and blind to baseline interview data"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Data from postcards processed and coded off site by researcher blind to group allocation

Shimada 2004

Methods	RCT (individually randomised)
Participants	Setting: 1 long-term care facility (intermediate level care), Japan N = 32 Sample: 78% women Age (years): mean (SD) intervention group 81.8 (5.9), control group 83.1 (6.4) Inclusion criteria: none stated Exclusion criteria: not able to walk more than 3 minutes on treadmill at greater than 0.5 km/hr; unable to participate because of recognizable dementia; unspecified health problems
Interventions	1. Supervised perturbed gait exercises on a treadmill (individually tailored) for 6 months (gait, balance and coordination + endurance) in addition to usual exercise. Complete programme of 600 minutes over 6 months, 1 to 3 x per wk. Intervention delivered by physical therapists 2. Usual exercise
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	6 months
Notes	

Risk of bias		***Risk of bias***

Shimada 2004 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "The 32 subjects were randomly divided into two groups ..." Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Collection of falls data not described but states "This study ... was carried out without blinding." Staff who recorded falls were likely to be aware of individual's allocation status

Sihvonen 2004

Methods	RCT (individually randomised)
Participants	Setting: 2 residential care homes (intermediate level care), Finland N = 28 Sample: 100% women Age (years): mean (SD) intervention group 80.7 (6.1), control group 82.9 (4.2) Inclusion criteria: aged ≥ 70; able to stand without walking aid; able to visualize feedback from a computer; able to follow instructions Exclusion criteria: acute illness; dementia; impending hip surgery
Interventions	1. Balance training using computerised visual feedback and a force platform (gait, balance and coordination exercises), 20 to 30 min sessions, 3 x per wk, for 4 wk. Exercises individually tailored. Intervention delivered by the research team 2. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	12 months
Notes	

Risk of bias ***Risk of bias***

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The subjects … were randomly assigned to an exercise group or a control group ... Since the study was carried out in two separate places, the randomization was done in blocks." "Randomisation was carried out by drawing lots."

Sihvonen 2004 (*Continued*)

Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Falls recorded by participants who were aware of group allocation. No mention of blinding of researchers contacting participants for details or if no diary returned

Stenvall 2007

Methods	RCT (individually randomised)
Participants	Setting: acute hospital wards (geriatric and orthopaedic), Umeå, Sweden N = 199 Sample: 74% women Age (years): mean 82.2 (SD 6.3) Inclusion criteria: admitted to hospital with femoral neck fracture; aged ≥ 70 Exclusion criteria: severe rheumatoid arthritis; severe hip osteoarthritis; pathological fracture of the femoral neck; severe renal failure; bedridden prior to the fracture
Interventions	1. Post-operative care in a geriatric orthopaedic service in a geriatric ward: multidisciplinary team providing comprehensive geriatric assessment, management, and rehabilitation 2. Control: usual care in an orthopaedic ward
Outcomes	1. Rate of falls 2. Number of people falling 3. Number sustaining a fracture (all fractures)
Duration of the study	32 months. Follow up time was until participants were discharged from hospital
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "Patients were randomized ... in opaque sealed envelopes. The lots in the envelopes were sequentially numbered ... Persons not involved in the study performed these procedures."
Allocation concealment (selection bias)	Low risk	Used sequentially numbered, opaque sealed envelopes
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Quote: "The staffs on the intervention and control wards were not aware of the nature of the present study."

Tideiksaar 1993

Methods	RCT (individually randomised)
Participants	Setting: acute geriatric care hospital ward, New York city, USA N = 70 Sample: 86% women Age (years): mean 84 (range 67 to 97) Inclusion criteria: one or more abnormal factors on a 9 point performance orientated environmental mobility screen (indicating impaired bed mobility) Exclusion criteria: none stated
Interventions	1. Bed alarm system to alert staff when patient leaves their bed. Intervention delivered by nurses 2. Control: usual care
Outcomes	1. Rate of falls
Duration of the study	9 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "Patients … were randomly assigned to either the experimental group … or the control group". Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff who recorded falls not blinded to individual participants' allocation status

Toulotte 2003

Methods	RCT (individually randomised)
Participants	Setting: nursing care facility, France. Published data implies residents receiving mixed high and intermediate levels of care N = 20 Sample: % women not stated Age (years): mean 81.4 (SD 4.7) Inclusion criteria: dementia (MMSE score < 21); history of ≥ 2 falls (not involving an environmental hazard) in previous 3 months; able to walk 10 metres without human assistance Exclusion criteria: none stated

Toulotte 2003 (*Continued*)

Interventions	1. Supervised exercises 1 h, 2 x per wk for 16 wk in groups of 5. Exercises incorporated gait, balance and coordination, strength/resistance, and flexibility. Exercises not individually tailored. Two physicians delivered intervention in each group. Individualised assessment of participants not part of intervention 2. Usual care
Outcomes	1. Rate of falls
Duration of the study	4 months follow up
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Quote: "A randomised cross-over design was used." Insufficient information about the sequence generation process to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Physician conducting tests was blinded to allocation status. Unlikely that these tests included recording of falls. Staff who recorded falls likely to be aware of individual participants' allocation status

Van Gaal 2011a

Methods	RCT (cluster randomised by ward)
Participants	Setting: 6 nursing homes (high level nursing care), The Netherlands N = 10 wards, 392 participants included in study Sample: 66% women Age (years): mean (SD) intervention group 78 (9.9), control group 78 (11.7) Inclusion criteria (facilities): 2 or 4 more or less comparable wards Inclusion criteria (residents): none stated Exclusion criteria: none stated
Interventions	1. Implementation of 3 guidelines (falls, urinary tract infection, pressure ulcers) targeting ward nursing staff: a. Educational meetings for all nurses (90 min) on the causes of 3 adverse events, assessment of patients at risk and prevention b. Two case discussions on every ward (30 min) covering these topics c. CD-ROM with education material issued to every ward (information, test and feedback) d. Information leaflets and oral information regarding prevention of pressure ulcers, urinary tract infection and falls issued to at-risk patients

Van Gaal 2011a (*Continued*)

	e. Nurses recorded presence or absence of adverse events in a computerised registration system daily. This programme generated feedback on process and outcome indicators to the nurses 2. Control: usual care
Outcomes	1. Rate of falls
Duration of the study	23 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States randomised after stratification. Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff recording falls would be aware of allocation. Cluster randomised trial so likely the person collecting data from patient files would be aware also

Van Gaal 2011b

Methods	RCT (cluster randomised)
Participants	Sample: 3 hospitals (acute care), The Netherlands N = 10 hospital wards, 2201 participants included in study Sample: 55% women Age (years): mean (SD) intervention group 66 (14.5), control group 64 (16.9) Inclusion criteria (hospitals): 2 or 4 more or less comparable wards Inclusion criteria (patients): expected length of stay of $\geq$ 5 days Exclusion criteria: none stated
Interventions	1. Implementation of 3 guidelines (falls, urinary tract infection, pressure ulcers) targeting ward nursing staff: a. Educational meetings for all nurses (90 min) on the causes of 3 adverse events, assessment of patients at risk and prevention b. Two case discussions on every ward (30 min) covering these topics c. CD-ROM with education material issued to every ward (information, test and feedback) d. Information leaflets and oral information regarding prevention of pressure ulcers, urinary tract infection and falls issued to at-risk patients e. Nurses recorded presence or absence of adverse events in a computerised registration system daily. This programme generated feedback on process and outcome indicators to the nurses 2. Control: usual care

Van Gaal 2011b (*Continued*)

Outcomes	1. Rate of falls
Duration of the study	23 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	States randomised after stratification. Insufficient information to permit judgement
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff recording falls would be aware of allocation. Cluster randomised trial so likely the person collecting data from patient files would be aware also

Wald 2011

Methods	CCT (odd vs even medical record number)
Participants	Setting: acute medical units in 1 hospital, Colorado, USA N = 217 Sample: 55% women Age (years): mean (SD) intervention group 80.5 (6.5), control group 80.7 (7.0) Inclusion criteria: aged ≥ 70 Exclusion criteria: patients admitted to medical subspecialty service (cardiology, pulmonary, oncology)
Interventions	1. Hospitalist-run acute care for the elderly service (ACE) (interdisciplinary team approach): admitted to 12-bed medical unit when beds available, attendance of patients by doctor with additional training in geriatrics, standardised geriatric assessment, daily (Mon to Fri) interdisciplinary rounds focusing on geriatric syndromes, standardized geriatric screens, clinical focus on mitigating harm and discharge planning; novel inpatient geriatrics training curriculum 2. Control: usual care. Admitted to general internal medicine unit with general medical teams with daily discharge planning rounds with social worker and discharge planner
Outcomes	1. Rate of falls
Duration of the study	22 weeks
Notes	

Risk of bias ***Risk of bias***

Wald 2011 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	A systematic non-random method was used (odd /even case record number)
Allocation concealment (selection bias)	High risk	Not possible to blind prior to allocation (see above)
Blinding of outcome assessment (detection bias) All outcomes	High risk	Falls from hospital event reports. Last digit of medical record number was used for group allocation. Allocation not concealed

Ward 2010

Methods	RCT (cluster randomised by facility)
Participants	Setting: 88 residential aged care facilities (high-care, low-care and dementia-specific), New South Wales, Australia N = 88 facilities, 5391 residents Sample: 73% women Age (years): median age 86 Inclusion criteria (facilities): $\geq$ 20 beds Exclusion criteria: none stated
Interventions	1. Intervention: full-time project nurse to assist facilities in using evidence-based approaches to falls injury prevention relating to risk assessment; mobility assessment; use of hip protectors; calcium and vitamin D supplementation; continence management; exercise programs; appropriate footwear; medication review; and post-fall management review. Project nurse provided intervention facilities with information and resources on preventing falls and fractures. Initial training session followed by 3 monthly network meetings. Intervention staff also could attend workshop on planning and running exercise programs 2. Control: usual care. Staff attended a workshop where data collection procedures were explained
Outcomes	1. Number of falls 2. Number sustaining a fracture (hip fractures)
Duration of the study	17 months
Notes	

Risk of bias			***Risk of bias***
Bias	**Authors' judgement**	**Support for judgement**	

Ward 2010 (*Continued*)

Random sequence generation (selection bias)	Low risk	Quote: "randomly allocated within strata into intervention or control groups by the statistician ... using the procedure "surveyselect" in SAS statistical software"
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement
Blinding of outcome assessment (detection bias) All outcomes	High risk	Staff recording falls and carrying out monthly record audit were aware of group allocation. Failure to produce monthly data followed up by project nurse (also aware of group allocation)

Zermansky 2006

Methods	RCT (individually randomised)
Participants	Setting: 65 care homes for the elderly (high, intermediate and mixed levels of care), UK N = 661 Sample: 77% women Age (years): mean 85 (interquartile range 80 to 90) Inclusion: aged ≥ 65; resident in a care home with ≥ 6 residents Exclusion criteria: participating in another trial; terminally ill; already receiving clinical medication review; at GP request
Interventions	1. Clinical medication review by a pharmacist comprising a review of the GP record and consultation with the participant and their carer. Written recommendations forwarded to participant GPs 2. Control: usual care
Outcomes	1. Rate of falls 2. Number of people falling
Duration of the study	6 months
Notes	

Risk of bias ***Risk of bias***

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Quote: "After collection of baseline data, patients were randomised in randomly sized blocks of two to eight patients using an algorithm written in Visual Basic in Microsoft Access."
Allocation concealment (selection bias)	Unclear risk	Insufficient information to permit judgement

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Falls data collected from accident book. Unclear whether staff recording falls in accident book would have been aware of allocation status

A&E: emergency department
ADLs: activities of daily living
AMTS: Abbreviated Mental Test Score
GCS: Glasgow Coma Score
GP: general practitioner
MMSE: Mini Mental State Examination
OT: occupational therapist
RCT: randomised controlled trial

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

Study	Reason for exclusion
Barreca 2004	RCT. Falls outcomes. Supervised exercises in older people post stroke
Bernhardt 2008	RCT. Falls recorded as adverse events. Early rehabilitation post stroke
Bosner 2012	Not randomised. Five nursing homes agreed to participate; three were assigned sequentially for the intervention and two for the control group
Bouwen 2008	RCT (cluster randomised). Nursing homes. Outcome of the study was a subgroup of falls only (falls with medical consequences)
Capezuti 1998	RCT (cluster randomised). Nursing homes. The intervention was designed to minimise restraints, not to reduce falls. Falls reported as adverse events
Crotty 2002	RCT. Accelerated discharge after hip fracture and home based rehabilitation in the community. Not designed to reduce falls. Falls recorded as adverse events
Davison 2005	RCT. Post-fall intervention with falls outcomes. Only one participant in residential/nursing care
de Morton 2007	CCT. The primary outcome was discharge destination. Falls were recorded as adverse events
Donat 2007	RCT. Exercise interventions in nursing homes. No falls outcomes
Fiatarone 1994	RCT. Boston FICSIT study in nursing home residents. No falls outcomes
Fossey 2006	RCT. Nursing homes. Intervention to reduce antipsychotics in people with severe dementia. Falls were recorded as adverse events

(*Continued*)

Grant 2005	RCT. Participants recruited in hospital after a hip fracture. Preventing falls in older people living in the community
Gruber-Baldini 2011	RCT. Intervention to motivate nursing assistants to actively engage nursing home residents in functional and physical activities. Falls recorded as adverse events
Gu 2006	Non-randomised controlled trial of exercise intervention in nursing homes. Experimental group was a convenience sample from two nursing homes; matched control group selected from another nursing home [personal communication]
Harwood 2004	RCT. Participants recruited at the end of ward rehabilitation post hip fracture. Preventing falls in older people living in the community
Hauer 2001	RCT. Exercise intervention. Recruited at the end of ward rehabilitation. Majority were community-dwelling (4% living in nursing homes)
Hopman-Rock 1999	RCT. Participants with dementia in homes for the elderly. Falls recorded as safety issue, i.e. as adverse events
Huang 2005	RCT. Discharge planning intervention to prevent falls in older people living in the community
Kato 2006	Not RCT. "Prospective clinical trial" of an exercise programme in a long term care facility with falls outcomes. Nurses volunteered their ward to be an intervention ward (personal communication from authors)
Katz 2004	RCT in residential care population. Intervention: three doses of risperidone in people with dementia and psychosis or agitation. Post hoc subgroup analysis of falls based on 85.9% of those randomised. Falls reported as adverse events
Katz 2005	This study was not primarily a falls prevention intervention. Falls reported as adverse events
Kenny 2001	RCT. Follow up of falls outcomes appears to be primarily in the community
Koczy 2011	The intervention was designed to minimise restraints, not to reduce falls. Falls reported as adverse events
Kopke 2012	RCT (cluster randomised). Nursing homes. The intervention was designed to minimise restraints, not to reduce falls. Falls reported as adverse events
Kwok 2006	RCT. Intervention to determine whether bed-chair pressure sensors reduced physical restraint use. Falls reported as adverse events
Lackner 2008	RCT in cognitively impaired nursing home residents with urge urinary incontinence. Falls reported as adverse events
Lord 2003b	RCT. Majority of participants community-dwelling. Only 121/551 participants were residents of an intermediate level nursing care facility
McRae 1996	Not RCT. Falls and fallers were not a primary outcome but were monitored as possible adverse events

(*Continued*)

Mudge 2008	Non-randomised controlled study. Patients admitted to an intervention ward or control ward
Ouslander 2005	RCT testing 'Functional Incidental Training' in nursing homes. Not designed to reduce falls. Falls recorded as adverse events
Peri 2008	RCT (cluster). Pilot for Kerse 2008 (same intervention). Excluded because falls were recorded as possible adverse effects of the intervention
Rantz 2001	RCT. Quality improvement intervention in nursing care facilities targeting 29 quality indicators, of which falls was one. Only included 87/113 homes in the analysis (23% loss). Insufficient information provided on falls outcomes to use in this review
Ray 2005	RCT. Study of falls related injuries. No data provided on falls or fallers
Resnick 2002	Participants resident in continuing care retirement community but all living independently
Resnick 2012	RCT in assisted living facilities. Testing changing model of care to function-focused care. Falls monitored as a safety issue, i.e. adverse events. Hypothesised that the intervention might increase the likelihood of falling
Rolland 2007	RCT. Exercise programme to improve ability to perform ADL for people with Alzheimer's disease in nursing homes. Falls monitored as a safety issue, i.e. adverse events
Sackley 2009	RCT. Falls described as an outcome at trial registration but not mentioned as an outcome in the published paper
Sato 2000	RCT. Etidronate versus placebo in older people with post stroke hemiplegia. Falls outcomes
Sato 2005a	RCT. Vitamin D vs placebo in older people with post stroke hemiplegia. Falls outcomes
Sato 2005b	RCT. Folate and mecobalamine (vitamin B12) vs placebo in older people with post stroke hemiplegia. Falls outcomes
Sato 2011	RCT. Aledronate versus alphacalcidol in older people post stroke. Falls outcomes
Schneider 2006	The objective of this study was to determine the effectiveness of atypical antipsychotic medications. Falls were monitored as a potential adverse effect
Schwendimann 2006	Not RCT. Described as quasi-randomised in abstract but author confirmed that all consecutively admitted patients were allocated at non-random order either to nursing unit A or B whenever a free hospital bed was available (1 to 5 admissions/discharges per day). Nurse-led fall prevention programme
Shimada 2003	RCT. Majority of participants community-dwelling (62%)
Shimada 2009	Not RCT. Exercise intervention versus control in a residential care facility. Falls outcomes. Intervention on 2 days per week and 2 other days randomly selected to be control days
Southard 2006	RCT with no falls outcomes. Balance and confidence were the primary outcomes of this study

(*Continued*)

Steadman 2003	RCT. Participants were attendees of a hospital-based falls clinic. "Prevously living in the community" [personal communication]. Not preventing falls in hospital or nursing care facility
Tariot 2004	RCT. Trial testing effectiveness of memantine in people with Alzheimer's disease already receiving donepezil. Falls were monitored as a potential adverse effect of the intervention
Tariot 2005	RCT. Trial testing effectiveness of divalproex sodium in nursing home residents with possible or probable Alzheimer disease. Falls were monitored as a potential adverse effect of the intervention
Underwood 2011	Ongoing RCT (cluster randomised). Exercise intervention in residential and nursing homes Primary outcome depression. No falls outcomes. Recording peripheral fractures and fear of falling
Vassallo 2004	Non-randomised controlled trial of a multidisciplinary fall-prevention programme in hospital. Falls outcomes
Von Koch 2001	RCT. Intervention: rehabilitation at home after a stroke. Not intervention to prevent falls; falls recorded as adverse events
Wolf 2003	RCT. Participants in independent living facilities or congregate living facilities, i.e. not nursing care facilities. Community-dwelling
Zhong 2007	RCT. Institutionalised participants with dementia randomised to quetiapine 200 mg per day, 100 mg per day, or placebo. Falls monitored as a potential adverse effect of the intervention

ADL: activities of daily living
RCT: randomised controlled trial

Characteristics of studies awaiting assessment *[ordered by study ID]*

MacRitchie 2001

Methods	RCT
Participants	Setting and sample: two nursing homes, Connecticut, USA N = 88 Age (years): mean 84 (SD 6.9), range 65 to 98 Inclusion criteria: none stated
Interventions	1. Standing-exercise Functional Maintenance programme of 4 months duration 2. Control
Outcomes	1. Incidence of falls
Notes	Thesis identified in *The Cochrane Library* (CENTRAL). No usable falls data in abstract. No published papers identified

Streim 2012

Methods	RCT
Participants	Setting and sample: residents in nursing homes and assisted living facilities within 30 miles of Philadelphia, USA N = 94 Age (years): range 60 to 95 Inclusion criteria: ambulatory; cognitively intact or with mild-moderate impairment but capable of self-reporting depression symptoms; receiving antidepressant treatment for a single episode of depression; in full remission for at least six months
Interventions	1. Discontine taking antidepressants 2. Control: continue taking antidepressants A third non-randomised arm of people choosing to discontinue antidepressants
Outcomes	1. Number of falls per week Other outcomes not included in this review, e.g. depression and cognition
Notes	Trial identified as an abstract only, with no falls results reported. Waiting for full report

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

ACTRN12611000332921

Trial name or title	Falls prevention in the acute hospital setting: a multi-centre cluster randomised controlled trial of efficacy, cost-effectiveness and sustainability of the 6-PACK programme
Methods	RCT (cluster randomised)
Participants	Setting and sample: six to eight hospitals, Australia N = 24 wards Inclusion criteria (wards): acute medical and surgical wards (primarily adult wards); average patient length of stay < 10 days; with $\leq$ 1 low-low bed to six standard beds on medical wards and $\leq$1 low-low bed to 29 standard beds on surgical wards Inclusion criteria (patients): aged 0 to 125; admitted to one of the randomised wards Exclusion criterion (wards): using a daily falls risk assessment and/or intervention checklist (not excluded for completing falls risk assessment tool on admission and / or as status changes)
Interventions	1. 6-PACK programme (completion of a nine-item falls risk assessment and six nursing interventions): "falls alert" sign above the patient's bed; supervision of patients while in the bathroom; ensuring that the patient's walking aid is within reach; establishment of a toileting regime; use of a low-low bed and use of bed/chair alarm. Intervention wards receive 6-PACK equipment; small group training and assignment of clinical leaders; audit, feedback and reminders 2. Control: usual care
Outcomes	1. Fall rates 2. Fall-related injury rates 3. Economic evaluation
Starting date	01 May 2011 (completed)

ACTRN12611000332921 (*Continued*)

Contact information	Dr Anna Barker Department of Epidemiology & Preventive Medicine Monash University Level 6, The Alfred Centre 99 Commerical Road Melbourne VIC 3000 Australia Email: Anna.Barker@monash.edu
Notes	*See* also www.falls6pack.monash.org Not just older patients

ACTRN12612000103864

Trial name or title	In residents of aged care facilities, can Tai Chi and/ or Yoga compared with usual care improve balance and prevent falls?
Methods	RCT (individually randomised)
Participants	Setting: one aged care facility in Newcastle, Australia N = 30 Sample: residents in aged care facility Inclusion criteria: able to stand with hand support; able to understand English; able to understand and follow simple instructions and demonstrations Exclusion criteria: severe debilitating illness; severe cognitive impairment; inability to see; inability to hear; medically unfit for exercise
Interventions	1. Modified yoga (limbering movements, asanas, breathing practices and a type of relaxation meditation called 'yoga nidra'). Half hour sessions, 2 x per wk for 14 wk 2. Modified Tai Chi (slow, controlled and circular movements using functional patterns and engaging the mind). Half hour sessions, 2 x per wk for 14 wk Control: offered a ' Staying Active' programme (weekly half hour seated exercise sessions; gym with bikes, pulleys, and massage by a trained staff; games and group activities, e.g. Bingo)
Outcomes	Duration of study: intervention period plus 6 months follow-up 1. Number of falls Other outcomes not included in this review
Starting date	29 August 2011
Contact information	Prof I Higgins Professor of Older Person Nursing School of Nursing and Midwifery Faculty of Health, University of Newcastle Callaghan, NSW 2308 Email: Isabel.Higgins@newcastle.edu.au

ACTRN12612000103864 (*Continued*)

Notes	

ISRCTN44972300

Trial name or title	REFINE
Methods	RCT (individually randomised)
Participants	In-patients (acute care) aged 65 and over
Interventions	1. Pressure sensor alert system, to alert staff to patients rising from their bed or chair 2. Usual care
Outcomes	1. Number of bedside in-patient falls per 1000 bed days from time of randomisation until the participant is discharged from the ward
Starting date	28 October 2008 (completed 2011)
Contact information	Prof O Sahota Professor in Orthogeriatric Medicine & Consultant Physician Queens Medical Centre Nottingham University Hospitals NHS Trust Nottingham NG7 2UH United Kingdom Email: opinder.sahota@nuh.nhs.uk
Notes	

