The Cochrane Database of Systematic Reviews
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Volume (4) 2004 [no page #]

Interventions for preventing falls in elderly people

[Review]

Gillespie, LD; Gillespie, WJ; Robertson, MC; Lamb, SE; Cumming, RG; Rowe, BH

Date of Most Recent Update: 24-February-2004 Updated

Date of Most Recent Substantive Update: 14-July-2003

Cochrane Musculoskeletal Injuries Group.
Mrs. Lesley Gillespie, Review Group Co-ordinator, Cochrane Musculoskeletal Injuries Group, Dept of Health Sciences, Area 4, Seebohm Rowntree Building, University of York, York, YO10 5DD, UK. Phone: +44 1904 321384, Fax: + 44 1904 321 739, E-mail: ldg2@york.ac.uk, GB.

Outline

- References to ongoing studies
- Additional references
- References to previously published studies

Graphics

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- Number sustaining me...
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- Mean number of falls...
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Abstract

Background: Approximately 30 per cent of people over 65 years of age and living in the community fall each year; the number is higher in institutions. Although less than one fall in 10 results in a fracture, a fifth of fall incidents require medical attention.

Objectives: To assess the effects of interventions designed to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care).

Search strategy: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2003), Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to February 2003), EMBASE (1988 to 2003 Week 19), CINAHL (1982 to April 2003), The National Research Register, Issue 2, 2003, Current Controlled Trials (www.controlled-trials.com accessed 11 July 2003) and reference lists of articles. No language restrictions were applied. Further trials were identified by contact with researchers in the field.

Selection criteria: Randomised trials of interventions designed to minimise the effect of, or exposure to, risk factors for falling in elderly people. Main outcomes of interest were the number of fallers, or falls. Trials reporting only intermediate outcomes were excluded.

Data collection and analysis: Two reviewers independently assessed trial quality and extracted data. Data were pooled using the fixed effect model where appropriate.

Main results: Sixty two trials involving 21,668 people were included.

Interventions likely to be beneficial:

* Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes in the community both for an unselected population of older people (4 trials, 1651 participants, pooled RR 0.73, 95%CI 0.63 to 0.85), and for older people with a history of falling or selected because of known risk factors (5 trials, 1176 participants, pooled RR 0.86, 95%CI 0.76 to 0.98), and in residential care facilities (1 trial, 439 participants,

cluster-adjusted incidence rate ratio 0.60, 95%CI 0.50 to 0.73)
* A programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional (3 trials, 566 participants, pooled relative risk (RR) 0.80, 95% confidence interval (95%CI) 0.66 to 0.98)
* Home hazard assessment and modification that is professionally prescribed for older people with a history of falling (3 trials, 374 participants, RR 0.66, 95% CI 0.54 to 0.81)
* Withdrawal of psychotropic medication (1 trial, 93 participants, relative hazard 0.34, 95%CI 0.16 to 0.74)
* Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity (1 trial, 175 participants, WMD -5.20, 95%CI -9.40 to -1.00)
* A 15 week Tai Chi group exercise intervention (1 trial, 200 participants, risk ratio 0.51, 95%CI 0.36 to 0.73).

Interventions of unknown effectiveness:

* Group-delivered exercise interventions (9 trials, 1387 participants)
* Individual lower limb strength training (1 trial, 222 participants)
* Nutritional supplementation (1 trial, 46 participants)
* Vitamin D supplementation, with or without calcium (3 trials, 461 participants)
* Home hazard modification in association with advice on optimising medication (1 trial, 658 participants), or in association with an education package on exercise and reducing fall risk (1 trial, 3182 participants)
* Pharmacological therapy (raubasine-dihydroergocristine, 1 trial, 95 participants)
* Interventions using a cognitive/behavioural approach alone (2 trials, 145 participants)
* Home hazard modification for older people without a history of falling (1 trial, 530 participants)
* Hormone replacement therapy (1 trial, 116 participants)
* Correction of visual deficiency (1 trial, 276 participants).

Interventions unlikely to be beneficial:

* Brisk walking in women with an upper limb fracture in the previous two years (1 trial, 165 participants).

Conclusions: Interventions to prevent falls that are likely to be effective are now available; less is known about their effectiveness in preventing fall-related injuries. Costs per fall prevented have been established for four of the interventions and careful economic modelling in the context of the local healthcare system is important. Some potential interventions are of unknown effectiveness and further research is indicated.

Issue protocol first published

1995 Issue 2

Date of last minor update

15 July, 2003

Date new studies found but not yet included or excluded

18 July, 2003

Date new studies found and included or excluded

11 June, 2003

Date reviewers' conclusions section amended

14 July, 2003

Issue next stage

Issue 2, 2004

Issue review first published

1997 Issue 4

Background

Fall-associated fractures in older people are a significant source of morbidity (Sattin 1992). A third to one half of people over 65 years old fall each year (Blake 1988; Campbell 1990; Downton 1991; Prudham 1981; Tinetti 1988). Since many risk factors appear to interact in those who suffer fall-related fractures (Cummings 1995), it is not clear to what extent interventions designed to prevent falls will also prevent hip or other fall-associated fractures.