ISRCTN90761620

Trial name or title	CARE MED
Methods	RCT (cluster randomised)
Participants	N = 30 nursing homes (824 participants) Inclusion criteria: nursing homes registered for more than 6 months, and with average age of residents >65 years Exclusion criteria: care homes specifically for people with dementia, learning difficulties, sensory impairment, mental health problems, physical disabilities, with alcohol dependence, which have received a medication review service from the PCT in the last six months, with residents who self-medicate
Interventions	1. Multi-professional medication review for 12 months 2. Usual care
Outcomes	1. Number of falls
Starting date	01 November 2010 (completed)

ISRCTN90761620 (*Continued*)

Contact information	Ms Julie Houghton University of East Anglia School of Pharmacy Earlham Road Norwich NR4 7TJ United Kingdom Email J.Houghton@uea.ac.uk
Notes	

NCT00636675

Trial name or title	CONNECT
Methods	RCT (cluster randomised by nursing home)
Participants	16 nursing homes (560 residents and 576 staff members)
Interventions	1. CONNECT plus standard FALLS quality improvement programme. CONNECT is a multi-component intervention that helps staff: learn new strategies to improve day-to-day interactions; establish relationship networks for creative problem-solving; and sustain newly acquired interaction behaviours through mentorship 2. FALLS quality improvement programme
Outcomes	1. Fall rates (secondary outcome)
Starting date	September 2009. Estimated completion date September 2016
Contact information	Ruth A Anderson, RN, PhD Duke University School of Nursing Durham, North Carolina, United States, 27710 Email: ruth.anderson@duke.edu
Notes	

NCT00817869

Trial name or title	The HIP-HOP flooring study
Methods	RCT (cluster randomised)
Participants	8 hospital wards (elderly general rehabilitation and elderly mental health)
Interventions	1. New flooring (8.3 mm thick floor covering (Omnisports EXCEL) to replace previous floor covering) 2. Standard flooring (ward will remain with standard floor covering. The overlay will have a comparable slip resistance rating to the new flooring. The subfloor will also be comparable)

NCT00817869 (*Continued*)

Outcomes	1. Number of falls 2. Fall-related injury Other outcomes not included in this review
Starting date	April 2010. Follow-up completed August 2011
Contact information	Amy K Drahota School of Health Sciences & Social Work University of Portsmouth Portsmouth PO1 2FR Hampshire, UK Email: amy.drahota@port.ac.uk
Notes	*See* also www.hiphopflooringstudy.org.uk

NCT01054287

Trial name or title	Falls prevention in acute care hospital (PRECEPT)
Methods	RCT
Participants	Inclusion criterion: all patients admitted to internal medicine ward
Interventions	1. Multifactorial falls prevention program 2. Control: usual care
Outcomes	1. Rate of falls over 2 years
Starting date	Not stated. Trial registered 21 January 2010
Contact information	Stephane Rochat, MD Centre Hospitalier Universitaire Vaudois Switzerland Email: stephane.rochat@chuv.ch
Notes	

NCT01375790

Trial name or title	Whole-body vibration training in older people (GERIAPLAT)
Methods	RCT (multicentre)
Participants	Setting: 10 nursing homes in Spain N = 160 Sample: volunteer residents Inclusion criteria: aged ≥ 65; resident in nursing home

NCT01375790 (*Continued*)

	Exclusion criteria: acute disease (not resolved during 10 days); pacemaker; epilepsy; high risk of thromboembolism; knee or hip prosthesis; musculoskeletal, physical or cognitive disorder preventing test and training procedures
Interventions	1. Whole body vibration + exercise: static/dynamic exercises (balance and resistance training) performed on a vibratory platform (Frequency: 30-35 Hz; Amplitude: 2-4 mm). 3 x per wk for 6 wk 2. Exercise alone: same exercise programme with no whole body vibration
Outcomes	1. Number of falls Other outcomes not included in this review
Starting date	November 2010
Contact information	Mª José Martínez Zapata Email: mj.martinez.zapata@gmail.com
Notes	

NCT01483456

Trial name or title	Impact of multidisciplinary program on falls in elderly inpatients (IPR)
Methods	RCT
Participants	Setting: hospitals (rehabilitation wards and geriatric acute wards), France N = 1680 (target sample size) Inclusion criteria: aged ≥ 65; admitted during study; consenting Exclusion criteria: cognitively impaired (MMSE < 10); psychiatric pathology; bedridden
Interventions	1. Multifactorial intervention: identification of patient's fall risk: multifactorial fall prevention program (integrated actions targeted on risk factors, exercise programs and review of the hospital environment); "Get up" workshop and morbidity and mortality conferences related to fall cases 2. Usual care
Outcomes	1. Incidence of falls 2. Incidence of fall-related injury
Starting date	July 2011
Contact information	P Krolak-Salmon Hospices Civils de Lyon Email: pierre.krolak-salmon@chu-lyon.fr
Notes	IPR (in French "Identifier, Prévenir, Relever"). Study design described as "Intervention model: single group assignment" no mention of a control group. Contact person has confirmed that this is an RCT

NCT01551121

Trial name or title	Assessment of an automated telesurveillance system on the incidence of serious falls in nursing homes (TELEHPAD)
Methods	RCT (individually randomised)
Participants	Settting: 3 Nursing homes in the Limousin region Target sample size: N = 216 Sample: people admitted to Limoges or Gueret nursing homes Inclusion criteria: aged $\geq$ 75; consenting; able to understand the study and complete evaluations; able to stand up from the bed; covered by French health insurance Exclusion criteria: short term prognosis; in multiple bed room and one co-occupant does consent to participate
Interventions	1. Installation of automated telesurveillance system (camera installed in room) 2. Usual care
Outcomes	Duration: 1 year 1. Number of people falling
Starting date	March 2012
Contact information	Thierry Dantoine, MD University Hospital Limoges Email: thierry.dantoine@chu-limoges.fr
Notes	

NCT01561872

Trial name or title	Assessment of an automated telesurveillance system on serious falls prevention in an elderly suffering from dementia specialized care unit: the URCC (GET-BETTER)
Methods	RCT (individually randomised)
Participants	Setting: Limoges and Brive's URCC Target sample size = 350 Inclusion criteria: men and women aged >65; admitted to Limoges or Brive's URCC (dementia care unit); consenting; covered by French health insurance Exclusion criteria: short term prognosis
Interventions	1. Automated telesurveillance system (camera installed) 2. Control: usual care (no telesurveillance)
Outcomes	Duration of study: 6 months 1. Rate of falls 2. Rate of injurious falls
Starting date	April 2012

NCT01561872 (*Continued*)

Contact information	Dr T Dantoine University Hospital Limoges France Email: thierry.dantoine@chu-limoges.fr
Notes	URCC: Unité de Réadaptation Cogintico-Comportementale (Unit for demented patients' rehabilitation) (Dantoine T, personal communication Oct 20 2012)

NCT01618786

Trial name or title	Randomized controlled trial of compliant flooring to reduce injuries due to falls in older adults in a long-term care facility (FLIP)
Methods	RCT
Participants	Setting: one long-term care facility, Burnaby, BC, Canada N = 151 (target sample size) Inclusion criteria: resident rooms in four units Exclusion criteria: resident rooms in which new flooring cannot be installed
Interventions	1. Plywood flooring 2. SmartCell flooring
Outcomes	4 year follow-up 1. Falls 2. Fractures 3. Health resource utilization
Starting date	October 2012
Contact information	Dawn C Mackey, PhD Simon Fraser University Email: dmackey@sfu.ca
Notes	

PROF-COG

Trial name or title	Prevention of falls in cognitively impaired older adults living in residential care (PROF-COG)
Methods	RCT (pilot)
Participants	N = 212 (target sample size)

PROF-COG (*Continued*)

Interventions	1. Multifactorial intervention (exercise, dementia related behaviour management, comprehensive geriatric assessment including medication review, staff training, movement sensors) 2. Usual care
Outcomes	1. Falls 2. Costs of the programme Other outcomes not included in this review
Starting date	September 2012
Contact information	Julie Whitney Research Fellow Kings College Hospital London, UK Email: julie.whitney@nhs.net
Notes	

LTC: long-term care

DATA AND ANALYSES

Comparison 1. Exercises vs usual care grouped by level of care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	8	1844	Rate ratio (Random, 95% CI)	1.03 [0.81, 1.31]
1.1 High level nursing care facilities (or mixed levels including high)	4	625	Rate ratio (Random, 95% CI)	1.29 [0.93, 1.79]
1.2 Intermediate level care facilities	4	1219	Rate ratio (Random, 95% CI)	0.80 [0.57, 1.13]
2 Number of fallers	8	1887	Risk Ratio (Random, 95% CI)	1.07 [0.94, 1.23]
2.1 High level nursing care facilities (or mixed levels including high)	3	609	Risk Ratio (Random, 95% CI)	1.17 [0.96, 1.42]
2.2 Intermediate level care facilities	5	1278	Risk Ratio (Random, 95% CI)	0.96 [0.77, 1.21]
3 Number of people sustaining a hip fracture	1		Risk Ratio (Fixed, 95% CI)	Totals not selected

Comparison 2. Exercises vs usual care grouped by type of exercise (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	8		Rate Ratio (Random, 95% CI)	Subtotals only
1.1 Gait, balance, functional training (balance training: mechanical apparatus)	2	53	Rate Ratio (Random, 95% CI)	0.45 [0.24, 0.85]
1.2 Gait, balance, and functional training (balance training: one-leg standing)	1	527	Rate Ratio (Random, 95% CI)	0.82 [0.65, 1.04]
1.3 Gait, balance, functional training (functional walking)	1	154	Rate Ratio (Random, 95% CI)	1.32 [1.09, 1.61]
1.4 Gait, balance, functional training (goal-setting physical activity programme)	1	639	Rate Ratio (Random, 95% CI)	1.11 [0.84, 1.45]
1.5 Combination of exercise categories (*see* Appendix 4 for categories in each trial)	4	561	Rate Ratio (Random, 95% CI)	1.24 [0.84, 1.83]
2 Number of fallers	8		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Gait, balance, and functional training (balance training: mechanical apparatus)	2	53	Risk Ratio (Fixed, 95% CI)	0.72 [0.43, 1.19]

2.2 Gait, balance, and functional training (balance training: one-leg standing)	1	527	Risk Ratio (Fixed, 95% CI)	0.90 [0.65, 1.23]
2.3 Gait, balance, functional training (functional walking)	1	154	Risk Ratio (Fixed, 95% CI)	1.31 [0.87, 1.98]
2.4 Gait, balance, functional training (goal-setting physical activity programme)	1	639	Risk Ratio (Fixed, 95% CI)	1.19 [0.94, 1.50]
2.5 3D (Tai Chi)	1	59	Risk Ratio (Fixed, 95% CI)	0.60 [0.19, 1.87]
2.6 Combination of exercise categories (*see* Appendix 4 for categories in each trial)	3	545	Risk Ratio (Fixed, 95% CI)	1.12 [0.92, 1.37]

Comparison 3. Medication review by pharmacist vs usual care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	2		Rate ratio (Fixed, 95% CI)	Totals not selected
2 Number of fallers	4	4857	Risk Ratio (Fixed, 95% CI)	1.00 [0.91, 1.10]

Comparison 4. Vitamin D supplementation vs no vitamin D supplementation (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	5	4603	Rate ratio (Random, 95% CI)	0.63 [0.46, 0.86]
1.1 Vitamin D3 + calcium vs calcium	2	747	Rate ratio (Random, 95% CI)	0.71 [0.56, 0.90]
1.2 Vitamin D2 vs usual care or placebo	2	3765	Rate ratio (Random, 95% CI)	0.55 [0.19, 1.64]
1.3 Multivitamins (including vitamin D3 + calcium) vs placebo	1	91	Rate ratio (Random, 95% CI)	0.38 [0.20, 0.71]
2 Number of fallers	6	5186	Risk Ratio (Random, 95% CI)	0.99 [0.90, 1.08]
2.1 Vitamin D3 + calcium vs calcium	2	747	Risk Ratio (Random, 95% CI)	0.85 [0.69, 1.05]
2.2 Vitamin D3 + calcium vs placebo	1	583	Risk Ratio (Random, 95% CI)	1.03 [0.90, 1.18]
2.3 Vitamin D2 vs usual care or placebo	2	3765	Risk Ratio (Random, 95% CI)	0.80 [0.38, 1.71]
2.4 Multivitamins (including vitamin D3 + calcium) vs placebo	1	91	Risk Ratio (Random, 95% CI)	0.82 [0.40, 1.66]
3 Number of people sustaining a fracture	4		Risk Ratio (Fixed, 95% CI)	Totals not selected

3.1 Vitamin D + calcium vs calcium	2	Risk Ratio (Fixed, 95% CI)	0.0 [0.0, 0.0]
3.2 Vitamin D + calcium vs placebo	1	Risk Ratio (Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Vitamin D vs usual care or placebo	1	Risk Ratio (Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 5. Environmental interventions vs usual care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	1		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Wireless position-monitoring patch vs usual care	1	72	Rate Ratio (Fixed, 95% CI)	0.65 [0.33, 1.27]

Comparison 6. Social environment vs usual care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	3		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Staff education on fracture prevention vs usual care	1	5637	Rate Ratio (Fixed, 95% CI)	1.19 [0.92, 1.53]
1.2 Guideline implementation programme vs control	1	392	Rate Ratio (Fixed, 95% CI)	0.63 [0.34, 1.16]
1.3 Risk assessment tool vs nurses' judgement	1	1125	Rate Ratio (Fixed, 95% CI)	0.96 [0.84, 1.10]
2 Number of fallers	1		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Risk assessment tool vs nurses' judgement	1	1125	Risk Ratio (Fixed, 95% CI)	0.99 [0.85, 1.16]
3 Number of people sustaining a fracture	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
3.1 Risk assessment tool vs nurses' judgement	1	1125	Risk Ratio (Fixed, 95% CI)	0.96 [0.57, 1.63]
3.2 Project nurse facilitating best-practice falls injury prevention strategies vs usual care	1	5391	Risk Ratio (Fixed, 95% CI)	0.95 [0.63, 1.44]

Comparison 7. Other single interventions vs control (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	2		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Lavender patch vs placebo	1	145	Rate Ratio (Fixed, 95% CI)	0.57 [0.32, 1.01]
1.2 Sunlight exposure vs usual care	1	395	Rate Ratio (Fixed, 95% CI)	1.05 [0.71, 1.56]
2 Number of fallers	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Lavender patch vs placebo	1	145	Risk Ratio (Fixed, 95% CI)	0.67 [0.40, 1.12]
2.2 Sunlight exposure vs usual care	1	395	Risk Ratio (Fixed, 95% CI)	1.09 [0.88, 1.36]
3 Number of people sustaining a fracture	1		Risk Ratio (Fixed, 95% CI)	Subtotals only
3.1 Sunlight exposure vs usual care	1	395	Risk Ratio (Fixed, 95% CI)	1.07 [0.53, 2.17]

Comparison 8. Multiple interventions vs usual care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	2		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Exercise + management of urinary incontinence + fluid therapy vs usual care	1	190	Rate Ratio (Fixed, 95% CI)	0.62 [0.38, 1.01]
1.2 Sunlight exposure + calcium vs usual care	1	412	Rate Ratio (Fixed, 95% CI)	1.03 [0.85, 1.25]
2 Number of fallers	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Exercise + management of urinary incontinence + fluid therapy vs usual care	1	190	Risk Ratio (Fixed, 95% CI)	0.62 [0.36, 1.05]
2.2 Sunlight exposure + calcium vs usual care	1	412	Risk Ratio (Fixed, 95% CI)	0.96 [0.77, 1.19]
3 Number of people sustaining a fracture	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
3.1 Exercise + management of urinary incontinence + fluid therapy vs usual care	1	190	Risk Ratio (Fixed, 95% CI)	4.26 [0.48, 37.55]
3.2 Sunlight exposure + calcium vs usual care	1	412	Risk Ratio (Fixed, 95% CI)	0.78 [0.36, 1.67]

Comparison 9. Multifactorial interventions vs usual care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	7	2876	Rate ratio (Random, 95% CI)	0.78 [0.59, 1.04]
2 Number of fallers	7	2632	Risk Ratio (Random, 95% CI)	0.89 [0.77, 1.02]
3 Number of people sustaining a hip fracture	3	1639	Risk Ratio (Random, 95% CI)	0.48 [0.24, 0.98]

Comparison 10. Multifactorial interventions vs usual care grouped by level of care (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	7	2876	Rate Ratio (Random, 95% CI)	0.78 [0.59, 1.04]
1.1 High level nursing care facilities (or mixed levels including high)	4	2206	Rate Ratio (Random, 95% CI)	0.88 [0.59, 1.29]
1.2 Intermediate level care facilities	3	670	Rate Ratio (Random, 95% CI)	0.64 [0.50, 0.83]
2 Number of fallers	7	2632	Risk Ratio (Random, 95% CI)	0.89 [0.77, 1.02]
2.1 High level nursing care facilities (or mixed levels including high)	4	1962	Risk Ratio (Random, 95% CI)	0.94 [0.80, 1.09]
2.2 Intermediate level care facilities	3	670	Risk Ratio (Random, 95% CI)	0.75 [0.60, 0.94]

Comparison 11. Multifactorial interventions vs usual care grouped by level of cognition (care facilities)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	7		Rate ratio (Random, 95% CI)	Subtotals only
1.1 Participants with cognitive impairment	3	1008	Rate ratio (Random, 95% CI)	0.72 [0.40, 1.31]
1.2 Participants with no cognitive impairment or mixed sample	6	1590	Rate ratio (Random, 95% CI)	0.78 [0.58, 1.05]
2 Number of fallers	7		Risk Ratio (Random, 95% CI)	Subtotals only
2.1 Participants with cognitive impairment	3	764	Risk Ratio (Random, 95% CI)	0.75 [0.50, 1.12]
2.2 Participants with no cognitive impairment or mixed sample	6	1590	Risk Ratio (Random, 95% CI)	0.94 [0.80, 1.11]

Comparison 12. Exercises vs usual physiotherapy (hospitals)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	1	54	Rate Ratio (Fixed, 95% CI)	0.54 [0.16, 1.81]
2 Number of fallers	2	83	Risk Ratio (Fixed, 95% CI)	0.36 [0.14, 0.93]

Comparison 13. Vitamin D supplements vs no vitamin D supplements (hospital)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Number of fallers	1		Risk Ratio (Fixed, 95% CI)	Subtotals only
1.1 Vitamin D + calcium vs calcium	1	203	Risk Ratio (Fixed, 95% CI)	0.82 [0.59, 1.14]
2 Number of people sustaining a fracture	1		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Vitamin D + calcium vs calcium	1	203	Risk Ratio (Fixed, 95% CI)	0.34 [0.04, 3.05]

Comparison 14. Environmental interventions vs usual care (hospitals)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	3		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Carpet flooring vs vinyl flooring	1	54	Rate Ratio (Fixed, 95% CI)	14.73 [1.88, 115.35]
1.2 Low-low beds vs usual care	1	11099	Rate Ratio (Fixed, 95% CI)	1.39 [0.22, 8.78]
1.3 Blue identification bracelet vs usual care (no bracelet)	1	134	Rate Ratio (Fixed, 95% CI)	1.15 [0.72, 1.84]
2 Number of fallers	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Carpet flooring vs vinyl flooring	1	54	Risk Ratio (Fixed, 95% CI)	8.33 [0.95, 73.37]
2.2 Blue identification bracelet vs usual care (no bracelet)	1	134	Risk Ratio (Fixed, 95% CI)	1.34 [0.76, 2.36]

Comparison 15. Social environment vs control (hospitals)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	4		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Multifaceted fall prevention guideline implementation vs routine dissemination	1	1122	Rate Ratio (Fixed, 95% CI)	1.82 [0.23, 14.55]
1.2 Guideline implementation programme vs control	1	2201	Rate Ratio (Fixed, 95% CI)	0.67 [0.17, 2.59]
1.3 Fall prevention tool kit software vs usual care	1	5264	Rate Ratio (Fixed, 95% CI)	0.55 [0.02, 16.29]
1.4 Acute care service for elderly patients vs usual care	1	217	Rate Ratio (Fixed, 95% CI)	0.72 [0.10, 5.10]
2 Number of fallers	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Fall prevention tool kit software vs usual care	1	5264	Risk Ratio (Fixed, 95% CI)	0.91 [0.06, 14.21]
2.2 Behaviour advisory service vs usual care	1	71	Risk Ratio (Fixed, 95% CI)	2.44 [0.85, 7.02]

Comparison 16. Knowledge/education interventions vs usual care (hospitals)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	1		Rate Ratio (Fixed, 95% CI)	Subtotals only
1.1 Educational materials + health professional follow-up vs usual care	1	782	Rate Ratio (Fixed, 95% CI)	0.83 [0.54, 1.27]
1.2 Educational materials only vs usual care	1	805	Rate Ratio (Fixed, 95% CI)	0.91 [0.62, 1.35]
2 Number of fallers	2		Risk Ratio (Fixed, 95% CI)	Subtotals only
2.1 Individualised educational session vs usual care	1	1822	Risk Ratio (Fixed, 95% CI)	0.29 [0.11, 0.74]
2.2 Educational materials + health professional follow-up vs usual care	1	782	Risk Ratio (Fixed, 95% CI)	0.74 [0.48, 1.14]
2.3 Educational materials only vs usual care	1	805	Risk Ratio (Fixed, 95% CI)	0.84 [0.56, 1.27]

Comparison 17. Multifactorial interventions vs usual care (hospitals)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Rate of falls	4	6478	Rate ratio (Random, 95% CI)	0.69 [0.49, 0.96]
2 Number of fallers	3	4824	Risk Ratio (Random, 95% CI)	0.71 [0.46, 1.09]
3 Number of people sustaining a fracture	3	4814	Risk Ratio (Random, 95% CI)	0.43 [0.10, 1.78]

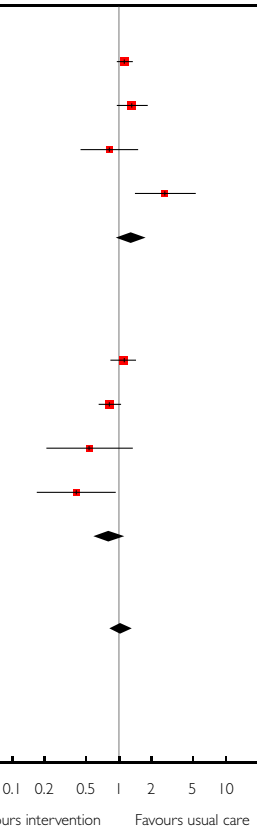
Analysis 1.1. Comparison 1 Exercises vs usual care grouped by level of care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 1 Exercises vs usual care grouped by level of care (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate ratio] (SE)	Rate ratio IV,Random,95% CI	Weight	Rate ratio IV,Random,95% CI
1 High level nursing care facilities (or mixed levels including high)						
Faber 2006 (1)	142	90	0.12 (0.09)		19.8 %	1.13 [0.95, 1.35]
Mulrow 1994	97	97	0.28 (0.17)		15.6 %	1.32 [0.95, 1.85]
Rosendahl 2008	87	96	-0.2 (0.32)		9.0 %	0.82 [0.44, 1.53]
Schoenfelder 2000	9	7	1 (0.33)		8.6 %	2.72 [1.42, 5.19]
Subtotal (95% CI)	**335**	**290**			**53.0 %**	**1.29 [0.93, 1.79]**
Heterogeneity: Tau^2 = 0.06; Chi^2 = 8.38, df = 3 (P = 0.04); I^2 =64%						
Test for overall effect: Z = 1.53 (P = 0.13)						
2 Intermediate level care facilities						
Kerse 2008	310	329	0.1 (0.14)		17.3 %	1.11 [0.84, 1.45]
Sakamoto 2006	315	212	-0.2 (0.12)		18.3 %	0.82 [0.65, 1.04]
Shimada 2004	15	11	-0.63 (0.47)		5.3 %	0.53 [0.21, 1.34]
Sihvonen 2004	20	7	-0.92 (0.43)		6.1 %	0.40 [0.17, 0.93]
Subtotal (95% CI)	**660**	**559**			**47.0 %**	**0.80 [0.57, 1.13]**
Heterogeneity: Tau^2 = 0.06; Chi^2 = 7.55, df = 3 (P = 0.06); I^2 =60%						
Test for overall effect: Z = 1.28 (P = 0.20)						
Total (95% CI)	**995**	**849**			**100.0 %**	**1.03 [0.81, 1.31]**
Heterogeneity: Tau^2 = 0.07; Chi^2 = 22.98, df = 7 (P = 0.002); I^2 =70%						
Test for overall effect: Z = 0.22 (P = 0.83)						
Test for subgroup differences: Chi^2 = 3.93, df = 1 (P = 0.05), I^2 =75%						



(1) Functional Walking (FW) and In Balance groups (IB) combined vs control

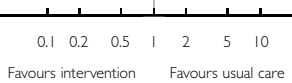
Analysis 1.2. Comparison 1 Exercises vs usual care grouped by level of care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 1 Exercises vs usual care grouped by level of care (care facilities)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Random,95% CI	Weight	Risk Ratio IV,Random,95% CI
1 High level nursing care facilities (or mixed levels including high)						
Faber 2006 (1)	142	90	0.31 (0.19)		12.5 %	1.36 [0.94, 1.98]
Mulrow 1994	97	97	0.15 (0.17)		15.4 %	1.16 [0.83, 1.62]
Rosendahl 2008	87	96	0.05 (0.16)		17.3 %	1.05 [0.77, 1.44]
Subtotal (95% CI)	**326**	**283**			**45.3 %**	**1.17 [0.96, 1.42]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 1.10, df = 2 (P = 0.58); I^2 =0.0%						
Test for overall effect: Z = 1.56 (P = 0.12)						
2 Intermediate level care facilities						
Choi 2005	29	30	-0.51 (0.58)		1.4 %	0.60 [0.19, 1.87]
Kerse 2008	310	329	0.17 (0.12)		28.9 %	1.19 [0.94, 1.50]
Sakamoto 2006	315	212	-0.11 (0.16)		17.3 %	0.90 [0.65, 1.23]
Shimada 2004	15	11	-0.49 (0.46)		2.2 %	0.61 [0.25, 1.51]
Sihvonen 2004	20	7	-0.26 (0.31)		4.9 %	0.77 [0.42, 1.42]
Subtotal (95% CI)	**689**	**589**			**54.7 %**	**0.96 [0.77, 1.21]**
Heterogeneity: Tau^2 = 0.01; Chi^2 = 5.08, df = 4 (P = 0.28); I^2 =21%						
Test for overall effect: Z = 0.32 (P = 0.75)						
Total (95% CI)	**1015**	**872**			**100.0 %**	**1.07 [0.94, 1.23]**
Heterogeneity: Tau^2 = 0.00; Chi^2 = 7.41, df = 7 (P = 0.39); I^2 =5%						
Test for overall effect: Z = 1.01 (P = 0.31)						
Test for subgroup differences: Chi^2 = 1.61, df = 1 (P = 0.21), I^2 =38%						



(1) Functional Walking (FW) and In Balance (IB) groups combined vs control

Analysis 1.3. Comparison 1 Exercises vs usual care grouped by level of care (care facilities), Outcome 3 Number of people sustaining a hip fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 1 Exercises vs usual care grouped by level of care (care facilities)

Outcome: 3 Number of people sustaining a hip fracture

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Risk Ratio IV,Fixed,95% CI
Rosendahl 2008	87	96	-1.83 (1.46)		0.16 [0.01, 2.81]

Analysis 2.1. Comparison 2 Exercises vs usual care grouped by type of exercise (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 2 Exercises vs usual care grouped by type of exercise (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Favours intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Random,95% CI	Weight	Rate Ratio IV,Random,95% CI
1 Gait, balance, functional training (balance training: mechanical apparatus)						
Shimada 2004	15	11	-0.63 (0.47)		45.6 %	0.53 [0.21, 1.34]
Sihvonen 2004	20	7	-0.92 (0.43)		54.4 %	0.40 [0.17, 0.93]
Subtotal (95% CI)	**35**	**18**			**100.0 %**	**0.45 [0.24, 0.85]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.21, df = 1 (P = 0.65); I^2 =0.0%						
Test for overall effect: Z = 2.48 (P = 0.013)						
2 Gait, balance, and functional training (balance training: one-leg standing)						
Sakamoto 2006	315	212	-0.2 (0.12)		100.0 %	0.82 [0.65, 1.04]
Subtotal (95% CI)	**315**	**212**			**100.0 %**	**0.82 [0.65, 1.04]**
Heterogeneity: not applicable						
Test for overall effect: Z = 1.67 (P = 0.096)						
3 Gait, balance, functional training (functional walking)						

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Study or subgroup	Favours intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Random,95% CI	Weight	Rate Ratio IV,Random,95% CI
Faber 2006 (1)	64	90	0.28 (0.1)		100.0 %	1.32 [1.09, 1.61]
Subtotal (95% CI)	**64**	**90**			**100.0 %**	**1.32 [1.09, 1.61]**
Heterogeneity: not applicable						
Test for overall effect: Z = 2.80 (P = 0.00051)						
4 Gait, balance, functional training (goal-setting physical activity programme)						
Kerse 2008	310	329	0.1 (0.14)		100.0 %	1.11 [0.84, 1.45]
Subtotal (95% CI)	**310**	**329**			**100.0 %**	**1.11 [0.84, 1.45]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.71 (P = 0.48)						
5 Combination of exercise categories (*see* Appendix 4 for categories in each trial)						
Faber 2006 (2)	78	90	-0.04 (0.11)		33.4 %	0.96 [0.77, 1.19]
Mulrow 1994	97	97	0.28 (0.17)		29.3 %	1.32 [0.95, 1.85]
Rosendahl 2008	87	96	-0.2 (0.32)		18.9 %	0.82 [0.44, 1.53]
Schoenfelder 2000	9	7	1 (0.33)		18.4 %	2.72 [1.42, 5.19]
Subtotal (95% CI)	**271**	**290**			**100.0 %**	**1.24 [0.84, 1.83]**
Heterogeneity: Tau^2 = 0.11; Chi^2 = 11.06, df = 3 (P = 0.01); I^2 =73%						
Test for overall effect: Z = 1.08 (P = 0.28)						
Test for subgroup differences: Chi^2 = 17.35, df = 4 (P = 0.00), I^2 =77%						

(1) Functional Walking (FW) group vs control

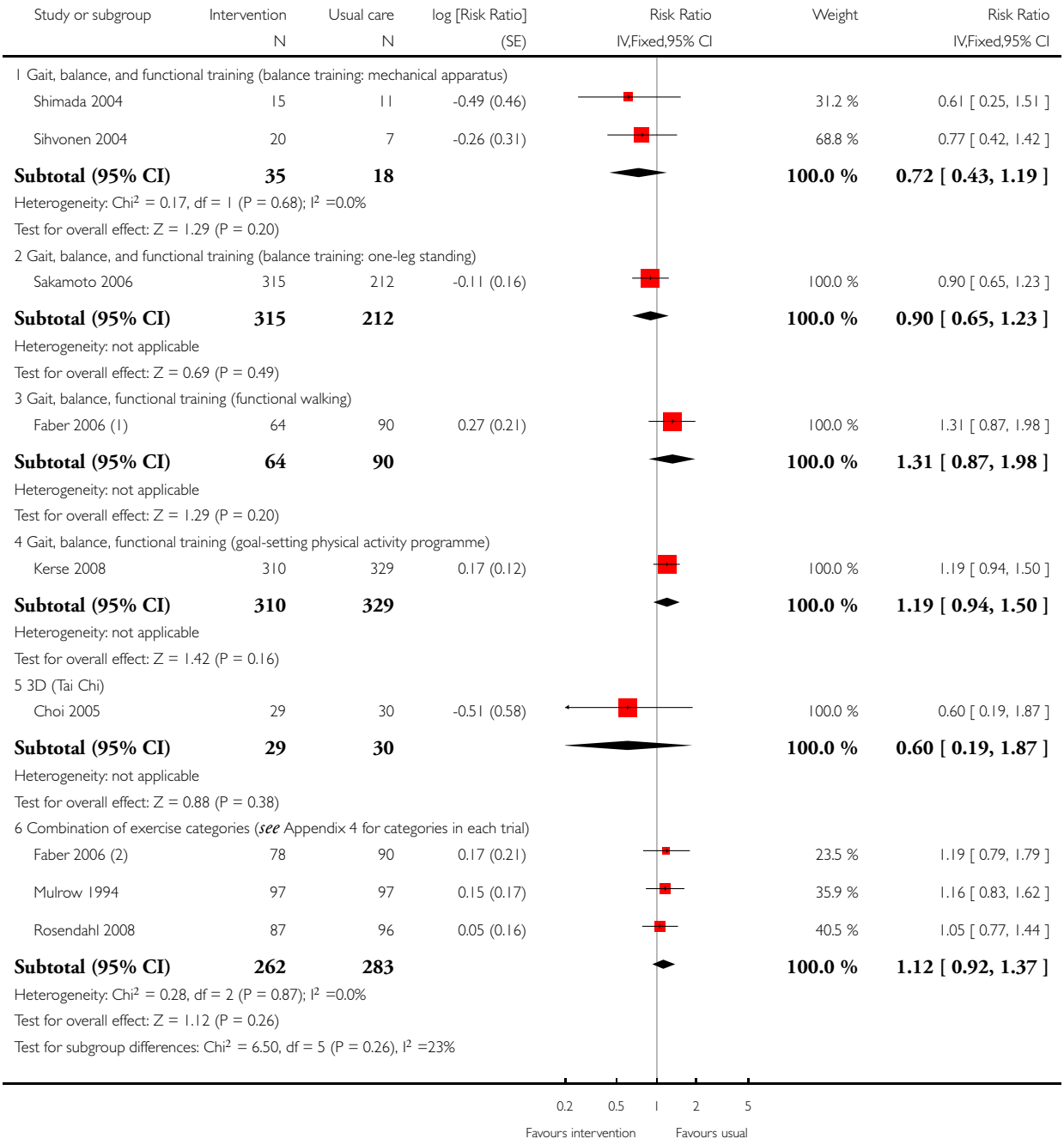
(2) In Balance (IB) group vs control

Analysis 2.2. Comparison 2 Exercises vs usual care grouped by type of exercise (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 2 Exercises vs usual care grouped by type of exercise (care facilities)

Outcome: 2 Number of fallers



(1) Functional Walking (FW) group vs control

(2) In Balance (IB) group vs control

Analysis 3.1. Comparison 3 Medication review by pharmacist vs usual care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 3 Medication review by pharmacist vs usual care (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Control N	log [Rate ratio] (SE)	Rate ratio IV,Fixed,95% CI	Rate ratio IV,Fixed,95% CI
Patterson 2010 (1)	173	161	0.36 (0.15)		1.43 [1.07, 1.92]
Zermansky 2006 (2)	331	330	-0.48 (0.08)		0.62 [0.53, 0.72]

(1) Monthly review targeting psychoactive medication prescribing for 12 months

(2) One review of GP record + consultation with patient and carer

Analysis 3.2. Comparison 3 Medication review by pharmacist vs usual care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 3 Medication review by pharmacist vs usual care (care facilities)

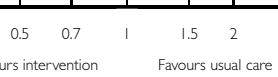
Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Weight	Risk Ratio IV,Fixed,95% CI
Crotty 2004a (1)	56	54	0.17 (0.26)		3.7 %	1.19 [0.71, 1.97]
Crotty 2004b (2)	381	384	0.16 (0.16)		9.7 %	1.17 [0.86, 1.61]
Lapane 2011 (3)	1769	1552	0.03 (0.06)		69.3 %	1.03 [0.92, 1.16]
Zermansky 2006 (4)	331	330	-0.24 (0.12)		17.3 %	0.79 [0.62, 1.00]
Total (95% CI)	**2537**	**2320**			**100.0 %**	**1.00 [0.91, 1.10]**

Heterogeneity: Chi^2 = 5.68, df = 3 (P = 0.13); I^2 =47%

Test for overall effect: Z = 0.02 (P = 0.98)

Test for subgroup differences: Not applicable



(1) Pharmacist transition coordinator for patients discharged from hospital to nursing care facilities for the first time

(2) Pharmacist-led outreach programme (audit + feedback + education of staff regarding medications and falls risk)

(3) GRAM software for decision support for prescribing practices

(4) One review of GP record + consultation with patient and carer

Analysis 4.1. Comparison 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Vitamin D N	No vitamin D N	log [Rate ratio] (SE)	Rate ratio IV,Random,95% CI	Weight	Rate ratio IV,Random,95% CI
1 Vitamin D3 + calcium vs calcium						
Bischoff 2003	62	60	-0.67 (0.41)		10.9 %	0.51 [0.23, 1.14]
Flicker 2005	313	312	-0.31 (0.13)		29.9 %	0.73 [0.57, 0.95]
Subtotal (95% CI)	**375**	**372**			**40.8 %**	**0.71 [0.56, 0.90]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.70, df = 1 (P = 0.40); I^2 =0.0%						
Test for overall effect: Z = 2.77 (P = 0.0057)						
2 Vitamin D2 vs usual care or placebo						
Broe 2007 (1)	23	25	-1.27 (0.51)		7.9 %	0.28 [0.10, 0.76]
Law 2006	1762	1955	-0.14 (0.04)		36.2 %	0.87 [0.80, 0.94]
Subtotal (95% CI)	**1785**	**1980**			**44.1 %**	**0.55 [0.19, 1.64]**
Heterogeneity: Tau^2 = 0.51; Chi^2 = 4.88, df = 1 (P = 0.03); I^2 =80%						
Test for overall effect: Z = 1.07 (P = 0.29)						
3 Multivitamins (including vitamin D3 + calcium) vs placebo						
Grieger 2009	48	43	-0.97 (0.32)		15.1 %	0.38 [0.20, 0.71]
Subtotal (95% CI)	**48**	**43**			**15.1 %**	**0.38 [0.20, 0.71]**
Heterogeneity: not applicable						
Test for overall effect: Z = 3.03 (P = 0.0024)						
Total (95% CI)	**2208**	**2395**			**100.0 %**	**0.63 [0.46, 0.86]**
Heterogeneity: Tau^2 = 0.07; Chi^2 = 14.08, df = 4 (P = 0.01); I^2 =72%						
Test for overall effect: Z = 2.87 (P = 0.0041)						
Test for subgroup differences: Chi^2 = 3.43, df = 2 (P = 0.18), I^2 =42%						

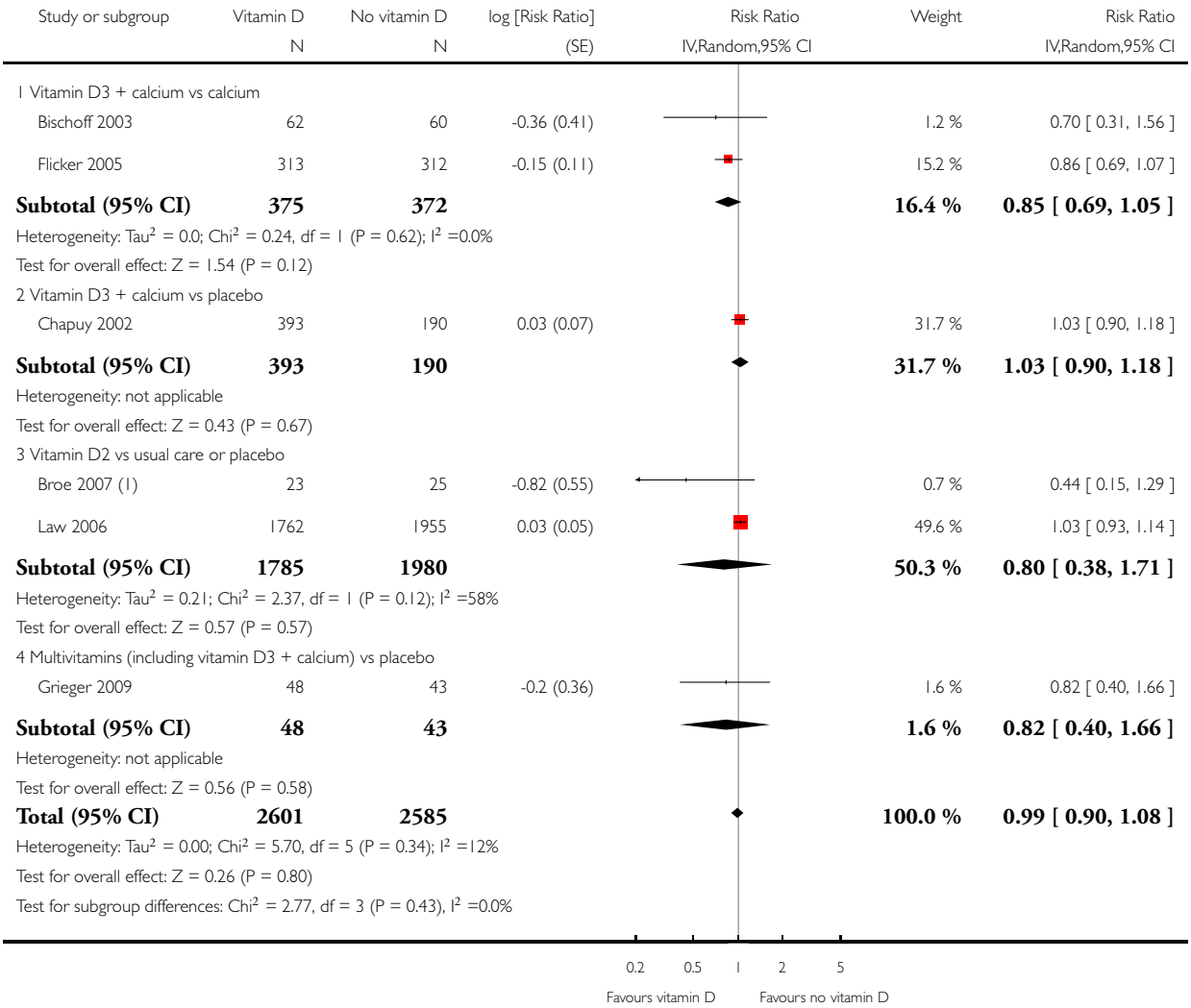
(1) 800 IU vitamin D group only vs placebo

Analysis 4.2. Comparison 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities)

Outcome: 2 Number of fallers



(1) 800 IU vitamin D group only vs placebo

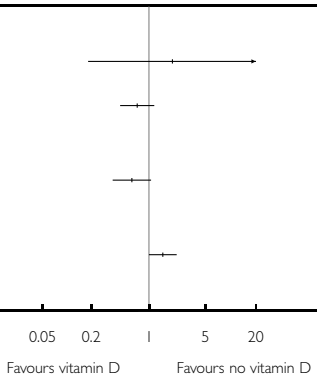
Analysis 4.3. Comparison 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities), Outcome 3 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 4 Vitamin D supplementation vs no vitamin D supplementation (care facilities)

Outcome: 3 Number of people sustaining a fracture

Study or subgroup	Vitamin D N	No vitamin D N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Risk Ratio IV,Fixed,95% CI
1 Vitamin D + calcium vs calcium					
Bischoff 2003 (1)	62	60	0.66 (1.21)		1.93 [0.18, 20.73]
Flicker 2005 (2)	313	312	-0.34 (0.25)		0.71 [0.44, 1.16]
2 Vitamin D + calcium vs placebo					
Chapuy 2002 (3)	393	190	-0.48 (0.28)		0.62 [0.36, 1.07]
3 Vitamin D vs usual care or placebo					
Law 2006 (4)	1762	1955	0.39 (0.2)		1.48 [1.00, 2.19]



(1) Hip fracture

(2) All fractures

(3) Hip fracture

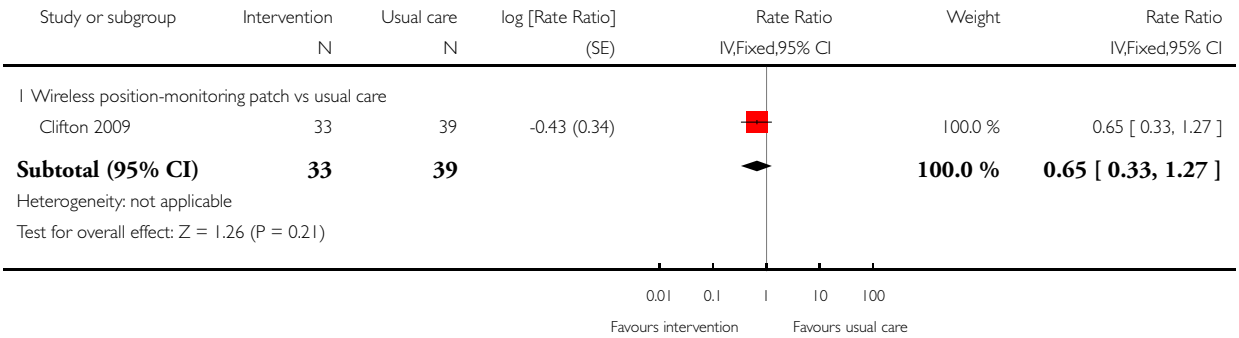
(4) Non vertebral fractures

Analysis 5.1. Comparison 5 Environmental interventions vs usual care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 5 Environmental interventions vs usual care (care facilities)

Outcome: 1 Rate of falls

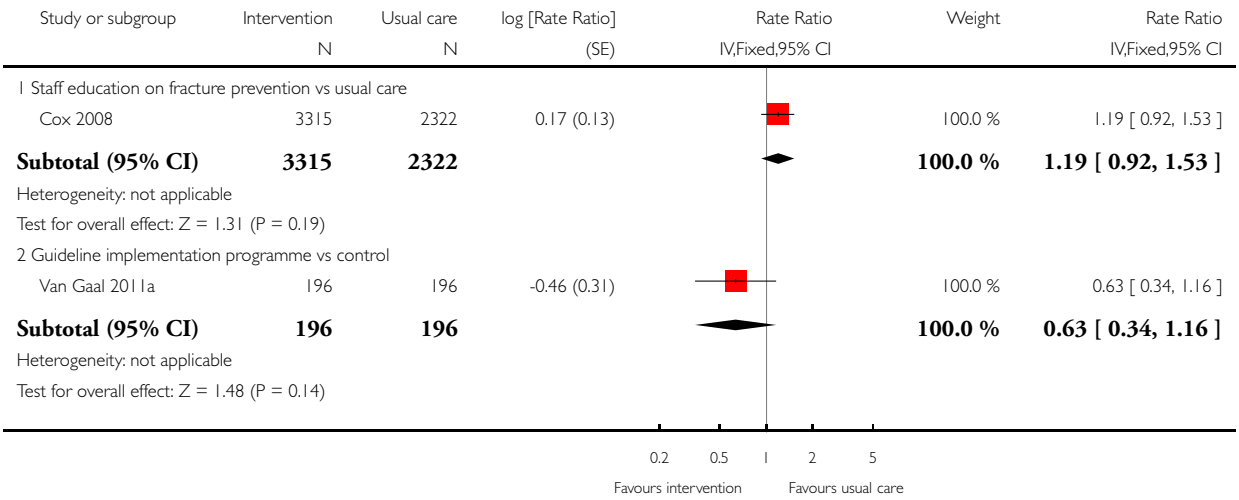


Analysis 6.1. Comparison 6 Social environment vs usual care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 6 Social environment vs usual care (care facilities)

Outcome: 1 Rate of falls



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Study or subgroup	Intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Fixed,95% CI	Weight	Rate Ratio IV,Fixed,95% CI
3 Risk assessment tool vs nurses' judgement						
Meyer 2009	574	551	-0.04 (0.07)		100.0 %	0.96 [0.84, 1.10]
Subtotal (95% CI)	**574**	**551**			**100.0 %**	**0.96 [0.84, 1.10]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.57 (P = 0.57)						