Estimates vary, but studies suggest that about 20 per cent of fall incidents require medical attention (Reinsch 1992a; Tinetti 1994a); less than 10 per cent result in fracture (Berg 1997; Campbell 1990; Gryfe 1977; Tinetti 1988). Therefore, interventions designed to reduce falls would require large effects to have an impact on the incidence of fractures. Interventions which do not target individuals at high risk may be less cost-effective.

The evidence for risk factors for falling in community-dwelling older people is derived from over 60 observational studies; the evidence is conflicting for some intrinsic (health related) and environmental risk factors. Environmental hazards may interact critically with individual behaviour (Connell 1997).

Many preventive intervention programmes based on these risk factors have been established and evaluated. These have included exercise programmes designed to improve strength or balance, education programmes, medication optimisation, environmental modification in homes or institutions, and nutritional or hormonal supplementation. In some studies, interventions designed to reduce the impact of single risk factors have been evaluated; in the majority, however, multiple interventions have been used.

Interventions have been offered to older people at varying levels of fall risk either as a "standard package", or individually tailored to target risk factors and impairments. Some programmes, for example the Harstad injury prevention study (Ytterstad 1996a), have extended to the whole elderly population of a town or region.

The best evidence for the efficacy of interventions to prevent falling should emerge from large, well conducted randomised controlled trials, or from meta-analysis of smaller trials. Where similar or identical single interventions are studied, pooling of data from studies should also be informative. The multifactorial nature of risk of falling makes intervention against multiple risk factors conceptually more attractive, but pooling of data presents more difficulties in this situation.

Objectives

To present the best evidence for effectiveness of programmes designed to reduce the incidence of falls in both community dwelling and institutionalised elderly people.
The following hypotheses were formulated a priori:
* Interventions designed to reduce the incidence of falls are effective.
* Interventions which target multiple risk factors are more effective than those which target single risk factors.
* Interventions of longer duration or higher intensity are more effective than those which are short or low intensity.
* Interventions which are individually tailored to target risk factors and impairments are more effective than those which are applied as a 'standard package'.

Criteria for considering studies for this review

Types of participants

Trials which included elderly individuals, of either sex, living in the community or in institutional care. Participant characteristics of interest included falling status at entry (e.g. non-faller, single faller, multiple faller), residential status (e.g. community, institution), and where appropriate, associated co-morbidity. We included trials of interventions in hospital settings if the patients were elderly. A post hoc decision was taken to exclude trials specifically designed to reduce falls in individuals who had experienced a stroke.

Types of intervention

Subjects randomised to receive an intervention or group of interventions versus usual care to minimise the effect of, or exposure to, any risk factor for falling. Studies comparing two types of interventions were also included.

Types of outcome measures

The main outcomes of interest were the number of fallers or falls, and severity of falls. Severity was assessed by the number of falls resulting in injury, medical attention, or fracture. Information was also sought on complications of the interventions employed, duration of effect of the interventions, and death

during the study period.

Trials which focused on intermediate outcomes such as improved balance or strength, and did not report fall rates or number of fallers, were excluded. An improvement in a surrogate outcome does not provide direct evidence that an intervention can impact on the clinical outcome of interest (Gotzsche 1996), in this case falls. Therefore, only trials which reported falls or falling as an outcome were included.

Types of studies

We included randomised controlled trials, including those in which the method of allocation to treatment or control group was inadequately concealed (e.g. trials in which patients were allocated using an open random number list or coin toss).

Search strategy for identification of studies

We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2003), Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to February 2003), EMBASE (1988 to 2003 Week 19), CINAHL (1982 to April 2003), The National Research Register, Issue 2, 2003, Current Controlled Trials (www.controlled-trials.com accessed 11 July 2003) and reference lists of articles. We searched PsycLIT and Social Sciences Citation Index to May 1997. No language restrictions were applied. Further trials were identified by contact with researchers in the field.

In MEDLINE (OVID ONLINE), the following search terms were combined with the first two sections of the optimal MEDLINE trial search strategy described in the Cochrane Reviewers' Handbook (Clarke 2003a). This search strategy was modified for use in other databases (see Table 01):

1. exp Accidental Falls/
2. (falls or faller$).tw
3. or/1-2
4. exp Aged/
5. (older or senior$ or elderly).tw
6. or/4-5
6. and/3,6

Methods of the review

(1) SELECTING TRIALS FOR INCLUSION

From the title, abstract, or descriptors, two reviewers (LDG, WJG) independently reviewed literature searches to identify potentially relevant trials for full review. Searches of bibliographies and texts were conducted to identify additional studies. From the full text, trials which met the selection criteria were selected for inclusion.

(2) ASSESSMENT OF METHODOLOGICAL QUALITY

Methodological quality was assessed for each study by two reviewers independently, using a pre-determined scoring system. Reviewers were not blinded to author and source institution. Disagreement was resolved by consensus, or third party adjudication.