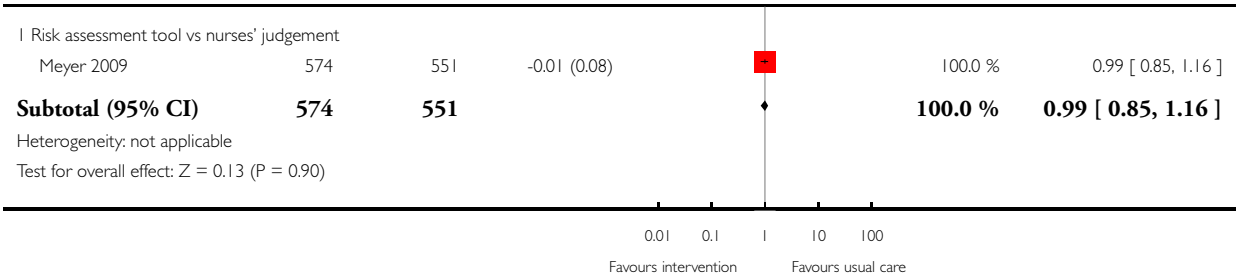
Analysis 6.2. Comparison 6 Social environment vs usual care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 6 Social environment vs usual care (care facilities)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Weight	Risk Ratio IV,Fixed,95% CI
1 Risk assessment tool vs nurses' judgement						
Meyer 2009	574	551	-0.01 (0.08)		100.0 %	0.99 [0.85, 1.16]
Subtotal (95% CI)	**574**	**551**			**100.0 %**	**0.99 [0.85, 1.16]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.13 (P = 0.90)						

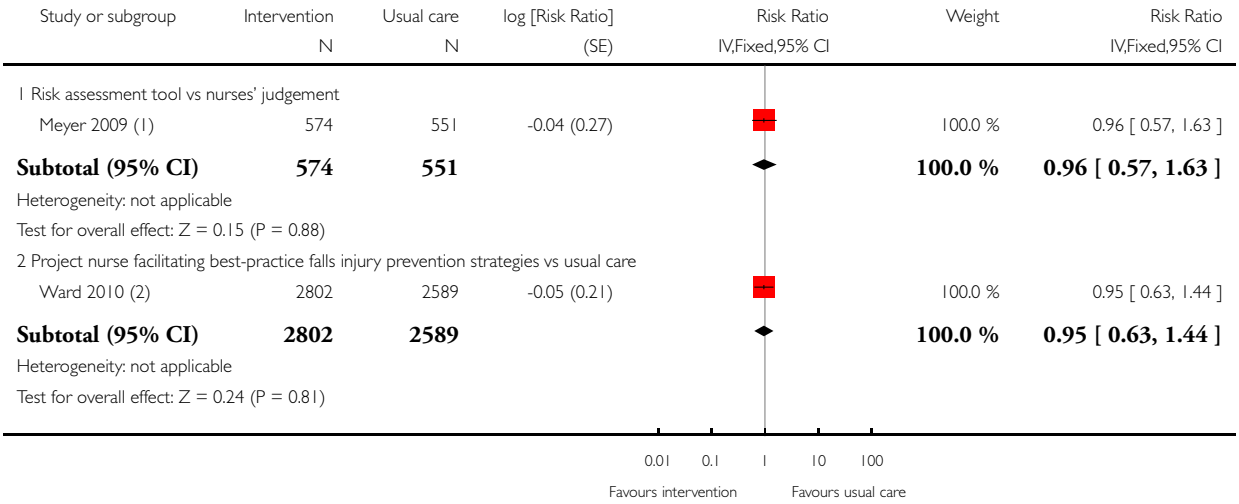


Analysis 6.3. Comparison 6 Social environment vs usual care (care facilities), Outcome 3 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 6 Social environment vs usual care (care facilities)

Outcome: 3 Number of people sustaining a fracture



(1) All fractures

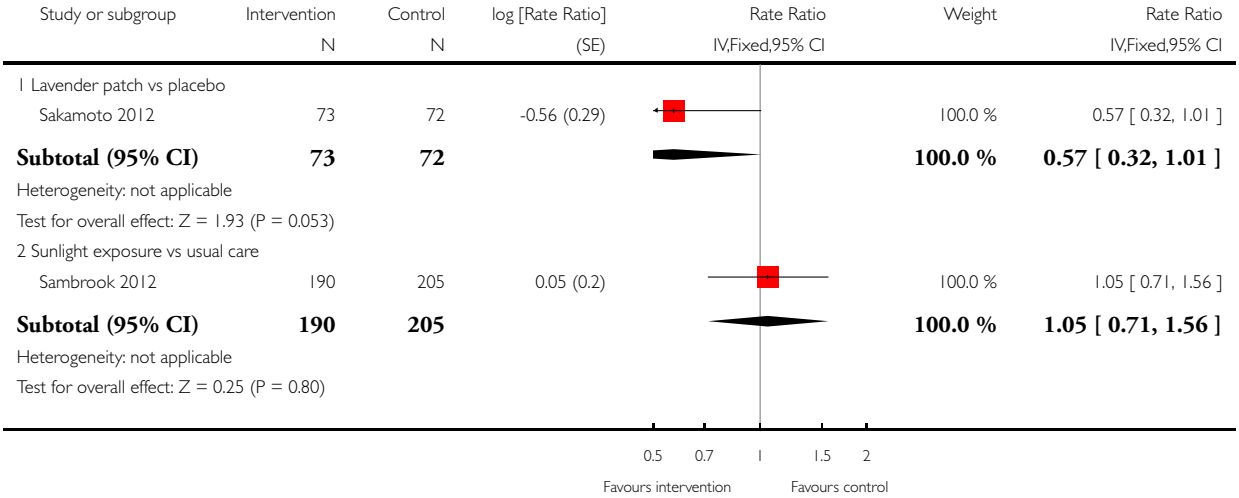
(2) Hip fracture

Analysis 7.1. Comparison 7 Other single interventions vs control (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 7 Other single interventions vs control (care facilities)

Outcome: 1 Rate of falls

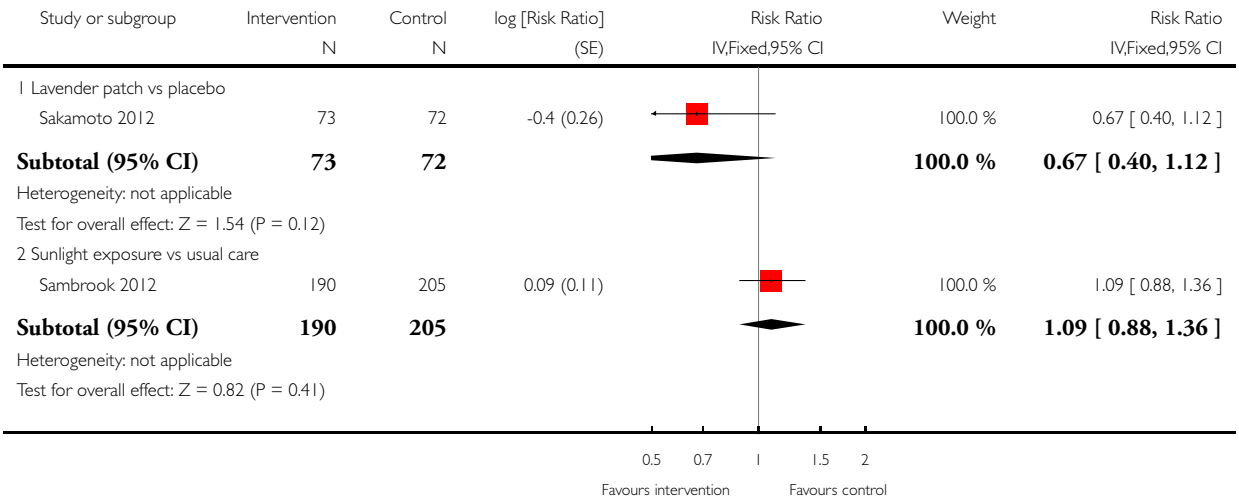


Analysis 7.2. Comparison 7 Other single interventions vs control (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 7 Other single interventions vs control (care facilities)

Outcome: 2 Number of fallers

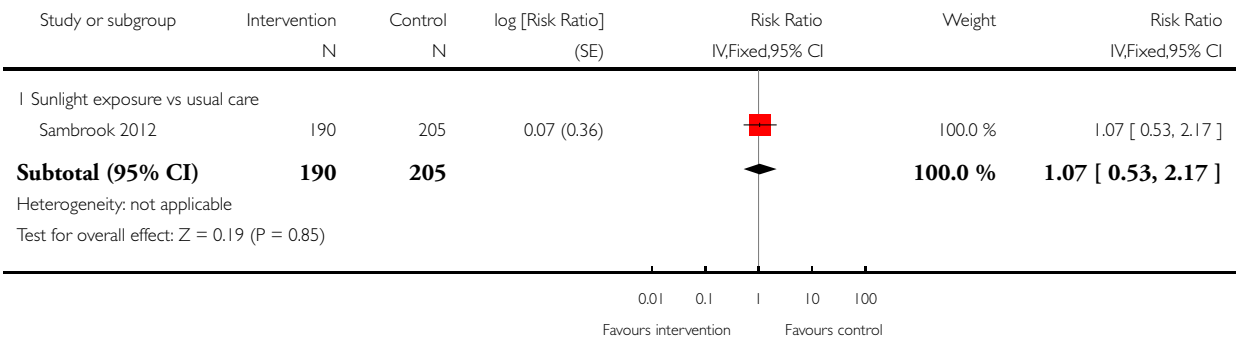


Analysis 7.3. Comparison 7 Other single interventions vs control (care facilities), Outcome 3 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 7 Other single interventions vs control (care facilities)

Outcome: 3 Number of people sustaining a fracture



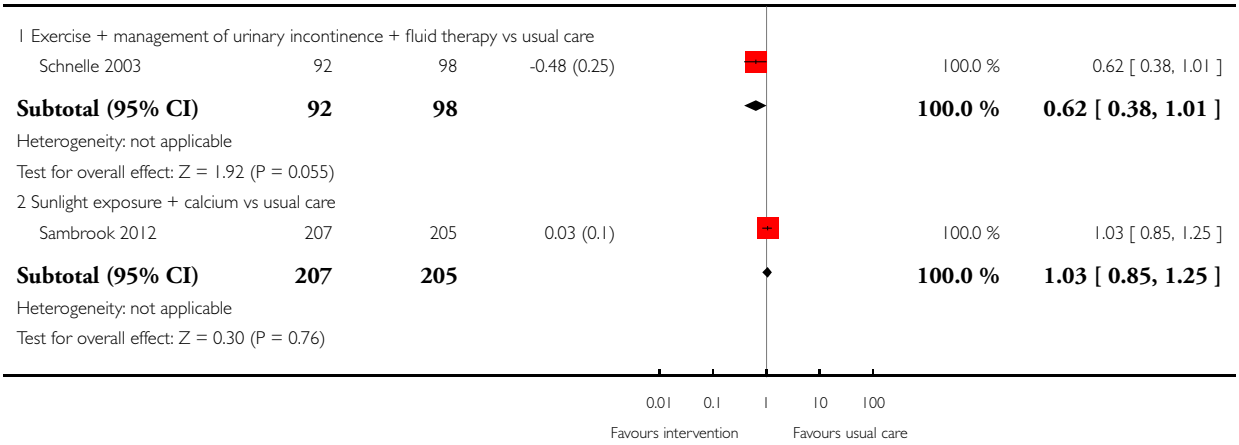
Analysis 8.1. Comparison 8 Multiple interventions vs usual care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 8 Multiple interventions vs usual care (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Fixed,95% CI	Weight	Rate Ratio IV,Fixed,95% CI
1 Exercise + management of urinary incontinence + fluid therapy vs usual care						
Schnelle 2003	92	98	-0.48 (0.25)		100.0 %	0.62 [0.38, 1.01]
Subtotal (95% CI)	**92**	**98**			**100.0 %**	**0.62 [0.38, 1.01]**
Heterogeneity: not applicable						
Test for overall effect: Z = 1.92 (P = 0.055)						
2 Sunlight exposure + calcium vs usual care						
Sambrook 2012	207	205	0.03 (0.1)		100.0 %	1.03 [0.85, 1.25]
Subtotal (95% CI)	**207**	**205**			**100.0 %**	**1.03 [0.85, 1.25]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.30 (P = 0.76)						

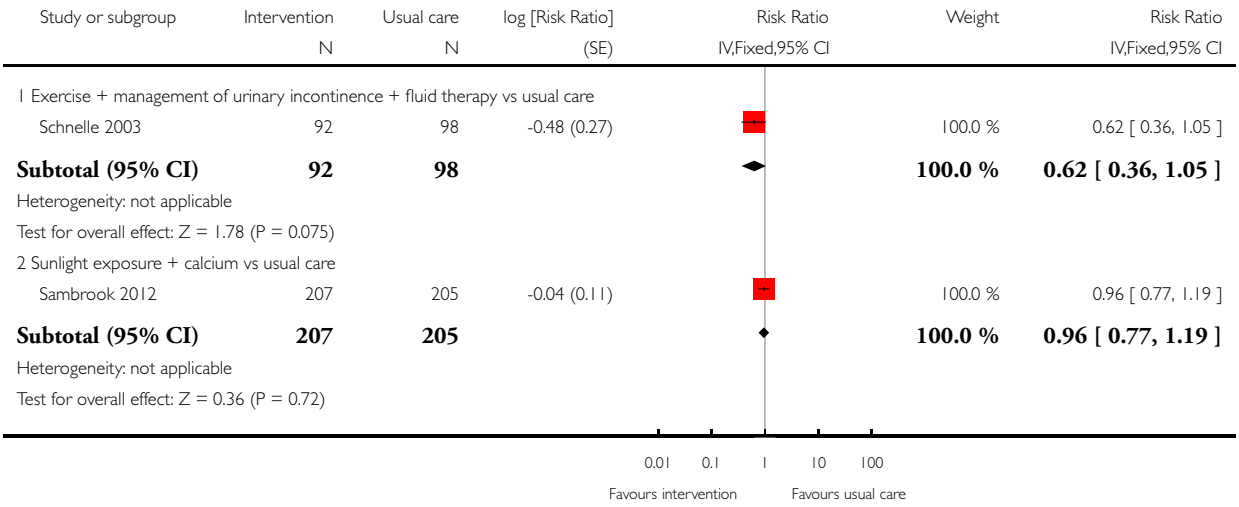


Analysis 8.2. Comparison 8 Multiple interventions vs usual care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 8 Multiple interventions vs usual care (care facilities)

Outcome: 2 Number of fallers

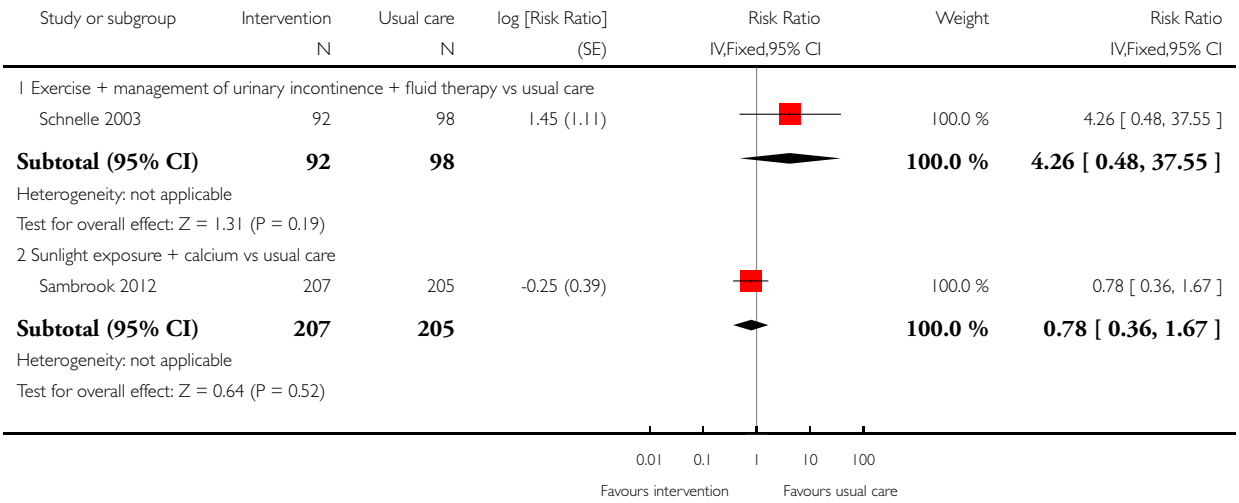


Analysis 8.3. Comparison 8 Multiple interventions vs usual care (care facilities), Outcome 3 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 8 Multiple interventions vs usual care (care facilities)

Outcome: 3 Number of people sustaining a fracture



Analysis 9.1. Comparison 9 Multifactorial interventions vs usual care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 9 Multifactorial interventions vs usual care (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate ratio] (SE)	Rate ratio IV,Random,95% CI	Weight	Rate ratio IV,Random,95% CI
Becker 2003	509	472	-0.6 (0.15)		15.3 %	0.55 [0.41, 0.74]
Dyer 2004	102	94	-0.62 (0.13)		15.9 %	0.54 [0.42, 0.69]
Jensen 2002	188	196	-0.29 (0.2)		13.6 %	0.75 [0.51, 1.11]
Kerse 2004	309	238	0.29 (0.12)		16.2 %	1.34 [1.06, 1.69]
McMurdo 2000	52	38	-0.25 (0.24)		12.2 %	0.78 [0.49, 1.25]
Neyens 2009	249	269	-0.24 (0.31)		10.0 %	0.79 [0.43, 1.44]
Rubenstein 1990	79	81	-0.05 (0.1)		16.8 %	0.95 [0.78, 1.16]
Total (95% CI)	**1488**	**1388**			**100.0 %**	**0.78 [0.59, 1.04]**

Heterogeneity: $Tau^2 = 0.12$; $Chi^2 = 36.71$, df = 6 ($P<0.00001$); $I^2 = 84\%$

Test for overall effect: Z = 1.68 (P = 0.093)

Test for subgroup differences: Not applicable

Analysis 9.2. Comparison 9 Multifactorial interventions vs usual care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 9 Multifactorial interventions vs usual care (care facilities)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Random,95% CI	Weight	Risk Ratio IV,Random,95% CI
Becker 2003	509	472	-0.29 (0.14)		15.0 %	0.75 [0.57, 0.98]
Dyer 2004	102	94	0.03 (0.28)		5.4 %	1.03 [0.60, 1.78]
Jensen 2002	188	196	-0.34 (0.14)		15.0 %	0.71 [0.54, 0.94]
Kerse 2004	309	238	0.25 (0.17)		11.7 %	1.28 [0.92, 1.79]
McMurdo 2000	52	38	-0.42 (0.3)		4.8 %	0.66 [0.36, 1.18]
Rubenstein 1990	79	81	-0.06 (0.1)		21.1 %	0.94 [0.77, 1.15]
Shaw 2003	130	144	-0.08 (0.07)		27.0 %	0.92 [0.80, 1.06]
Total (95% CI)	**1369**	**1263**			**100.0 %**	**0.89 [0.77, 1.02]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 10.59$, df = 6 (P = 0.10); $I^2 = 43\%$

Test for overall effect: Z = 1.67 (P = 0.094)

Test for subgroup differences: Not applicable

Analysis 9.3. Comparison 9 Multifactorial interventions vs usual care (care facilities), Outcome 3 Number of people sustaining a hip fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 9 Multifactorial interventions vs usual care (care facilities)

Outcome: 3 Number of people sustaining a hip fracture

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Random,95% CI	Weight	Risk Ratio IV,Random,95% CI
Becker 2003	509	472	-0.07 (0.81)		19.7 %	0.93 [0.19, 4.56]
Jensen 2002	188	196	-1.47 (0.7)		26.4 %	0.23 [0.06, 0.91]
Shaw 2003	130	144	-0.6 (0.49)		53.9 %	0.55 [0.21, 1.43]
Total (95% CI)	**827**	**812**			**100.0 %**	**0.48 [0.24, 0.98]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.85$, df = 2 (P = 0.40); $I^2 = 0.0\%$

Test for overall effect: Z = 2.02 (P = 0.044)

Test for subgroup differences: Not applicable

Analysis 10.1. Comparison 10 Multifactorial interventions vs usual care grouped by level of care (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 10 Multifactorial interventions vs usual care grouped by level of care (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Random,95% CI	Weight	Rate Ratio IV,Random,95% CI
1 High level nursing care facilities (or mixed levels including high)						
Becker 2003	509	472	-0.6 (0.15)		15.3 %	0.55 [0.41, 0.74]
Kerse 2004	309	238	0.29 (0.12)		16.2 %	1.34 [1.06, 1.69]
Neyens 2009	249	269	-0.24 (0.31)		10.0 %	0.79 [0.43, 1.44]
Rubenstein 1990	79	81	-0.05 (0.1)		16.8 %	0.95 [0.78, 1.16]
Subtotal (95% CI)	**1146**	**1060**			**58.3 %**	**0.88 [0.59, 1.29]**
Heterogeneity: $Tau^2 = 0.13$; $Chi^2 = 21.81$, df = 3 (P = 0.00007); $I^2 = 86\%$						
Test for overall effect: Z = 0.67 (P = 0.50)						
2 Intermediate level care facilities						
Dyer 2004	102	94	-0.62 (0.13)		15.9 %	0.54 [0.42, 0.69]
Jensen 2002	188	196	-0.29 (0.2)		13.6 %	0.75 [0.51, 1.11]
McMurdo 2000	52	38	-0.25 (0.24)		12.2 %	0.78 [0.49, 1.25]
Subtotal (95% CI)	**342**	**328**			**41.7 %**	**0.64 [0.50, 0.83]**
Heterogeneity: $Tau^2 = 0.02$; $Chi^2 = 2.98$, df = 2 (P = 0.23); $I^2 = 33\%$						
Test for overall effect: Z = 3.44 (P = 0.00058)						
Total (95% CI)	**1488**	**1388**			**100.0 %**	**0.78 [0.59, 1.04]**
Heterogeneity: $Tau^2 = 0.12$; $Chi^2 = 36.71$, df = 6 (P<0.00001); $I^2 = 84\%$						
Test for overall effect: Z = 1.68 (P = 0.093)						
Test for subgroup differences: $Chi^2 = 1.72$, df = 1 (P = 0.19), $I^2 = 42\%$						

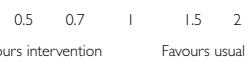
Analysis 10.2. Comparison 10 Multifactorial interventions vs usual care grouped by level of care (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 10 Multifactorial interventions vs usual care grouped by level of care (care facilities)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Random,95% CI	Weight	Risk Ratio IV,Random,95% CI
1 High level nursing care facilities (or mixed levels including high)						
Becker 2003	509	472	-0.29 (0.14)		15.0 %	0.75 [0.57, 0.98]
Kerse 2004	309	238	0.25 (0.17)		11.7 %	1.28 [0.92, 1.79]
Rubenstein 1990	79	81	-0.06 (0.1)		21.1 %	0.94 [0.77, 1.15]
Shaw 2003	130	144	-0.08 (0.07)		27.0 %	0.92 [0.80, 1.06]
Subtotal (95% CI)	**1027**	**935**			**74.8 %**	**0.94 [0.80, 1.09]**
Heterogeneity: Tau^2 = 0.01; Chi^2 = 6.04, df = 3 (P = 0.11); I^2 =50%						
Test for overall effect: Z = 0.82 (P = 0.41)						
2 Intermediate level care facilities						
Dyer 2004	102	94	0.03 (0.28)		5.4 %	1.03 [0.60, 1.78]
Jensen 2002	188	196	-0.34 (0.14)		15.0 %	0.71 [0.54, 0.94]
McMurdo 2000	52	38	-0.42 (0.3)		4.8 %	0.66 [0.36, 1.18]
Subtotal (95% CI)	**342**	**328**			**25.2 %**	**0.75 [0.60, 0.94]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 1.62, df = 2 (P = 0.44); I^2 =0.0%						
Test for overall effect: Z = 2.50 (P = 0.012)						
Total (95% CI)	**1369**	**1263**			**100.0 %**	**0.89 [0.77, 1.02]**
Heterogeneity: Tau^2 = 0.01; Chi^2 = 10.59, df = 6 (P = 0.10); I^2 =43%						
Test for overall effect: Z = 1.67 (P = 0.094)						
Test for subgroup differences: Chi^2 = 2.54, df = 1 (P = 0.11), I^2 =61%						



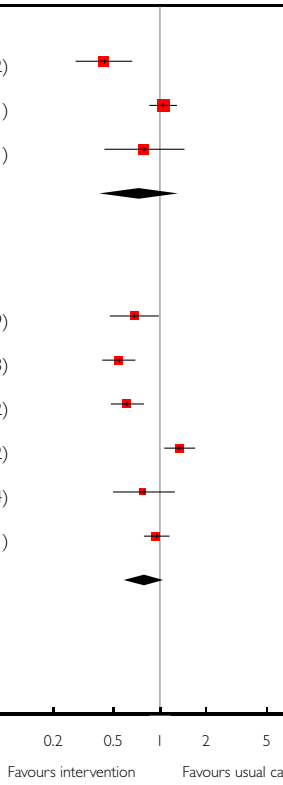
Analysis 11.1. Comparison 11 Multifactorial interventions vs usual care grouped by level of cognition (care facilities), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 11 Multifactorial interventions vs usual care grouped by level of cognition (care facilities)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate ratio] (SE)	Rate ratio IV,Random,95% CI	Weight	Rate ratio IV,Random,95% CI
1 Participants with cognitive impairment						
Becker 2003 (1)	150	169	-0.84 (0.22)		33.3 %	0.43 [0.28, 0.66]
Jensen 2002 (2)	69	102	0.05 (0.11)		38.3 %	1.05 [0.85, 1.30]
Neyens 2009 (3)	249	269	-0.24 (0.31)		28.4 %	0.79 [0.43, 1.44]
Subtotal (95% CI)	**468**	**540**			**100.0 %**	**0.72 [0.40, 1.31]**
Heterogeneity: $Tau^2 = 0.23$; $Chi^2 = 13.21$, df = 2 (P = 0.001); I^2 =85%						
Test for overall effect: Z = 1.08 (P = 0.28)						
2 Participants with no cognitive impairment or mixed sample						
Becker 2003 (4)	215	191	-0.39 (0.19)		15.2 %	0.68 [0.47, 0.98]
Dyer 2004	102	94	-0.62 (0.13)		17.5 %	0.54 [0.42, 0.69]
Jensen 2002 (5)	112	79	-0.49 (0.12)		17.8 %	0.61 [0.48, 0.78]
Kerse 2004	309	238	0.29 (0.12)		17.8 %	1.34 [1.06, 1.69]
McMurdo 2000	52	38	-0.25 (0.24)		13.3 %	0.78 [0.49, 1.25]
Rubenstein 1990	79	81	-0.05 (0.1)		18.4 %	0.95 [0.78, 1.16]
Subtotal (95% CI)	**869**	**721**			**100.0 %**	**0.78 [0.58, 1.05]**
Heterogeneity: $Tau^2 = 0.11$; $Chi^2 = 36.23$, df = 5 (P<0.00001); I^2 =86%						
Test for overall effect: Z = 1.62 (P = 0.10)						
Test for subgroup differences: $Chi^2 = 0.06$, df = 1 (P = 0.81), I^2 =0.0%						



(1) At least one sign of cognitive impairment or depression based on Minimum Data Set of the Resident Assessment Instrument (MDS RAI 2.0)

(2) Subgroup with MMSE score <19

(3) Psychogeriatric patients

(4) No sign of cognitive impairment or depression based on Minimum Data Set of the Resident Assessment Instrument (MDS RAI 2.0)

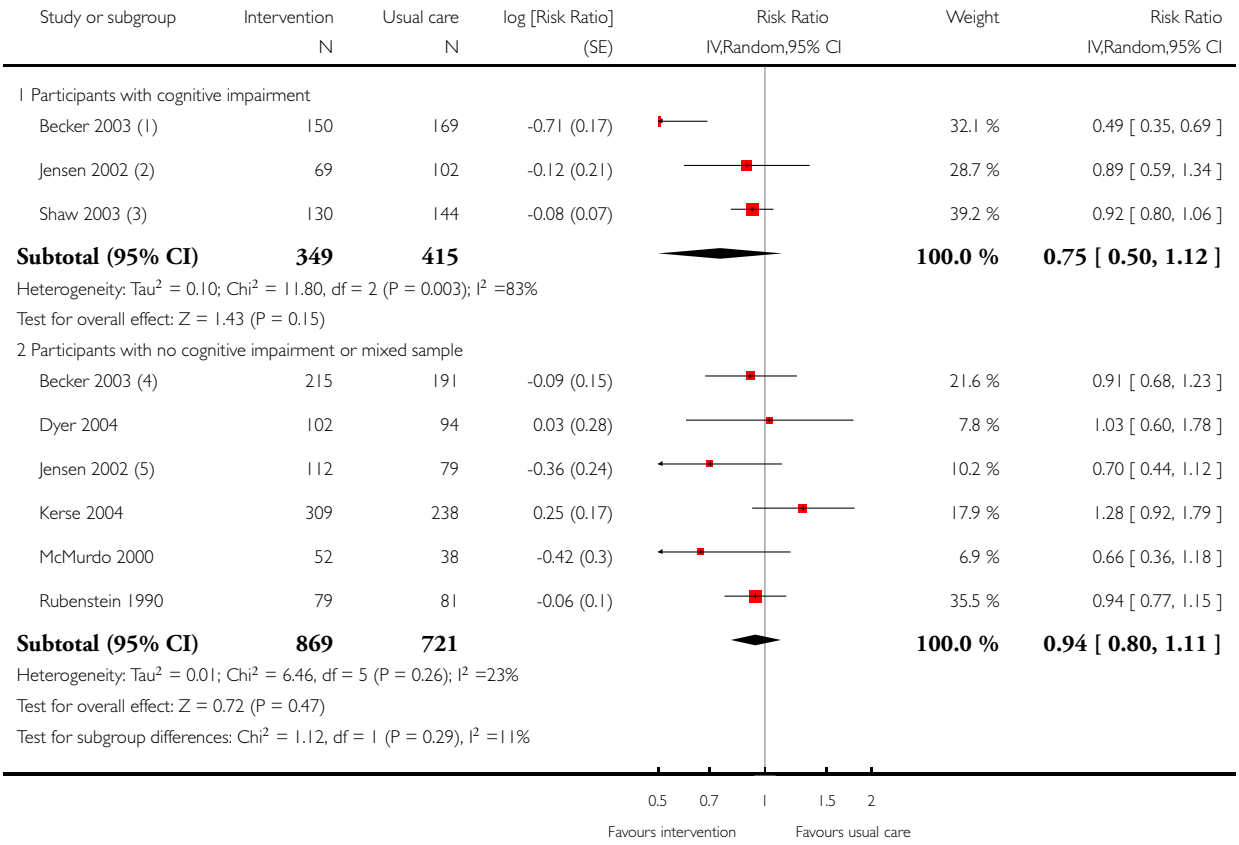
(5) Subgroup with MMSE score ≥19

Analysis 11.2. Comparison 11 Multifactorial interventions vs usual care grouped by level of cognition (care facilities), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 11 Multifactorial interventions vs usual care grouped by level of cognition (care facilities)

Outcome: 2 Number of fallers



(1) At least one sign of cognitive impairment or depression based on Minimum Data Set of the Resident Assessment Instrument (MDS RAI 2.0)

(2) Subgroup with MMSE score <19

(3) All participants had an MMSE score <24

(4) No sign of cognitive impairment or depression based on Minimum Data Set of the Resident Assessment Instrument (MDS RAI 2.0)

(5) Subgroup with MMSE score ≥19

Analysis 12.1. Comparison 12 Exercises vs usual physiotherapy (hospitals), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 12 Exercises vs usual physiotherapy (hospitals)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Control N	log [Rate Ratio] (SE)	Rate Ratio IV,Fixed,95% CI	Weight	Rate Ratio IV,Fixed,95% CI
Donald 2000 (1)	30	24	-0.62 (0.62)		100.0 %	0.54 [0.16, 1.81]
Total (95% CI)	**30**	**24**			**100.0 %**	**0.54 [0.16, 1.81]**

Heterogeneity: not applicable

Test for overall effect: Z = 1.00 (P = 0.32)

Test for subgroup differences: Not applicable

(1) Factorial design: additional exercises with carpet or vinyl flooring vs conventional physiotherapy with carpet or vinyl flooring

Analysis 12.2. Comparison 12 Exercises vs usual physiotherapy (hospitals), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 12 Exercises vs usual physiotherapy (hospitals)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Weight	Risk Ratio IV,Fixed,95% CI
Donald 2000 (1)	30	24	-1.56 (0.87)		30.8 %	0.21 [0.04, 1.16]
Jarvis 2007	14	15	-0.78 (0.58)		69.2 %	0.46 [0.15, 1.43]
Total (95% CI)	**44**	**39**			**100.0 %**	**0.36 [0.14, 0.93]**

Heterogeneity: Chi^2 = 0.56, df = 1 (P = 0.46); I^2 =0.0%

Test for overall effect: Z = 2.11 (P = 0.035)

Test for subgroup differences: Not applicable

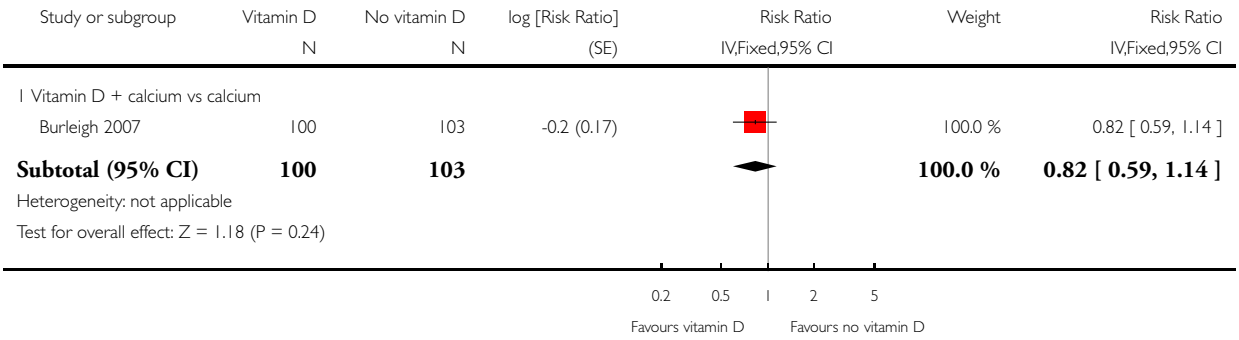
(1) Factorial design: additional exercises with carpet or vinyl flooring vs conventional physiotherapy with carpet or vinyl flooring

Analysis 13.1. Comparison 13 Vitamin D supplements vs no vitamin D supplements (hospital), Outcome 1 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 13 Vitamin D supplements vs no vitamin D supplements (hospital)

Outcome: 1 Number of fallers

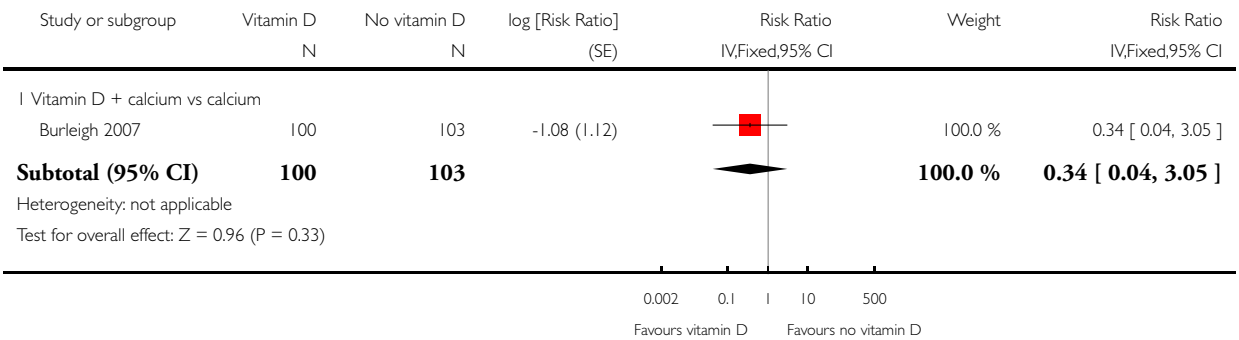


Analysis 13.2. Comparison 13 Vitamin D supplements vs no vitamin D supplements (hospital), Outcome 2 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 13 Vitamin D supplements vs no vitamin D supplements (hospital)

Outcome: 2 Number of people sustaining a fracture

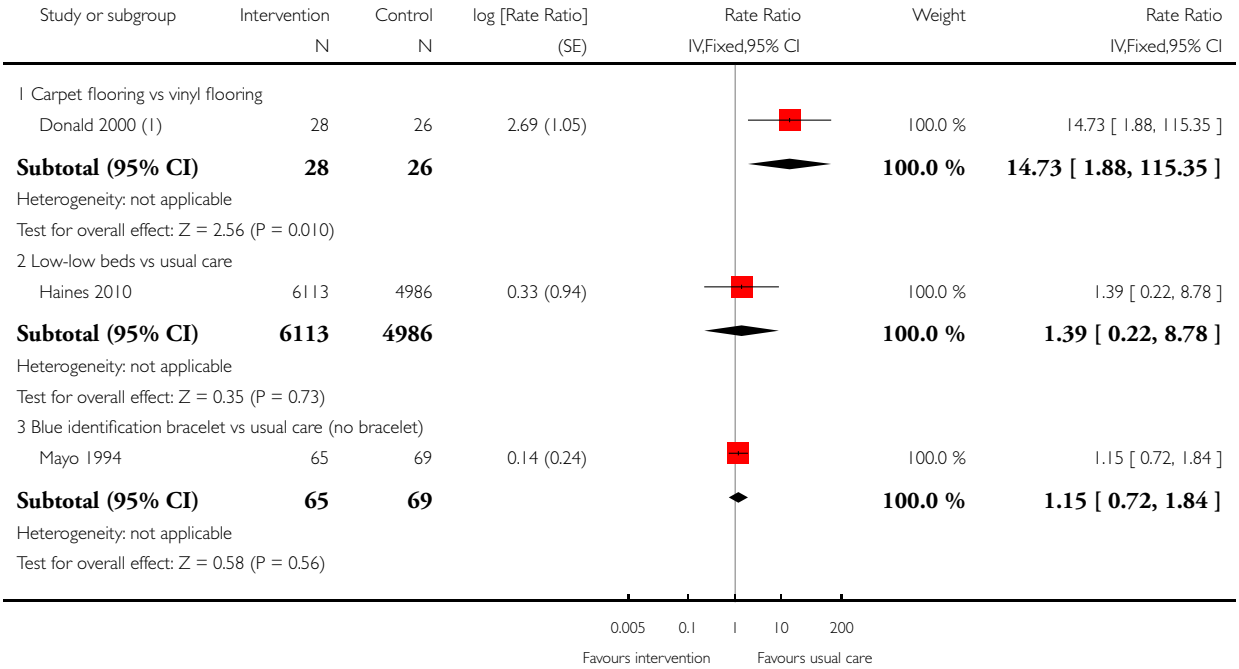


Analysis 14.1. Comparison 14 Environmental interventions vs usual care (hospitals), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 14 Environmental interventions vs usual care (hospitals)

Outcome: 1 Rate of falls



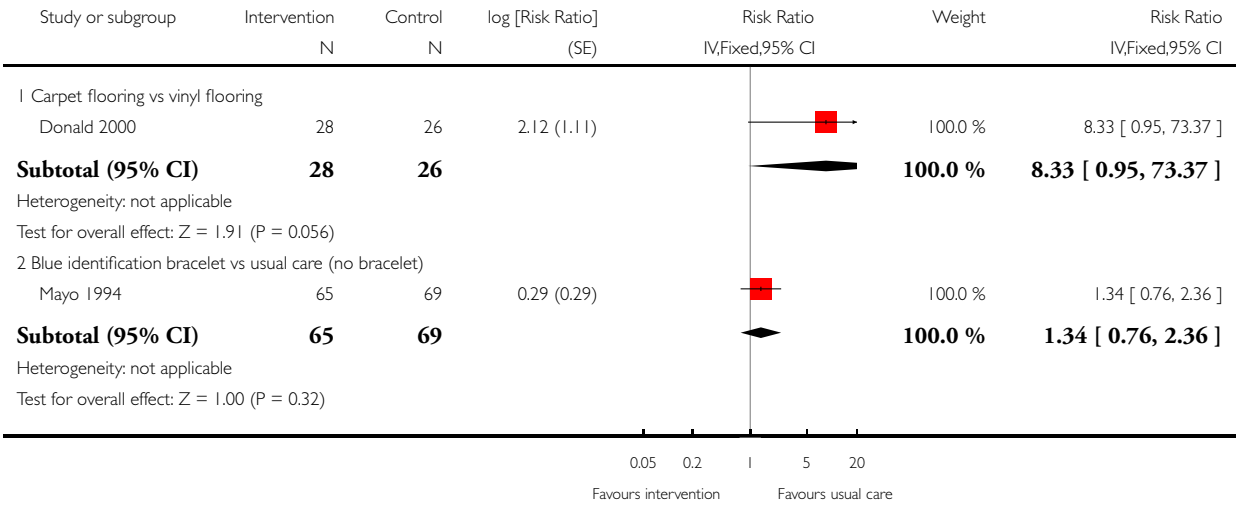
(1) Factorial design: carpet flooring with or without additional exercises vs vinyl flooring with or without additional exercises

Analysis 14.2. Comparison 14 Environmental interventions vs usual care (hospitals), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 14 Environmental interventions vs usual care (hospitals)

Outcome: 2 Number of fallers

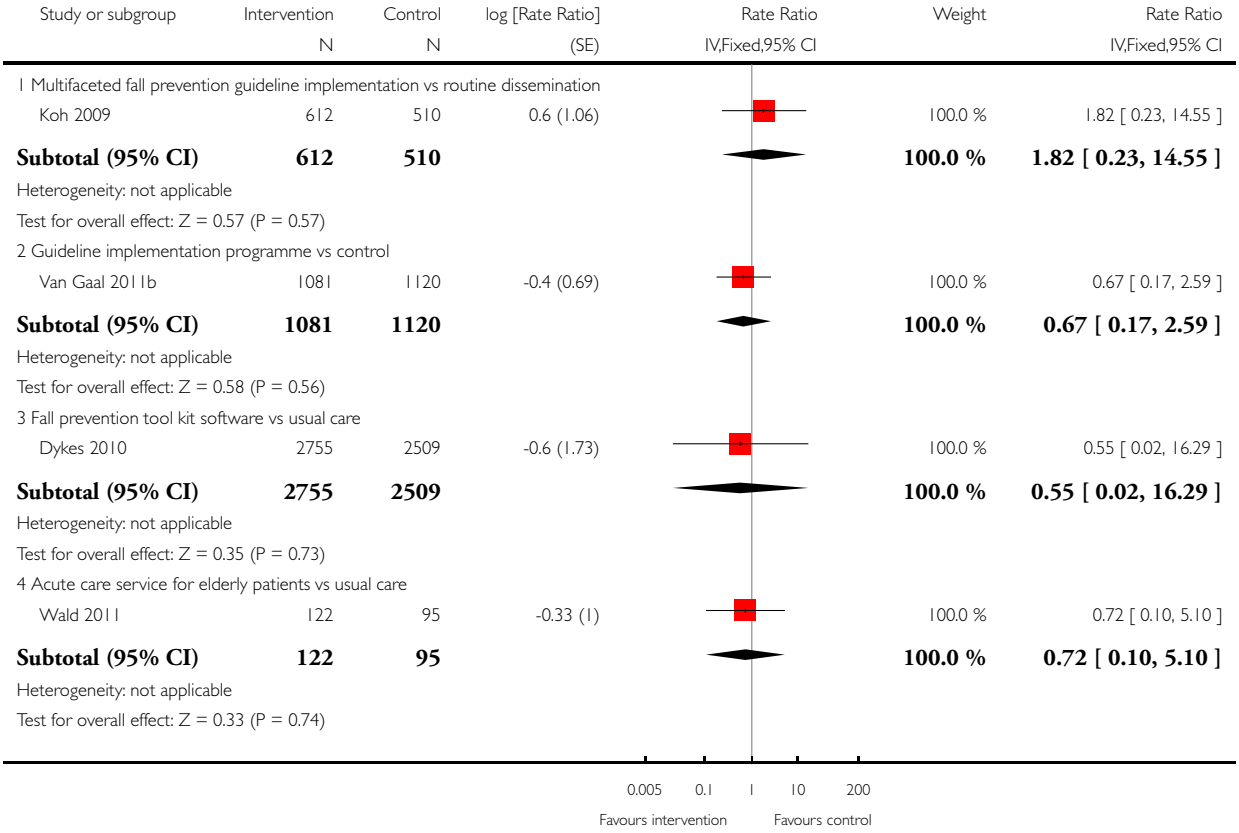


Analysis 15.1. Comparison 15 Social environment vs control (hospitals), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 15 Social environment vs control (hospitals)

Outcome: 1 Rate of falls

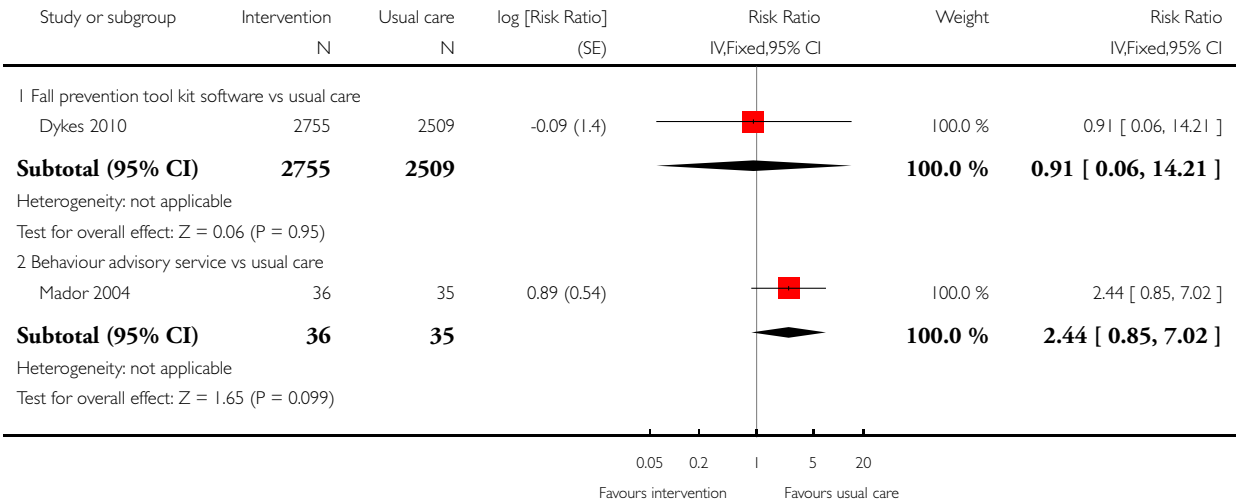


Analysis 15.2. Comparison 15 Social environment vs control (hospitals), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 15 Social environment vs control (hospitals)

Outcome: 2 Number of fallers



Analysis 16.1. Comparison 16 Knowledge/education interventions vs usual care (hospitals), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 16 Knowledge/education interventions vs usual care (hospitals)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate Ratio] (SE)	Rate Ratio IV,Fixed,95% CI	Weight	Rate Ratio IV,Fixed,95% CI
1 Educational materials + health professional follow-up vs usual care						
Haines 2011	401	381	-0.19 (0.22)		100.0 %	0.83 [0.54, 1.27]
Subtotal (95% CI)	**401**	**381**			**100.0 %**	**0.83 [0.54, 1.27]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.86 (P = 0.39)						
2 Educational materials only vs usual care						
Haines 2011	424	381	-0.09 (0.2)		100.0 %	0.91 [0.62, 1.35]
Subtotal (95% CI)	**424**	**381**			**100.0 %**	**0.91 [0.62, 1.35]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.45 (P = 0.65)						

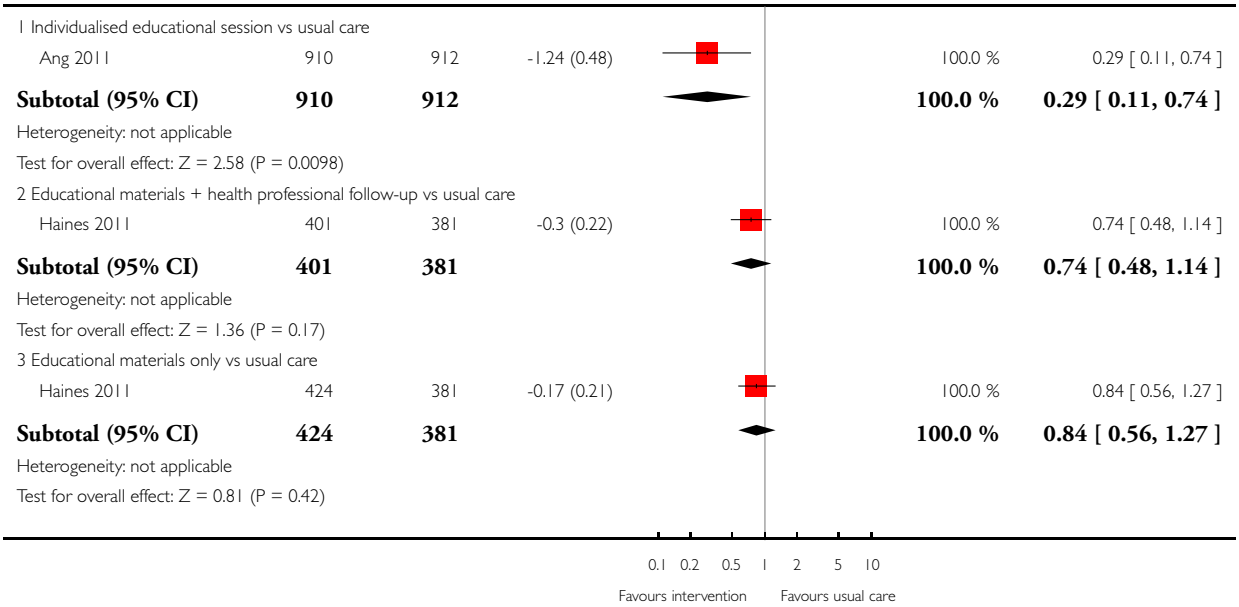
Analysis 16.2. Comparison 16 Knowledge/education interventions vs usual care (hospitals), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 16 Knowledge/education interventions vs usual care (hospitals)

Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Fixed,95% CI	Weight	Risk Ratio IV,Fixed,95% CI
1 Individualised educational session vs usual care						
Ang 2011	910	912	-1.24 (0.48)		100.0 %	0.29 [0.11, 0.74]
Subtotal (95% CI)	**910**	**912**			**100.0 %**	**0.29 [0.11, 0.74]**
Heterogeneity: not applicable						
Test for overall effect: Z = 2.58 (P = 0.0098)						
2 Educational materials + health professional follow-up vs usual care						
Haines 2011	401	381	-0.3 (0.22)		100.0 %	0.74 [0.48, 1.14]
Subtotal (95% CI)	**401**	**381**			**100.0 %**	**0.74 [0.48, 1.14]**
Heterogeneity: not applicable						
Test for overall effect: Z = 1.36 (P = 0.17)						
3 Educational materials only vs usual care						
Haines 2011	424	381	-0.17 (0.21)		100.0 %	0.84 [0.56, 1.27]
Subtotal (95% CI)	**424**	**381**			**100.0 %**	**0.84 [0.56, 1.27]**
Heterogeneity: not applicable						
Test for overall effect: Z = 0.81 (P = 0.42)						



Analysis 17.1. Comparison 17 Multifactorial interventions vs usual care (hospitals), Outcome 1 Rate of falls.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 17 Multifactorial interventions vs usual care (hospitals)

Outcome: 1 Rate of falls

Study or subgroup	Intervention N	Usual care N	log [Rate ratio] (SE)	Rate ratio IV,Random,95% CI	Weight	Rate ratio IV,Random,95% CI
Cumming 2008 (1)	2047	1952	-0.04 (0.15)		34.5 %	0.96 [0.72, 1.29]
Haines 2004 (2)	310	316	-0.36 (0.13)		36.9 %	0.70 [0.54, 0.90]
Healey 2004 (3)	749	905	-0.53 (0.42)		12.2 %	0.59 [0.26, 1.34]
Stenvall 2007 (4)	102	97	-0.97 (0.34)		16.4 %	0.38 [0.19, 0.74]
Total (95% CI)	**3208**	**3270**			**100.0 %**	**0.69 [0.49, 0.96]**

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 7.39$, df = 3 (P = 0.06); $I^2 = 59\%$

Test for overall effect: Z = 2.17 (P = 0.030)

Test for subgroup differences: Not applicable

(1) Acute and subacute care: risk assessment, staff and patient education, drug review, environmental modifications, exercise vs usual care

(2) Subacute: risk assessment and targeted interventions (exercise, educational sessions from OT, hip protectors) vs usual care

(3) Acute and subacute care: risk factor screening and targeted care plan in at-risk patients vs usual care

(4) Acute care: unit specialising in geriatric orthopaedic care versus conventional orthopaedic care after proximal femoral fracture surgery

Analysis 17.2. Comparison 17 Multifactorial interventions vs usual care (hospitals), Outcome 2 Number of fallers.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 17 Multifactorial interventions vs usual care (hospitals)

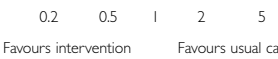
Outcome: 2 Number of fallers

Study or subgroup	Intervention N	Usual care N	log [Risk Ratio] (SE)	Risk Ratio IV,Random,95% CI	Weight	Risk Ratio IV,Random,95% CI
Cumming 2008 (1)	2047	1952	0.04 (0.4)		21.7 %	1.04 [0.48, 2.28]
Haines 2004 (2)	310	316	-0.25 (0.16)		53.2 %	0.78 [0.57, 1.07]
Stenvall 2007 (3)	102	97	-0.89 (0.36)		25.1 %	0.41 [0.20, 0.83]
Total (95% CI)	**2459**	**2365**			**100.0 %**	**0.71 [0.46, 1.09]**

Heterogeneity: $Tau^2 = 0.07$; $Chi^2 = 3.50$, df = 2 (P = 0.17); $I^2 = 43\%$

Test for overall effect: Z = 1.56 (P = 0.12)

Test for subgroup differences: Not applicable



(1) Acute and subacute care: risk assessment, staff and patient education, drug review, environmental modifications, exercise vs usual care

(2) Subacute: risk assessment and targeted interventions (exercise, educational sessions from OT, hip protectors) vs usual care

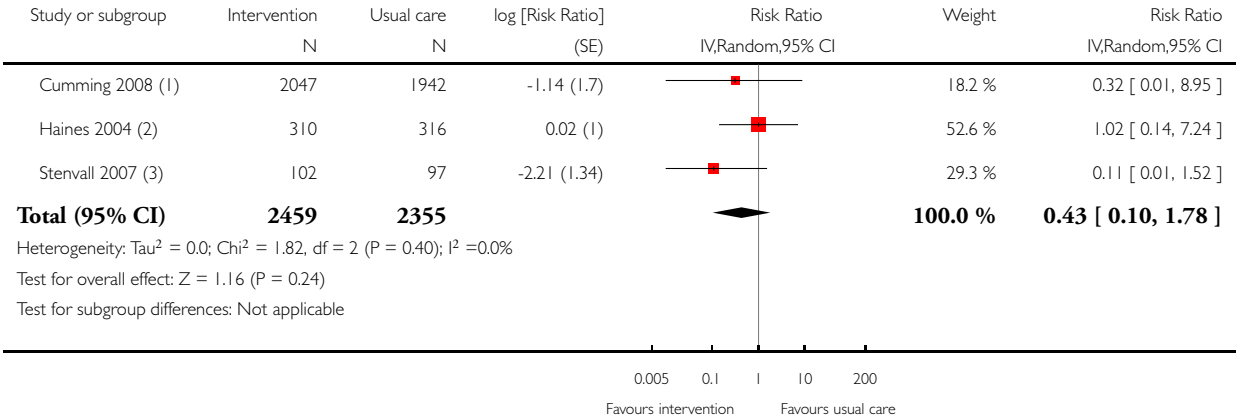
(3) Acute care: unit specialising in geriatric orthopaedic care versus conventional orthopaedic care after proximal femoral fracture surgery

Analysis 17.3. Comparison 17 Multifactorial interventions vs usual care (hospitals), Outcome 3 Number of people sustaining a fracture.

Review: Interventions for preventing falls in older people in care facilities and hospitals

Comparison: 17 Multifactorial interventions vs usual care (hospitals)

Outcome: 3 Number of people sustaining a fracture



(1) Acute and subacute care: risk assessment, staff and patient education, drug review, environmental modifications, exercise vs usual care

(2) Subacute: risk assessment and targeted interventions (exercise, educational sessions from OT, hip protectors) vs usual care

(3) Acute care: unit specialising in geriatric orthopaedic care versus conventional orthopaedic care after proximal femoral fracture surgery

ADDITIONAL TABLES

Table 1. Description of included studies: reference links

Study description	Links to references
Additional studies included in this update	**Care facilities** N = 13: Chenoweth 2009; Clifton 2009; Grieger 2009; Klages 2011; Lapane 2011; Meyer 2009; Neyens 2009; Patterson 2010; Sakamoto 2012; Sambrook 2012; Serra-Rexach 2011; Van Gaal 2011a; Ward 2010 **Hospitals** N = 7: Ang 2011; Dykes 2010; Haines 2010; Haines 2011; Koh 2009; Van Gaal 2011b; Wald 2011
Design	**Cluster randomised** N = 26: Becker 2003; Chenoweth 2009; Choi 2005; Cox 2008; Crotty 2004b; Cumming 2008; Dyer 2004; Dykes 2010; Haines 2010; Healey 2004; Jensen 2002; Kerse 2004; Kerse 2008; Koh 2009; Lapane 2011; Law 2006; McMurdo 2000; Meyer 2009; Neyens 2009; Patterson 2010; Ray 1997; Rosendahl 2008; Sambrook 2012; Van Gaal 2011a; Van Gaal 2011b; Ward 2010
Setting (country)	**Australia** (N = 12): Chenoweth 2009; Crotty 2004a; Crotty 2004b; Cumming 2008; Flicker 2005; Grieger 2009; Haines 2004; Haines 2010; Haines 2011; Mador 2004; Sambrook 2012; Ward 2010

Table 1. Description of included studies: reference links (*Continued*)

	Canada (N = 2): Klages 2011; Mayo 1994 **Finland** (N = 1): Sihvonen 2004 **France** (N = 2): Chapuy 2002; Toulotte 2003 **Germany** (N = 2): Becker 2003; Meyer 2009 **Korea** (N = 1): Choi 2005 **Japan** (N = 3): Sakamoto 2006; Sakamoto 2012; Shimada 2004 **The Netherlands** (N = 4): Faber 2006; Neyens 2009; Van Gaal 2011a; Van Gaal 2011b **New Zealand** (N = 2): Kerse 2004; Kerse 2008 **Singapore** N = 2: Ang 2011; Koh 2009 **Spain** N = 1: Serra-Rexach 2011 **Sweden** (N = 3): Jensen 2002; Rosendahl 2008; Stenvall 2007 **Switzerland** (N = 1): Bischoff 2003 **United Kingdom** (N = 11): Burleigh 2007; Cox 2008; Donald 2000; Dyer 2004; Healey 2004; Jarvis 2007; Law 2006; McMurdo 2000; Patterson 2010; Shaw 2003; Zermansky 2006 **USA** (N = 13): Broe 2007; Buettner 2002; Clifton 2009; Dykes 2010; Lapane 2011; Mulrow 1994; Nowalk 2001; Ray 1997; Rubenstein 1990; Schnelle 2003; Schoenfelder 2000; Tideiksaar 1993; Wald 2011
Setting	**Care facilities** N = 43 ***High level nursing care*** N = 13: Becker 2003; Broe 2007; Bischoff 2003; Chenoweth 2009; Clifton 2009; Crotty 2004a; Meyer 2009; Mulrow 1994; Neyens 2009; Ray 1997; Schnelle 2003; Schoenfelder 2000; Van Gaal 2011a ***Intermediate level care*** N = 11: Chapuy 2002; Choi 2005; Dyer 2004; Jensen 2002; Kerse 2008; McMurdo 2000; Sakamoto 2006; Sakamoto 2012; Sambrook 2012; Serra-Rexach 2011; Sihvonen 2004 ***Mixed levels of care*** N = 19: Buettner 2002; Cox 2008; Crotty 2004b; Faber 2006; Flicker 2005; Grieger 2009; Kerse 2004; Klages 2011; Lapane 2011; Law 2006; Nowalk 2001; Patterson 2010; Rosendahl 2008; Rubenstein 1990; Shaw 2003; Shimada 2004; Toulotte 2003; Ward 2010; Zermansky 2006 **Hospitals** N = 17 ***Acute care*** N = 8: Ang 2011; Dykes 2010; Koh 2009; Mador 2004; Stenvall 2007; Tideiksaar 1993; Van Gaal 2011b; Wald 2011 ***Subacute care*** N = 7: Burleigh 2007; Donald 2000; Haines 2004; Haines 2010; Healey 2004; Jarvis 2007; Mayo 1994 ***Acute and subacute care*** N = 2: Cumming 2008; Haines 2011
Care facilities	**Exercises** N = 13: Buettner 2002; Choi 2005; Faber 2006; Kerse 2008; Mulrow 1994; Nowalk 2001; Rosendahl 2008; Sakamoto 2006; Schoenfelder 2000; Serra-Rexach 2011; Shimada 2004; Sihvonen 2004; Toulotte 2003

APPENDICES

Appendix 1. Search strategies and number of records identified

The Cochrane Library 2012, Issue 3 (Wiley Online Library)

#1 MeSH descriptor Accidental Falls, this term only (739)
#2 ("falls" or "faller*") (2691)
#3 (#1 OR #2) (2691)
#4 MeSH descriptor Aged explode all trees (476)
#5 ("older" or "senior*" or "elderly") (28950)
#6 (#4 OR #5) (28952)
#7 (#3 AND #6) (1253)
#8 MeSH descriptor Residential Facilities explode all trees (1108)
#9 MeSH descriptor Long-Term Care explode all trees (948)
#10 MeSH descriptor Institutionalization, this term only (145)
#11 MeSH descriptor Hospitalization explode all trees (10061)
#12 MeSH descriptor Subacute Care, this term only (16)
#13 MeSH descriptor Hospitals explode all trees (2355)
#14 MeSH descriptor Hospital Units explode all trees (2468)
#15 MeSH descriptor Rehabilitation Centers, this term only (202)
#16 ((care near (long next stay)) or (care near acute) or (care near sub-acute) or (care near subacute) or (care near residential)) (2691)
#17 ((ward* near (long next stay)) or (ward* near acute) or (ward near sub-acute) or (ward near subacute) or (ward* near residential)) (298)
#18 ((rehabilitation next ward*) or (rehabilitation next hospital*) or (rehabilitation next unit*)) (736)
#19 ((geriatric next ward*) or (geriatric next hospital*) or (geriatric next unit*)) (265)
#20 hostel* (63)
#21 (#8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20) (18294)
#22 (#7 AND #21) in Trials (*The Cochrane Central Register of Controlled Trials)* (131)

MEDLINE (OvidSP)

1 Accidental Falls/ (12611)
2 (falls or faller$).tw. (23057)
3 or/1-2 (29346)
4 exp Aged/ (2067157)
5 (older or senior$ or elderly).tw. (338625)
6 or/4-5 (2194169)
7 and/3,6 (12226)
8 exp Residential Facilities/ (39760)
9 Long-Term Care/ (20056)
10 Institutionalization/ or Hospitalization/ (66717)
11 Subacute Care/ (705)
12 exp Hospitals/ (182789)
13 Hospital Units/ (8130)
14 Rehabilitation Centers/ (6112)
15 ((long stay or acute or sub-acute or subacute or residential or hospital) adj3 (care or ward$1)).tw. (42017)
16 ((rehabilitation or geriatric) adj (ward$1 or hospital$1 or unit$1)).tw. (4826)
17 (hostel$1 or nursing home$).tw. (19323)
18 or/8-17 (336948)
19 and/7,18 (2095)
20 randomized controlled trial.pt. (321532)

21 controlled clinical trial.pt. (83674)
22 randomized.ab. (226575)
23 placebo.ab. (129187)
24 Clinical Trials as Topic/ (158407)
24 randomly.ab. (163757)
25 trial.ab. (233632)
26 or/20-26 (811059)
28 exp Animals/ not Humans/ (3683200)
29 27 not 28 (740692)
30 and/19,29 (295)

EMBASE (OvidSP)

1 Falling/ (20325)
2 (falls or fallers).tw. (35142)
3 or/1-2 (46189)
4 exp Aged/ (2055571)
5 (elderly or senior$ or older).tw. (477074)
6 or/4-5 (2283117)
7 and/3,6 (15915)
8 Residential Home/ or Nursing Home/ or Assisted Living Facility/ (43655)
9 Halfway House/ or Long Term Care/ (80379)
10 Hospitalization/ (173393)
11 Institutional Care/ or Home For The Aged/ or Institutionalization/ (21625)
12 exp Hospital/ (577131)
13 Rehabilitation Center/ (8831)
14 ((long stay or acute or sub-acute or subacute or residential or hospital) adj3 (care or ward$1)).tw. (57263)
15 ((rehabilitation or geriatric) adj (ward$1 or hospital$1 or unit$1)).tw. (7558)
16 (hostel$1 or nursing home$).tw. (25306)
17 or/8-16 (880204)
18 and/7,17 (3451)
19 exp Randomized Controlled rial/ (320955)
20 exp Double Blind Procedure/ (112487)
21 exp Single Blind Procedure/ (15625)
22 exp Crossover Procedure/ (33657)
23 or/19-22 (364799)
24 ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed) adj3 (trial or study)).tw. (653781)
25 (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. (151992)
26 ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. (151890)
27 (cross?over$ or (cross adj1 over$)).tw. (63684)
28 ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. (197599)
29 or/24-28 (978103)
30 or/23,29 (1101196)
31 Animal/ not Human/ (1329508)
32 30 not 31 (1068522)
33 and/18,32 (696)

CINAHL (EBSCOhost)

1. (MH “Accidental Falls”) (10211)
2. TI ((falls or faller or fallers)) OR AB ((falls or faller or fallers)) (7950)
3. S1 or S2(13400)

4. (MH "Aged+") (358315)
5. TI ((senior or seniors or elderly or older)) OR AB ((senior or seniors or elderly or older)) (109297)
6. S4 or S5 (392592)
7. S3 and S6 (7584)
8. (MH "Residential Facilities+")(19601)
9. (MH "Long Term Care") (16238)
10. MH Hospitalization OR MH Institutionalization (14204)
11. (MH "Subacute Care") (1000)
12. (MH "Hospitals+") (61632)
13. (MH "Hospital Units") (3999)
14. (MH "Rehabilitation Centers") (4901)
15. TX (long stay or acute or sub-acute or subacute or residential) N3 (care or ward or wards) (24428)
16. TX (rehabilitation or geriatric) N1 (ward* or hospital* or unit*) (7615)
17. TX hostel OR TX hostels (259)
18. S8 or S9 or S10 or S11 or S12 or S13 or S14 or S15 or S16 or S17 (136377)
19. S7 and S18 (1376)
20. (MH "Clinical Trials+") (135118)
21. (MH "Evaluation Research+") (18003)
22. (MH "Comparative Studies") (65579)
23. (MH "Crossover Design") (8854)
24. PT Clinical Trial (69063)
25. (MH "Random Assignment") (31790)
26. S20 or S21 or S22 or S23 or S24 or S25 (221577)
27. TX ((clinical or controlled or comparative or placebo or prospective or randomi?ed) and (trial or study)) (383713)
28. TX (random* and (allocat* or allot* or assign* or basis* or divid* or order*)) (55388)
29. TX ((singl* or doubl* or trebl* or tripl*) and (blind* or mask*)) (604833)
30. TX (crossover* or 'cross over') or TX cross n1 over (11265)
31. TX ((allocat* or allot* or assign* or divid*) and (condition* or experiment* or intervention* or treatment* or therap* or control* or group*)) (69243)
32. S27 or S28 or S29 or S30 or S31 (916428)
33. S26 or S32 (972123)
34. S19 and S33 (744)

Appendix 2. Methodological quality assessment criteria

Bias	Judgement of risk of bias: LOW, HIGH, or UNCLEAR	Description, e.g. text from a report to support judgement
Random sequence generation Relating to selection bias (biased allocation to interventions) due to inadequate generation of a randomised sequence		
Allocation concealment Relating to selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment		

(*Continued*)

Blinding of outcome assessment Relating to detection bias due to knowledge of the allocated interventions by outcome assessors		

Items	Scores	Notes
A: Were the outcomes of patients who withdrew described and included in the analysis (intention-to-treat)?	2 = intention-to-treat based on all cases randomised possible or carried out 1 = States number and reason for withdrawal but intention-to-treat analysis not possible 0 = Inadequate detail	
B: Were the treatment and control group comparable at entry?	2 = Good comparability of groups, or confounding adjusted for in analysis 1 = Confounding small, or mentioned but not adjusted 0 = Large potential for confounding, or not discussed	Principal confounders for consideration include age, gender, previous falls, medical status and dependency
C: Were the participants blind to assignment status after allocation?	2 = Effective action taken to blind participants 1 = Small or moderate chance of unblinding of participants 0 = Not possible, possible but not done, or not mentioned	
D: Were the treatment providers blind to assignment status?	2 = Effective action taken to blind treatment providers 1 = Small or moderate chance of unblinding treatment providers 0 = Not possible, possible but not done, or not mentioned	
E: Were the care programmes identical (other than trial options)?	2 = Care programmes clearly identical 1 = Differences were clear but trivial 0 = Differences not mentioned or not clear, or important differences	
F: Were the inclusion and exclusion criteria clearly defined?	2 = Clearly defined 1 = Poorly defined 0 = Not defined	
G: Were the falls events clearly defined to staff collecting and recording the data?	2 = Clearly defined and staff were trained in use of the definition 1 = Clearly defined but staff were not	Staff recording falls events may have differing views on what defines a falls event. Research protocols that define falls events and

(*Continued*)

	trained in use of the definition 0 = Poorly defined	train staff in the use of their definition may be more reliable
H: Was the ascertainment of falls and other outcomes identical in all arms of the study?	2 = Ascertainment of falls and other outcomes clearly identical 1 = Differences were clear but trivial 0 = Differences not mentioned or not clear, or important differences	

Appendix 3. Settings, combinations and categories of interventions (ProFaNE) for each included study

Setting/ Combination	Study ID	Exercises	Medication (drug target)	Management of urinary incontinence	Fluid or nutritional therapy	Environment/ assistive technology	Social environment	Knowledge	Other
CARE FACILITIES									
Single	Bischoff 2003		****						
	Broe 2007		****						
	Buettner 2002	****							
	Chapuy 2002		****						
	Chenoweth 2009						****		
	Choi 2005	****							
	Clifton 2009					****			
	Cox 2008						****		
	Crotty 2004a		****						

(*Continued*)

	Crotty 2004b		****						
	Faber 2006	****							
	Flicker 2005		****						
	Grieger 2009		****						
	Kerse 2008	****							
	Klages 2011								**** Multisensory stimulation
	Lapane 2011		****				****		
	Law 2006		****						
	Meyer 2009						****		
	Mulrow 1994	****							
	Nowalk 2001	****							
	Patterson 2010		****						
	Rosendahl 2008	****							
	Sakamoto 2006	****							
	Sakamoto 2012								**** Lavender patches
	Sambrook 2012 (UV)								**** Sunlight

(*Continued*)

	Schoenfelder 2000	****							
	Serra-Rexach 2011	****							
	Shimada 2004	****							
	Sihvonen 2004	****							
	Toulotte 2003	****							
	Van Gaal 2011a						****		
	Ward 2010						****		
	Zermansky 2006		****						
Multiple	Schnelle 2003	****		****	****				
	Sambrook 2012 (UV+)		****						**** Sunlight
Multifactorial	Becker 2003	****				****	****	****	
	Dyer 2004	****	****			****	****		**** Podiatry referral
	Jensen 2002	****	****			****	****		
	Kerse 2004		****	****		****	****		

(*Continued*)

	McMurdo 2000	****	****			****		****	
	Neyens 2009	****	****			****	****		
	Ray 1997		****			****	****	****	
	Rubenstein 1990		****			****			
	Shaw 2003	****	****			****			
HOSPITALS									
Single	Ang 2011							****	
	Burleigh 2007		****						
	Donald 2000 (2 x 2 factorial)	****				****			
	Dykes 2010						****		
	Haines 2010					****			
	Haines 2011							****	
	Jarvis 2007	****							
	Koh 2009						****		
	Mador 2004						****		
	Mayo 1994					****			

(*Continued*)

	Tideiksaar 1993					****			
	Van Gaal 2011b						****		
	Wald 2011						****		
Multifactorial	Cumming 2008	****	****			****	****	****	
	Haines 2004	****				****		****	
	Healey 2004		****			****			**** Opthalmology referral
	Stenvall 2007		****	****	****	****	****		

Abbreviations

UV: increased sunlight exposure group.
UV+: increased sunlight exposure + calcium supplementation group

Appendix 4. Categories of exercise (ProFaNE) by study setting and combination

Study setting/type	Study ID	Gait/balance/ functional training	Strength/ resistance training	Flexibility	3D (Tai Chi, dance etc)	General physical activity	Endurance	Other
CARE FACILITIES								
Single	Buettner 2002	****	****	****		****		****
	Choi 2005				****			

(*Continued*)

	Faber 2006 (FW)	****						
	Faber 2006 (IB)	****	****	****	****			
	Kerse 2008	****						
	Mulrow 1994	****	****	****				
	Nowalk 2001 (FNBF)		****	****				
	Nowalk 2001 (LL/TC)				****			
	Rosendahl 2008	****	****					
	Sakamoto 2006	****						
	Schoen-felder 2000		****			****		
	Serra-Rexach 2011		****	****			****	
	Shimada 2004	****						
	Sihvonen 2004	****						
	Toulotte 2003	****	****	****				
Multiple	Schnelle 2003		****			****		

(*Continued*)

Multifactorial	Becker 2003	****	****					
	Dyer 2004	****	****	****		****		
	Jensen 2002	****	****					
	McMurdo 2000	****	****	****				
	Neyens 2009[a]							
	Shaw 2003	****	****	****				
HOSPITALS								
Single	Donald 2000 (EX)		****					
	Jarvis 2007	****	****	****				
Multifactorial	Cumming 2008	****						
	Haines 2004	****	****		****			

[a] No description of the exercise components in Neyens 2009

Abbreviations

EX: supplementary exercises
FNBF: 'Fit NB Free' group
FW: 'Functional Walking' group
IB: 'In Balance' group
LL/TC: 'Living and learning/Tai Chi' group

Appendix 5. Categories of environment/assistive technology interventions (ProFaNE) by study setting and combination

Study setting/ type	Study ID	Furnishing/ adaptations	Personal mobility aids	Communication/signalling aids	Body worn care/protection aids	Other environmental
CARE FACILITIES						
Single	Clifton 2009			****		
Multifactorial	Becker 2003	****	****		****	
	Dyer 2004	****				
	Jensen 2002	****	****	****	****	
	Kerse 2004	****	****		****	
	McMurdo 2000	****				
	Neyens 2009	****	****			
	Ray 1997	****	****			
	Rubenstein 1990	****				
	Shaw 2003	****	****		****	
HOSPITALS						
Single	Donald 2000 (FL)	****				
	Mayo 1994			****		
	Haines 2010	****				
	Tideiksaar 1993			****		
Multifactorial	Cumming 2008	****	****	****		
	Haines 2004			****	****	

(*Continued*)

	Healey 2004	****		****	****	****
	Stenvall 2007					**** Home visit by OT and/or PT

Abbreviations

FL: carpet flooring group
OT: occupational therapist
PT: physiotherapist

Appendix 6. Source of data for generic inverse variance analysis (*see* footnotes for explanation of codes)

Study ID	Source for rate ratio (falls)	Source for risk ratio (fallers)	Source of risk ratio (number with fractures)
Ang 2011	NA	4	NA
Becker 2003	1b	5b	7c
Becker 2003 (Cognitively impaired/not impaired subgroup analysis)	1	5	NA
Bischoff 2003	1a	5a	7
Broe 2007 (800 IU)	1a	4a	NA
Buettner 2002	ND	NA	NA
Burleigh 2007	ND	5	7
Chapuy 2002	NA	7	7
Chenoweth 2009	NA	ND	NA
Choi 2005	NA	7c	NA
Clifton 2009	3	NA	NA
Cox 2008	1ab	NA	ND

(*Continued*)

Crotty 2004a	NA	5	NA
Crotty 2004b	NA	5ab	NA
Cumming 2008	1ab	7c	7c
Donald 2000	3	5	NA
Dyer 2004	3c	6b	NA
Dykes 2010	3c	7c	NA
Faber 2006	3	4 (FW vs control and IB vs control) 4a (FW + IB vs control)	NA
Flicker 2005	1	4	7
Grieger 2009	3	7	NA
Haines 2004	3	5	7
Haines 2010	3c	NA	NA
Haines 2011	2a	6a	NA
Healey 2004	3c	NA	NA
Jarvis 2007	ND	7	NA
Jensen 2002	1b	4b	6a
Jensen 2002 (MMSE < 19/ ≥ 19 subgroup analysis)	1b	7c	NA
Kerse 2004	1ab	7c	NA
Kerse 2008	2b	7c	NA
Klages 2011	ND	NA	NA
Koh 2009	3c	NA	NA
Lapane 2011	NA	4b	NA
Law 2006	3c	7c	5ab

(*Continued*)

Mador 2004	NA	7	NA
Mayo 1994	3	4	NA
McMurdo 2000	3c	7c	7c
Meyer 2009	3c	7c	7c
Mulrow 1994	3	7	NA
Neyens 2009	1b	NA	NA
Nowalk 2001	NA	ND	NA
Patterson 2010	3c	NA	NA
Ray 1997	NA	ND	NA
Rosendahl 2008	1c	7c	7c
Rubenstein 1990	3	7	7
Sakamoto 2006	3	7	7
Sakamoto 2012	1	4	NA
Sambrook 2012	1c	7c	7c
Schnelle 2003	3	7	7
Schoenfelder 2000	3	NA	NA
Serra-Rexach 2011	ND	NA	NA
Shaw 2003	ND	5	5
Shimada 2004	3	7	NA
Sihvonen 2004	1a	7	NA
Stenvall 2007	1	4	7
Tideiksaar 1993	NA	ND	NA
Toulotte 2003	ND	NA	NA
Van Gaal 2011a	1c	NA	NA
Van Gaal 2011b	1c	NA	NA

(*Continued*)

Wald 2011	3	NA	NA
Ward 2010	ND	NA	7c
Zermansky 2006	3	7	NA

Abbreviations
FW: 'Functional Walking' group
IB: 'In Balance' group
MMSE: Mini Mental State Examination
800 IU: 800 International Units vitamin D group
Codes for source of rate ratio:
1: incidence rate ratio reported by trial authors
2: hazard ratio/relative hazard (multiple events) reported by trial authors
3: incidence rate ratio calculated by review authors
a: adjusted for confounders by trial authors
b: adjusted for clustering by trial authors
c: adjusted for clustering by review authors
Codes for source of risk ratio:
4: hazard ratio/relative hazard (first fall only) reported by trial authors
5: relative risk reported by trial authors
6: odds ratio reported by trial authors
7: relative risk calculated by review authors
a: adjusted for confounders by trial authors
b: adjusted for clustering by trial authors
c: adjusted for clustering by review authors
NA: not applicable. Falls (for rate ratio) or fallers (for risk ratio) or number of people sustaining a fracture (for risk ratio) not reported as an outcome in the trial
ND: outcomes relating to falls or fallers or fractures were reported, but there were no useable data; results from the paper reported in the text of the review

Abbreviations
FW: 'Functional
IB: 'In Balance'
MMSE: Mini M
800 IU: 800 Int
Codes for sourc
1: incidence rate
2: hazard ratio/r
3: incidence rate
a: adjusted for c
b: adjusted for c
c: adjusted for c
Codes for sourc
4: hazard ratio/r
5: relative risk re
6: odds ratio rep
7: relative risk ca
a: adjusted for c
b: adjusted for c
c: adjusted for c
NA: not applicab
of people sustain
in the trial
ND: outcomes
there were no us
the review

Appendix 7. Raw data for rate of falls and number of fallers when available

Study ID	Intervention group: falls per person year	Control group: falls per person year	Intervention group: number of fallers	Intervention group: number in analysis	Intervention group: proportion of fallers	Control group: number of fallers	Control group: number in analysis	Control group: proportion of fallers
Ang 2011	---	---	4	910	0.004	14	912	0.02
Becker 2003	1.40	2.56	188	509	0.37	247	472	0.52

(*Continued*)

Becker 2003 (Cognitively impaired)	1.10	2.71	50	150	0.33	98	169	0.58
Becker 2003 (Not cognitively impaired)	1.42	2.04	93	215	0.43	91	191	0.48
Bischoff 2003	---	---	14	62	0.23	18	60	0.30
Broe 2007 (800 IU)	0.28	1.00	5	23	0.22	11	25	0.44
Buettner 2002	---	---	---	---	---	---	---	---
Burleigh 2007	---	---	36	100	0.36	45	103	0.44
Chapuy 2002	---	---	251	393	0.64	118	190	0.62
Chenoweth 2009	---	---	---	---	---	---	---	---
Choi 2005	---	---	9	29	0.31	15	30	0.50
Clifton 2009	2.45	3.79	---	43	---	---	43	---
Cox 2008	---	---	---	3315	---	---	2322	---
Crotty 2004a	---	---	19	44	0.43	16	44	0.36
Crotty 2004b	---	---	97	381	0.26	73	334	0.22
Cumming 2008	3.36	3.39	157	2047	0.08	143	1952	0.07
Donald 2000 (FL)	5.75	0.39	7	28	0.25	1	26	0.04
Donald 2000 (EX)	2.22	2.10	2	30	0.07	6	24	0.25

(*Continued*)

Dyer 2004	2.17	4.02	56	102	0.55	51	94	0.54
Dykes 2010	1.01	1.84	34	2755	0.01	51	2509	0.02
Faber 2006 (FW)	3.3	2.5	40	64	0.63	48	90	0.53
Faber 2006 (IB)	2.4	2.5	45	78	0.58	48	90	0.53
Faber 2006 (FW + IB)	2.8	2.5	85	142	0.60	48	90	0.53
Flicker 2005	1.26	1.90	170	313	0.54	185	312	0.59
Grieger 2009	0.60	1.60	11	48	0.23	12	43	0.28
Haines 2004	4.12	5.94	54	310	0.17	71	316	0.22
Haines 2010	1.91	1.37	---	6113	---	---	4986	---
Haines 2011 (ED)	3.14	3.39	56	424	0.13	54	381	0.14
Haines 2011 (ED+)	2.79	3.39	44	401	0.11	54	381	0.14
Healey 2004	4.12	7.03	---	749	---	---	905	---
Jarvis 2007	---	---	3	14	0.21	7	15	0.47
Jensen 2002	2.45	3.03	82	188	0.44	109	196	0.56
Jensen 2002 (MMSE < 19)	3.50	3.34	37	69	0.54	62	102	0.61
Jensen 2002 (MMSE ≥ 19)	1.77	2.90	42	112	0.38	43	79	0.54
Kerse 2004	4.1	2.3	173	309	0.56	103	238	0.43
Kerse 2008	---	---	162	310	0.52	146	329	0.44
Klages 2011	---	---	---	---	---	---	---	---

(*Continued*)

Koh 2009	0.40	0.22	---	612	---	---	510	---
Lapane 2011	---	---	---	1769	---	---	1552	---
Law 2006	2.01	2.31	770	1762	0.44	833	1955	0.43
Mador 2004	---	---	10	36	0.28	4	35	0.11
Mayo 1994	4.62	4.01	27	65	0.42	21	69	0.30
McMurdo 2000	3.02	3.85	20	52	0.38	22	38	0.58
Meyer 2009	1.97	2.04	299	574	0.52	291	551	0.53
Mulrow 1994	1.86	2.44	44	97	0.45	38	97	0.39
Neyens 2009	2.09	2.54	---	249	---	---	269	---
Nowalk 2001 (LL/TC)	---	---	---	---	---	---	---	---
Nowalk 2001 (FNBF)	---	---	---	---	---	---	---	---
Patterson 2010	1.96	1.37	---	173	---	---	161	---
Ray 1997	---	---	---	---	---	---	---	---
Rosendahl 2008	3.6	4.6	46	87	0.53	49	96	0.51
Rubenstein 1990	2.49	2.63	56	79	0.71	61	81	0.75
Sakamoto 2006	0.93	1.14	68	315	0.22	51	212	0.24
Sakamoto 2012	1.04	1.40	26	73	0.36	36	72	0.50
Sambrook 2012 (UV)	---	---	111	190	0.58	111	205	0.54

(*Continued*)

Sambrook 2012 (UV+)	---	---	108	207	0.52	111	205	0.54
Schnelle 2003	0.68	1.09	17	92	0.18	29	98	0.30
Schoen-felder 2000	9.33	3.43	---	9	---	---	7	---
Serra-Rexach 2011	---	---	---	---	---	---	---	---
Shaw 2003	---	---	96	130	0.74	115	144	0.80
Shimada 2004	1.07	2.00	5	15	0.33	6	11	0.55
Sihvonen 2004	---	---	11	20	0.55	5	7	0.71
Stenvall 2007	2.30	5.95	12	102	0.12	26	97	0.27
Tideiksaar 1993	---	---	---	---	---	---	---	---
Toulotte 2003	---	---	---	---	---	---	---	---
Van Gaal 2011a	1.56	2.08	---	196	---	---	196	---
Van Gaal 2011b	1.04	1.04	---	1081	---	---	1120	---
Wald 2011	1.75	2.45	---	122	---	---	95	---
Ward 2010	---	---	---	---	---	---	---	---
Zermansky 2006	1.60	2.60	84	331	0.25	106	330	0.32

Abbreviations
ED: educational materials only group
ED+: educational materials plus physiotherapist follow-up
EX: supplementary exercises group
FL: carpet flooring group
FNBF: 'Fit NB Free' group

Abbreviations
ED: educational
group
ED+: educatio
plus physiothera

(*Continued*)

FW: 'Functional Walking' group IB: 'In Balance' group MMSE: Mini Mental State Examination LL/TC: 'Living and learning/Tai Chi' group UV: increased sunlight exposure group. UV+: increased sunlight exposure + calcium supplementation group 800 IU: 800 International Units vitamin D group	EX: supplemen group FL: carpet floori FNBF: 'Fit NB FW: 'Functio group IB: 'In Balance' MMSE: Mini M amination LL/TC: 'Living Tai Chi' group UV: increased sure group. UV+: increased sure + calcium tion group 800 IU: 800 Units vitamin D

Appendix 8. Methodological quality assessment scores (see Appendix 2 for criteria)

Study ID	Item A	ItemB	Item C	Item D	Item E	Item F	Item G	Item H
Ang 2011	2	2	0	0	2	2	0	2
Becker 2003	2	1	0	0	0	2	2	2
Bischoff 2003	1	2	2	2	2	2	2	2
Broe 2007	2	2	2	2	0	2	1	2
Buettner 2002	0	0	0	0	2	2	0	2
Burleigh 2007	2	0	2	2	2	2	2	2
Chapuy 2002	2	2	2	2	2	2	0	2
Chenoweth 2009	1	2	0	0	0	2	0	2
Choi 2005	1	1	0	0	0	2	1	0

(*Continued*)

Clifton 2009	1	2	0	0	2	2	1	2
Cox 2008	1	2	0	0	0	2	0	0
Crotty 2004a	0	2	0	0	2	2	0	2
Crotty 2004b	0	2	0	0	0	1	0	0
Cumming 2008	2	2	0	0	2	2	2	2
Donald 2000	1	1	0	0	2	2	1	2
Dyer 2004	2	1	0	0	2	1	2	2
Dykes 2010	2	2	0	0	0	2	2	2
Faber 2006	1	2	0	0	1	2	1	2
Flicker 2005	2	2	2	2	2	2	2	2
Grieger 2009	1	2	2	2	2	2	0	2
Haines 2004	2	2	1	1	1	1	2	2
Haines 2010	2	0	0	0	0	2	2	2
Haines 2011	2	2	0	1	0	2	2	2
Healey 2004	2	1	0	0	0	2	0	2
Jarvis 2007	0	2	0	0	2	2	2	2
Jensen 2002	1	2	0	0	0	2	1	2
Kerse 2004	2	2	0	0	1	2	2	2
Kerse 2008	2	0	0	0	1	2	1	2
Klages 2011	2	2	0	0	2	2	1	2

(*Continued*)

Koh 2009	0	0	0	0	0	0	0	0
Lapane 2011	0	1	0	0	1	2	1	0
Law 2006	2	2	0	0	2	2	0	0
Mador 2004	2	1	0	0	2	2	0	2
Mayo 1994	2	1	0	1	2	2	2	2
McMurdo 2000	2	2	0	0	2	2	1	2
Meyer 2009	2	2	0	0	0	2	2	2
Mulrow 1994	1	2	0	0	2	2	0	2
Neyens 2009	2	2	0	0	0	2	0	2
Nowalk 2001	0	2	0	0	2	2	1	2
Patterson 2010	2	2	0	0	0	2	0	2
Ray 1997	2	1	0	0	1	2	2	2
Rosendahl 2008	1	2	0	0	2	2	1	2
Rubenstein 1990	2	2	0	0	1	2	1	2
Sakamoto 2006	0	0	0	0	2	2	0	0
Sakamoto 2012	2	2	1	2	2	2	2	2
Sambrook 2012	2	2	0	0	0	2	0	2
Schnelle 2003	2	2	0	0	2	2	2	2

(*Continued*)

Schoen-felder 2000	2	0	0	0	0	2	0	2
Serra-Rexach 2011	1	2	0	0	2	2	2	2
Shaw 2003	1	2	0	0	2	2	2	2
Shimada 2004	1	2	0	1	2	1	0	2
Sihvonen 2004	1	2	0	0	2	1	0	2
Stenvall 2007	2	1	0	0	2	2	2	2
Tideiksaar 1993	2	0	0	1	2	2	2	2
Toulotte 2003	2	2	0	0	0	2	0	0
Van Gaal 2011a	1	2	0	0	0	2	2	2
Van Gaal 2011b	1	2	0	0	0	2	2	2
Wald 2011	2	2	0	0	0	2	0	2
Ward 2010	0	2	0	0	0	2	2	2
Zermansky 2006	2	2	0	0	2	2	0	2
Summary of quality scores	**Item A**	**Item B**	**Item C**	**Item D**	**Item E**	**Item F**	**Item G**	**Item H**
2: high quality	34	42	6	7	31	54	24	52
1: moderate quality	17	10	2	5	7	5	13	0

(*Continued*)

0: unclear or low quality	9	8	52	48	22	1	23	8
% high quality	56.7%	70.0%	10.0%	11.7%	51.7%	90.0%	40.0%	86.7%
% moderate quality	28.3%	16.7%	3.3%	8.3%	11.7%	8.3%	21.7%	0.0%
% unclear or low quality	15.0%	13.3%	86.7%	80.0%	36.7%	1.7%	38.3%	13.3%

Appendix 9. Studies reporting cost-effectiveness or costs of the intervention and/or healthcare resource use

Study ID (source if not primary reference), sample, efficacy analyses, type of evaluation	Intervention(s) and comparator (N in analysis)	Perspective(s), type of currency, price year, time horizon	Cost items measured	Mean (SD) intervention cost per person	Healthcare service costs	Incremental cost per fall prevented/per QALY gained
•Buettner 2002 •Residents of 3 dementia care units (Oxford, Boston, and Palo Alto, US) ≥ 2 falls in 1 month, mean age 83 (range 60 to 98) years •No effectiveness data available for analysis •Cost analysis	•Daily "graded" walking, "exercise for function" programme 3 x week, sensory air mat 2 x week (evenings) for 2 months vs usual care, number allocated to each group not reported (total N = 27)	•Not stated •US dollar •Not stated •2 months	•Therapist time (intervention only) •Cost of falls and injuries ("based on research data on falls")		•Treatment group USD 30,031, control group USD 79,535	
•Chenoweth 2009 (Norman 2008) •Residents from	•Dementia care mapping (DCM) (N = 109, 5 sites)	•Health service •Australian dollar •2008	•Trainer time, post-training support, staff replacement	•Not reported (annual total cost per residential care set-	•Annual pharmaceutical cost per resident AUD 545.	•Not reported •Incremental cost per behaviour

(*Continued*)

15 dementia care sites across Sydney, Australia, category 1 to 3 on Australian Resident Classification Scale (high level of care), mean age 84 (SD 7) years •No effectiveness data available for analysis •Cost-effectiveness analysis	vs person centred care (PCC) (N = 98, 5 sites) vs usual care (N = 82, 5 sites) for 4 months	•8 months	(DCM, PCC) •Pharmaceutical use	ting DCM AUD 10,034, PCC AUD 2250)	55	(CMAI point) averted DCM vs usual care AUD 46.89, PCC vs usual care AUD 6.43
•Clifton 2009 •Skilled nursing care facility residents, Eastern Washington State, US, mean age 82 (SD 7) years •Analysis 5.1 •Analytic model	•Wear FallSaver monitor for 60 days (N = 33) vs no device for 60 days (N = 39), cross over trial	•Not stated •US dollar •2004 •1 year	•Annual intervention implementation for 100 residents (direct costs only) •Mean hospitalisation cost for injurious fall (from the literature)	•USD 2 per resident per day (annual cost for 100 resident facility USD 73,000)	•Assuming 35 injurious falls per 100 residents per year, annual cost savings for 100 resident facility if 12% fewer injurious falls USD 429, USD 232, 953 if 50% fewer injurious falls	
•Meyer 2009 •Nursing home residents in Hamburg, Germany, mean age 86 (SD 6) years •Analysis 6.1, Analysis 6.2, Analysis 6.3 •Cost description	•Administer standardised risk assessment tool (Downton Index) monthly (N = 574, 29 nursing homes) vs usual care (N = 551, 29 nursing homes)	•Nursing care facility •Euro •2006 •1 year	•Nurse time for training and assessing using the Downton Index	•Not reported (total during the study EUR 10, 500 (USD 16,170, GBP 8, 160)		
•Mulrow 1994 •Residents from 9 nursing homes in San Antonio,	•One-on-one physical therapy sessions (N = 97) vs friendly vis-	•Not stated •US dollar •Not stated •4 months	•Intervention delivery (wages, travel expenses, equip-	•USD 1220 (95% CI 412 to 1832) for physical ther-	•Healthcare charges (81% nursing home,	

(*Continued*)

Texas, US, dependent in ≥ 2 activities of daily living, mean age 80 (SD 8) years •Analysis 1.1, Analysis 1.2, Analysis 2.1, Analysis 2.2 •Cost analysis	its (N = 97) 3 x week for 4 months		ment, overheads) •Nursing home, hospitalisation, physician and other health professional visits, emergency department visits, procedures, and medication charges	apy programme, USD 189 (95% CI 80 to 298) control group	15% hospitalisation) USD 11, 398 (95% CI 10,929 to 11, 849) per participant (NS)	
•Schnelle 2003 •Residents of 4 nursing homes, incontinence of urine, US, mean age 88 (SD 8) years •Analysis 8.1, Analysis 8.2, Analysis 8.3 •Cost analysis	•Low intensity functionally orientated exercise and incontinence care 5 days a week every 2 hours between 8: 00 am and 4:00 pm for 8 months (N = 92) vs usual care (N = 98)	•Not stated •US dollar •1997/98 •8 months	•Diagnostic tests, treatment related to each acute condition (dermatological, genitourinary, gastrointestinal, respiratory and cardiovascular systems; falls; pain; psychiatric and nutritional disturbances)		•USD 24.42 per resident per week to evaluate and treat the selected conditions intervention group, USD 38. 36 control group (NS)	
•Wald 2011 •Medical inpatients at University of Colorado Hospital, US, aged ≥ 70 years, mean age 81 (SD 7) years •Analysis 15.1 •Cost analysis	•Hospitalist run acute care service for elderly people (N = 122) vs usual hospital inpatient care (N = 95)	•Not stated •US dollar •2007 •6 months	•"Hospital charges"		•Mean "hospital charges" USD 24,617 (SD 15, 828) intervention vs USD 21, 488 (SD 13,407) usual care, P = 0. 12	
•Zermansky 2006 •Residents of 65 nursing care facilities in Leeds, UK taking ≥ 1 medicines, mean age 85 (interquartile range 80 to 91) years	•Clinical medication review by pharmacist (N = 331) vs usual general practitioner care (N = 330)	•Not stated •Pound sterling •2003 •6 months	• Pharmaceutical use		•Mean medication cost per patient per 28 days medication review group GBP 42. 24 (SD 38.33) vs GBP 42.95 (SD 41.01) con-	

(*Continued*)

•Analysis 3.1, Analysis 3.2 •Cost analysis					trol group, mean difference GBP -0.70 (95% CI -7.28 to 5.71)	

CMAI: Cohen-Mansfield agitation inventory
NS: difference between groups not statistically significant
QALY: quality adjusted life year

Appendix 10. Contribution of authors for the first version of this review

Ian Cameron and Lesley Gillespie initiated splitting the previous review, entitled 'Interventions for preventing falls in elderly people', into separate reviews for older people living in the community and for older people in nursing care facilities and hospitals. The protocol was adapted by Geoffrey Murray from the previous review with guidance from Lesley Gillespie and Ian Cameron. All authors then met to finalise the protocol before preparation by Geoffrey Murray. Geoffrey Murray was primarily responsible for locating studies, and both he and Ian Cameron decided independently and then by consensus which studies met inclusion criteria. All seven authors assessed quality and extracted data from included studies. Keith Hill adjudicated differences in quality assessments and data in most studies and Geoffrey Murray adjudicated the others. Geoffrey Murray prepared the drafts and did the primary data entry and analysis into RevMan. Lesley Gillespie and Clare Robertson provided guidance with this process. Clare Robertson prepared the generic inverse data for entry into RevMan. All authors commented on re-analyses and revisions at all stages. Ian Cameron is the guarantor of the review.

FEEDBACK

Assessment of selection bias and reporting of raw data (absolute numbers), 19 December 2012

Summary

1. For the risk of bias assessment, the review reports allocation concealment in Figure 1 , but in the Characteristics of included studies risk of bias table, the description given under allocation concealment describes sequence generation. Although sequence generation and allocation concealment both deal with selection bias, they are separate items that contribute to maintaining randomization. For the next update of this review, we recommend an assessment of sequence generation and allocation concealment as separate categories in the risk of bias assessment and a re-evaluation of the quality of the included studies.

2. The review states that the primary outcomes are "falls, which means number of falls (for example, fall rate per person year, rate ratio) and fallers, which means the number of people who fall (for example, fallers/non-fallers/multiple fallers, time to first fall)". However, the reported outcomes are in terms of rate of fall and risk of fall, with no absolute numbers reported.
Having the absolute numbers reported would aid clinicians in assessing the clinical significance of the results, and would also give readers a sense of the baseline risk of falls in the pooled patient population.

Reference

Savovic J, Jones HE, Altman DG, Harris RJ, Juni P, Pildal J, et al. Influence of reported study design characteristics on intervention effect estimates from randomized, controlled trials. Annals of Internal Medicine 2012;157(6):429-38.
Note: This is an abridged version of the feedback received.

Reply

We are grateful for this feedback on an earlier version of this review (Cameron 2010).

1. We agree that "Although sequence generation and allocation concealment both deal with selection bias, they are separate items that contribute to maintaining randomization." This issue was addressed in the 2012 update of this review (Cameron 2012) when all included trials were reassessed for risk of bias relating to 'Random sequence generation' and 'Allocation concealment' separately. These two assessments are now reported separately under 'Allocation' in the Risk of bias in included studies section of the results. The detailed assessment of each trial is provided in the risk of bias tables in the Characteristics of included studies, and shown in Figure 1.
2. The feedback refers to an earlier version of this review (Cameron 2010) and the wording relating to the primary outcomes was revised in the updated review in 2012. We agree that the absolute numbers for rate of falls and number of fallers should be reported when available. We have revised the appendices in this review and these data are now provided in Appendix 7. We anticipate that 'Summary of findings' tables will be added to future Cochrane reviews on this topic, including the Overview Review which is being prepared, and these will provide further information to assist clinicians and decision makers.

Reference

Udell JE, Drahota A, Dean TP, Sander R, Mackenzie H. Interventions for preventing falls in older people: an overview of Cochrane Reviews (Protocol). Cochrane Database of Systematic Reviews 2011, Issue 4. Art. No.: CD009074. DOI: 10.1002/14651858.CD009074.

Contributors

Feedback from: Serena Bains, Kayla Fang, Kelvin Lou and Aaron Tejani, Canada
Reply from: Lesley Gillespie, M Clare Robertson, Ian Cameron (with advice from Xavier Griffin, Feedback Editor, Cochrane Bone, Joint and Muscle Trauma Group).

Confidence interval for pooled data in Analysis 4.1.2, 12 February 2013

Summary

In the HTML version of this review, the forest plot of analysis 4.1 (vitamin D) seems to contain an error. The confidence interval for the subtotal in analysis 4.1.2 does not fit with the two studies that were pooled. The confidence intervals for the individual studies do not include 1, but the pooled interval does. I did not check the pdf version.

Reply

We thank Dr van der Wouden for his interest in our review.
The forest plots are the same in all published formats (HTML and pdf). They are generated in the Review Manager software used to produce the review.
In relation to Analysis 4.1.2 'Vitamin D2 vs usual care or placebo', Dr van der Wouden is correct in his observations regarding the confidence intervals (*see* Table 1).
Table 1: Analysis 4.1.2: Vitamin D2 vs usual care or placebo

Study ID	Rate ratio (95% CI)
Broe 2007	0.28 (0.10 to 0.76)
Law 2006	0.87 (0.80 to 0.94)

(*Continued*)

Pooled rate ratio (95% CI) random-effects model	0.55 (0.19 to 1.64)
Heterogeneity: Tau² = 0.51; Chi² = 4.88, df = 1 (P = 0.03)[a]; I² = 80%	

[a] Statistically significant at P < 0.10.

The results of these two studies were pooled using the random-effects model. This subgroup was part of the overall pooling in Analysis 4.1 to answer the question "on average, does vitamin D supplementation reduce falls?". We used the random-effects model rather than the fixed-model to pool data in the overall analysis (and therefore this subgroup analysis) because of the variation in vitamin D interventions tested, and due to the statistical heterogeneity in Analysis 4.1 (P = 0.007; I² = 72%). The random-effects model is also appropriate for the subgroup Analysis 4.1.2 for the same reasons (P = 0.03; I² = 80%).

The random-effects model takes account of between study variation as well as within study variation. "The random-effects method and the fixed-effect method give identical results when there is no heterogeneity among the studies. Where there is heterogeneity, confidence intervals for the average intervention effect will be wider if the random-effects method is used rather than a fixed-effect method …". [1] In Analysis 4.1.2, there is substantial heterogeneity (variation in effect estimates beyond chance), hence the wide confidence interval for the pooled result.

Reference

1. Deeks JJ, Higgins JPT, Altman DG (editors). Chapter 9.4.4.3: Random-effects method. In: Higgins JPT, Green S (editors). *Cochrane Handbook of Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Contributors

Feedback from: Johannes C van der Wouden, Netherlands

Reply from: Lesley Gillespie, M Clare Robertson, Ian Cameron (with advice from Xavier Griffin, Feedback Editor, Cochrane Bone, Joint and Muscle Trauma Group).

Comments relating to 'Vitamin D supplementation', 17 October 2014

Summary

1. We question your conclusion, "In care facilities, vitamin D supplementation reduced the rate of falls (Rate ratio 0.63, 95% CI 0.46 to 0.86; 5 trials, 4603 participants)," aligns with the evidence that you have published in your review. This conclusion is based on a meta-analysis of trials which included vitamin D monotherapy, calcium and vitamin D dual therapy as well as a multivitamin containing vitamin D. When the trials using vitamin D monotherapy were analyzed separately, the rate of falls was not significantly different when compared to placebo (Rate ratio 0.55 95%CI 0.19-1.64). The only significant results were the analyses looking at vitamin D + calcium versus calcium (Rate ratio 0.71 95%CI 0.56-0.90) and multivitamin (including vitamin D + calcium) versus placebo (Rate ratio 0.38 95%CI 0.2-0.71). Based on these findings, it seems that vitamin D must be administered concomitantly with calcium or in the form of a multivitamin in order to support your stated conclusion that vitamin D reduces the rate of falls.

2. We do not think Law 2006 should have been included as part of the meta-analysis. This trial did not randomize patients to different interventions and therefore would not meet the inclusion criteria for your systematic review. Furthermore, the study had significant limitations. The participants were randomized in clusters by care home units which can lead to imbalances in the patient groups.

3. According to the risk of bias assessment in the review, this study was assessed to have a high risk of bias for blinding of outcome assessment. There was no placebo used therefore staff who were assessing outcomes and patients could have been unblinded to treatment. The review also concluded that there was unclear risk of bias regarding the random sequence generation and allocation concealment. Furthermore, general practitioners prescribed vitamin D and calcium to subjects in both the treatment and control groups throughout the trial. This is concerning because control subjects may actually have received the intervention.

4. As a result of these limitations and the fact that this trial had a relatively high weight (36.2%) in the meta-analysis, we suggest excluding Law 2006, redoing all analyses without this trial data, and present the results and conclusions in an updated review.
5. We are also concerned about the level of detail reported in the trials regarding description and ascertainment of a fall. The review did not include a definition for a fall in their inclusion criteria. The definition of a "fall" can have an impact on how the outcome is measured; and falls may be missed depending on the definition used in a trial. Ascertainment of "fall" events may differ between the trials that stated a definition and the ones that did not state a definition. Broe 2007 and Flicker 2005 had similar definitions, whereas in Bischoff 2003, "coming to rest against furniture or a wall" was not counted. In Chapuy 2002, Greiger 2009 and Law 2006, there was no definition of a fall in the main publication.
6. Most of the trials had a nurse or staff member record falls but Chapuy 2002 had the residents self-report their falls. In this case, there is a risk of recall bias and falls could have been over or under reported. None of the trials reported if the falls had to be witnessed in order to be counted and we are concerned that this may lead to inconsistency between trials. We would be interested in knowing if the trial authors were contacted when a fall definition was not reported, when the definition was too vague or to enquire about witnessed falls in order to ensure consistent interpretation between studies.
7. An additional concern is the second part of the statement, "In care facilities, the prescription of vitamin D reduced the number of falls, probably because residents have low vitamin D levels." This review did not analyze the impact of vitamin D supplementation on serum vitamin D levels and if this may have been correlated with the effect on falls.
8. The review should emphasize that vitamin D plus calcium appears to reduce the risk of subsequent falls in people that have fallen (i.e. the rate of falls) but has no impact on the risk of falling a first time (i.e. the risk of falls).
9. The risk of bias tables need to incorporate assessments for incomplete outcome data and selective outcome reporting biases. Is there a plan to have this done and when?
10. Broe 2007 was included in the analysis but only data on the treatment group (e.g. Vitamin D 800 IU) that demonstrated a reduction in the risk ratio of falls was included while other groups with different doses of vitamin D were ignored. We are not sure how this can be justified.
Note: This is a slightly abridged version of the feedback received.

Reply

1. The results of our review do not support the conclusion suggested in this Feedback. The forest plot for Comparison 4 shows that there is no significant difference between the results for the three subgroups (Vitamin D3 + calcium versus calcium, Vitamin D2 versus usual care or placebo, and Multivitamins (including vitamin D3 + calcium) vs placebo) (test for subgroup differences Chi2 = 3.43, df = 2 (P = 0.18), I^2 =42%). This is consistent with the recommendations in Scragg 2012 that "Conclusions should not be drawn from subgroup analyses … , but from analyses involving all studies of vitamin D, with and without calcium".
The biological plausibility should also be considered and for Vitamin D monotherapy the number of participants is limited. In falls prevention trials, calcium is regarded as a placebo (has no direct action on falling), whereas there is a direct mechanism for vitamin D to reduce falls (improves neuromuscular and psychomotor performance).
However, we note that calcium supplementation using tablets is considered controversial given that these supplements have been associated with increased cardiovascular risk (Bolland 2010). It is now generally recommended that dietary calcium is safer than calcium supplements.
2. We included cluster randomised trials and adjusted our analyses for clustering. In the next revision of the Review we will state this more clearly in the types of studies section.
3. Many of the interventions considered for the review could not be masked with reference to the participants or staff of the facilities. Twelve of the 1955 control participants (0.6%) were prescribed vitamin D, but this is unlikely to have had any impact on the results. Any effect would be to reduce the association that was demonstrated.
4. We have carried out an exploratory sensitivity analysis and when Law 2006 is removed from the analysis in Comparison 4 the overall result remains significant (rate ratio 0.51, 95% CI 0.31 to 0.80, 886 participants).
5: We consider that it would be inappropriate to include only trials that define a fall in the published paper or use one specific definition of a fall. We agree that the definition of a fall is variably reported in the papers included in this Review, and this also applies to the other Cochrane Collaboration falls prevention reviews. Hauer 2006 carried out a systematic review of fall definitions in randomised controlled trials of fall prevention interventions and out of 90 trials identified 44 did not include a definition (49%), and those that did used a variety of definitions.
6. Falls could have been under reported in Chapuy 2002 as patients were asked to report the number of falls at three-monthly intervals, however this was a placebo controlled trial so this would be unlikely to introduce bias i.e. there is no reason to expect reporting to differ

between the intervention and control groups. It is not possible only to include witnessed falls because those data are not available and the vast majority of falls in care facilities are unwitnessed. The authors were not contacted about the definition of falls.
7. The statement was made due to the evidence that residents of nursing care facilities have low vitamin D levels (for example see Malik 2007).
8. The rate of falls is calculated from the total number of falls in a particular time period and is not a direct measure of the risk of subsequent falls in people who have fallen. The rate of falls is a more powerful outcome because there are more events than for risk of falling (one event).
9. The risk of bias tables will be revised in line with the current Cochrane Collaboration recommendations when the review is next updated.
10. The results for each of the four intervention arms (200 IU, 400 IU, 600 IU, 800 IU vitamin D) were presented by the trial authors as comparisons with the same participants (placebo group, N = 25). We chose only one of these comparisons (800 IU versus placebo) to be included in Analysis 4.1 and Analysis 4.2 (a valid option, please see Cochrane Handbook section 16.5.4) and this was not because the incidence rate ratio for this particular group was significant. We consider that the comparison we chose was the most appropriate given that the dose was similar to others in these analyses and is the recommended daily allowance for older adults (*see* http://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional and IOM 2011 below).

References

1. Scragg R. Do we need to take calcium with vitamin D supplements to prevent falls, fractures, and death? Current Opinion in Clinical Nutrition and Metabolic Care 2012;15(6):614-24.
2. Bolland MJ, Avenell A, Baron JA, Grey A, MacLennan GS, Gamble GD, Reid IR. Effect of calcium supplements on risk of myocardial infarction and cardiovascular events: meta-analysis. BMJ 2010 Jul 29;341:c3691.
3. Hauer K, Lamb SE, Jorstad EC, Todd C, Becker C, ProFaNE-Group. Systematic review of definitions and methods of measuring falls in randomised controlled fall prevention trials. Age and Ageing 2006;35(1):5-10.
4. Malik R. Vitamin D and secondary hyperparathyroidism in the institutionalized elderly: a literature review. Journal of Nutrition for the Elderly 2007;26(3-4):119-38.
5. IOM (Institute of Medicine). Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: The National Academies Press, 2011.

Contributors

Feedback from: Donna Rahmatian, Stacey Tkachuk, Sarah Burgess, Cristi Froyman, Cait O'Sullivan, and Aaron M Tejani, Canada
Reply from: Ian Cameron (corresponding author), Lesley Gillespie, and M Clare Robertson (authors), (with advice from Xavier Griffin, Feedback Editor, Cochrane Bone, Joint and Muscle Trauma Group).

WHAT'S NEW

Last assessed as up-to-date: 30 June 2012.

Date	Event	Description
16 December 2014	Amended	Removal of Rosendahl 2008 (exercise) from Analysis 9.3 (multifactorial) and correction of associated text in response to a personal communication (Lundin-Olsson 2014).
16 December 2014	Feedback has been incorporated	Changes relate to feedback received 17 October 2014. Summary [of feedback] and Reply entries were added to the Feedback section. There were no changes to the review in relation to the feedback

HISTORY

Protocol first published: Issue 3, 2005

Review first published: Issue 1, 2010

Date	Event	Description
27 February 2013	Feedback has been incorporated	Changes relate to two pieces of feedback, received 19 December 2013 and 12 February 2013. Two Summary [of feedback] and Reply entries were added to the Feedback section. There were no changes to the review in relation to the second piece of feedback. Changes in relation to the first piece included: 1. Appendix 6 was revised and Appendices 7 and 8 were deleted. 2. A new Appendix 7, containing raw data, was added. 3. Sections of the review (principally, the 'Description of studies') were revised to reflect these changes
9 November 2012	New citation required and conclusions have changed	1. In response to the external referee's comments, the title of this review has been changed to reflect the fact that facilities which do not include nursing care are also included in this review. 2. Change in conclusion for multifactorial interventions in care facilities from no evidence of effect to a suggestion of possible benefits. Evidence from one trial for the effectiveness of an educational session targeting identified risk factors in acute hospital setting
9 November 2012	New search has been performed	For this update, published in Issue 12, 2012, the following changes were made: 1. Search updated to March 2012 2. Twenty additional trials (35,270 participants) included in this update 3. One previously included trial recruiting people post stroke (Barreca 2004) excluded, as no longer within the scope of this version of the review 4. Kerse 2008 reclassified as an exercise intervention (formerly multifactorial) 5. Additional trials testing multifactorial interventions with results for subgroups with and without cognitive impairment 6. Evidence relating to additional interventions, these include: patient education in hospital (Ang 2011; Haines 2011), dementia care mapping (Chenoweth 2009), motion sensors (Clifton 2009), decision-support software (Dykes 2010; Lapane 2011), multivitamin supplementation (Grieger 2009), low-low beds (Haines 2010), multisensory stimulation (Klages 2011), guideline implementation (Koh 2009; Van

(*Continued*)

		Gaal 2011a; Van Gaal 2011b), a fall risk assessment tool (Meyer 2009), increased sunlight exposure (Sambrook 2012), lavender oil stimulation (Sakamoto 2012), an acute care service for elderly people (Wald 2011) 7. One newly included trial included a cost-effectiveness analysis (Chenoweth 2009) 8. Background section revised and citations updated 9. 'Risk of bias' item relating to 'Allocation concealment' split into two: 'Sequence generation' and 'Allocation concealment' and applied to all included studies 10. Subgroup analyses revised
30 November 2009	Amended	Correction of two minor errors
23 September 2009	Amended	The published review 'Interventions for preventing falls in elderly people' (Gillespie 2003) is not being updated. Due to its size and complexity it was split into two reviews: 'Interventions for preventing falls in older people living in the community' and 'Interventions for preventing falls in older people in nursing care facilities and hospitals'
1 April 2009	Amended	Converted to new review format

CONTRIBUTIONS OF AUTHORS

ID Cameron, the guarantor for this review, conceived and designed the review and for this update carried out 'Risk of bias' assessment and data extraction, assisted with categorisation of trial interventions using the ProFaNE taxonomy, and commented on drafts of the review.

LD Gillespie conceived the review and for this update coordinated the review, modified the search strategies, carried out the searches, screened search results and obtained papers, screened retrieved papers against inclusion criteria, carried out 'Risk of bias' assessment and data extraction, entered data into RevMan, and wrote the review.

MC Robertson carried out 'Risk of bias' assessment and data extraction for all newly included trials, managed data and carried out statistical calculations, wrote the economic evaluation section and Appendix 9, and wrote the review.

GR Murray conceived and designed the review, and for this update screened retrieved papers against inclusion criteria, updated the Characteristics of included studies, Appendix 3, Appendix 4 and Appendix 5, assisted with categorisation of trial interventions using the ProFaNE taxonomy, and commented on drafts of the review.

KD Hill carried out 'Risk of bias' assessment and data extraction, and commented on drafts of the review.

RG Cumming carried out 'Risk of bias' assessment and data extraction, and commented on drafts of the review.

N Kerse carried out 'Risk of bias' assessment and data extraction, and commented on drafts of the review.

See Appendix 10 for 'Contribution of authors' for the previous version of this review.

DECLARATIONS OF INTEREST

Four review authors were investigators for six included studies: ID Cameron and RG Cumming (Cumming 2008; Sambrook 2012); KD Hill (Haines 2004; Haines 2011); N Kerse (Kerse 2004; Kerse 2008). Authors did not assess risk of bias in their own trials.

SOURCES OF SUPPORT

Internal sources

- University of Sydney, Australia.

Salary, administration, computing, and library services (IDC, RGC)

- University of Otago, Dunedin, New Zealand.

Computing, administration, and library services (LDG, MCR)

- Illawarra Shoalhaven Local Health Network, Warrawong, Australia.

Computing and library services (GM)

- Curtin University, Perth, Australia.

Salary, administration, computing, and library services (KDH)

- University of Auckland, New Zealand.

Salary, administration, computing and library services (NK)

External sources

- National Health and Medical Research Council, Practitioner Fellowship, Australia.

Salary contribution (IAC)

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

Criteria for considering studies for this review

Trials including only participants after stroke were excluded as a protocol for a Cochrane review on interventions for preventing falls in people after stroke has been published (Verheyden 2010).

Separation of analyses by setting

We reported the results for care facilities and hospitals separately as the primary analyses because this is likely to be more useful to the users of this review. Interventions will be organised differently in these two types of settings and there may be different effectiveness of similar interventions between the two settings.

'Risk of bias' assessment

The protocol was completed and submitted for publication prior to the general release of RevMan 5 and the supporting version of the *Cochrane Handbook for Systematic Reviews of Interventions* (version 5.0) in February 2008. In the protocol we stated that we would assess methodological quality using the 11-item tool used in Gillespie 2003.

For this version of the review we have used three criteria from The Cochrane Collaboration tool for assessing risk of bias: 'Random sequence generation', 'Allocation concealment', and 'Blinding of outcome assessment', and eight items from the 11-item tool (*see* Appendix 2). The items relating to allocation concealment and blinding of outcome assessors have not been used (now redundant). Also the item relating to appropriateness of duration of clinical surveillance was not used due to very poor agreement between assessors during preparation of the first version of this review.

Other changes

Interventions were classified using the Prevention of Falls Network Europe (ProFaNE) fall prevention taxonomy (Lamb 2007; Lamb 2011). Subgroup analyses were conducted to explore heterogeneity where appropriate.

INDEX TERMS

Medical Subject Headings (MeSH)

*Hospitals [statistics & numerical data]; *Nursing Homes [statistics & numerical data]; Accidental Falls [*prevention & control; statistics & numerical data]; Calcium, Dietary [administration & dosage]; Exercise; Randomized Controlled Trials as Topic; Safety Management; Vitamin D [administration & dosage]; Vitamins [administration & dosage]

MeSH check words

Aged; Aged, 80 and over; Female; Humans; Male