Level of concealment of allocation at randomisation was assessed using the criteria in the Cochrane Reviewers' Handbook (Clarke 2003b). Studies were graded A if it appeared that the assigned treatment was adequately concealed prior to allocation, B if there was inadequate information to judge concealment, and C if the assigned treatment was clearly not concealed prior to allocation.

Methodological quality was scored using eleven items (see Table 02).

(3) METHODS USED TO COLLECT DATA FROM INCLUDED TRIALS
Data were independently extracted by pairs of reviewers using a data extraction form which had been designed and tested prior to use. Disagreement was resolved by consensus, or third party adjudication.
(4) STATISTICAL ANALYSIS
Statistical analysis of individually randomised studies was carried out using MetaView in Review Manager (RevMan 2003). Raw data from cluster randomised studies were not entered as the units of randomisation and analysis differed. For dichotomous data, the individual and pooled statistics were calculated using the fixed effects model and were reported as relative risk (RR) with 95 per cent confidence intervals (95%CI). For continuous data (reporting mean and standard deviation or standard error of the mean), pooled weighted mean differences (WMD) with 95 per cent confidence intervals were calculated. Heterogeneity between pooled trials was tested using a standard chi-squared test and was considered to be significant when P< 0.1.

Description of the studies

Included in this updated review are 62 trials reporting a variety of settings, participants, and interventions. Seventy one percent of the studies are in two categories: 23 trials studied exercise or physical therapy interventions and 21 trials examined multidisciplinary, multifactorial risk factor screening and intervention. Details are provided in the Characteristics of Included Studies table, and are briefly summarised below.

(1) SETTINGS
Of the 62 studies, 47 reported the effect of interventions in participants living in the community. Eight studies were set in long term care facilities (including long term care wards in hospital) or nursing homes (Becker 2003; Bischoff 2003; Jensen 2002; McMurdo 2000; Mulrow 1994; Ray 1997; Rubenstein 2000; Schnelle 2003). Four studies were designed to reduce the incidence of falls in elderly patients in rehabilitation or geriatric assessment wards in hospital (Donald 2000; Mayo 1994; Tideiksaar 1993; Vassallo 2001). A further three studies (Kenny 2001; Nowalk 2001; Shaw 2003) included participants with specific conditions from a range of residential settings.
(2) PARTICIPANTS
Sampling frame and inclusion/exclusion criteria for each study are listed in the Characteristics of Included Studies table. In 17 studies, eligibility for inclusion included a history of falling, or of a postulated risk factor other than general frailty, residence in long-term care, or age (Campbell 1999; Close 1999; Hogan 2001; Kenny 2001; Kingston 2001; Lightbody 2002; Mayo 1994; Means 1996; Pardessus 2002; Ray 1997; Rubenstein 1990; Rubenstein 2000; Sato 1999; Shaw 2003; Tinetti 1994; van Haastregt 2000; Vellas 1991). General frailty, residence in long-term care, history of requiring admission to a rehabilitation facility for older people, use of home help services, or age at least 80 years defined eligibility in a further 17 studies (Becker 2003;

Bischoff 2003; Buchner 1997a; Campbell 1997; Coleman 1999; Donald 2000; Fiatarone 1997; Gray-Donald 1995; Jensen 2002; Latham 2003; McMurdo 2000; Mulrow 1994; Nikolaus 2003; Nowalk 2001; Schnelle 2003; Tideiksaar 1993; Vassallo 2001). In the remaining 28 studies, participants were recruited from seniors centres, lists of older people, or through advertisement for volunteers. The mean age of participants at enrolment exceeded 80 years in 17 studies (Becker 2003; Bischoff 2003; Campbell 1997; Donald 2000; Fiatarone 1997; Jensen 2002; McMurdo 2000; Nikolaus 2003; Nowalk 2001; Pardessus 2002; Ray 1997; Rubenstein 1990; Robertson 2001a; Schnelle 2003; Shaw 2003; Tideiksaar 1993; Vassallo 2001), and was less than 70 years in Armstrong 1996, McMurdo 1997; Pereira 1998, and Steinberg 2000. In ten studies (Armstrong 1996; Bischoff 2003; Campbell 1997; Carter 2002; Ebrahim 1997; Kingston 2001; Lord 1995; McMurdo 1997; Pfeifer 2000; Ryan 1996) the participants were all women, and in Rubenstein 2000 the participants were all men. The remaining studies recruited men and women in varying proportions; in most, the proportion of women was over 70%.

(3) INTERVENTIONS

(a) EXERCISE/PHYSICAL THERAPY INTERVENTIONS (23 studies)

Fourteen studies (Buchner 1997a; Campbell 1997; Carter 2002; Cerny 1998; Cornillon 2002; Day 2002; Fiatarone 1997; Lord 1995; McMurdo 1997; Mulrow 1994; Pereira 1998; Robertson 2001a; Rubenstein 2000; Wolf 1996) compared a physical exercise or physical therapy intervention alone, with either a social meeting or visit, education only, or no intervention. In Ebrahim 1997 self paced brisk walking was compared with upper limb exercises, while Means 1996 examined the effect of adding obstacle training to a standard exercise programme. The remaining seven studies in this category examined complex interventions. Campbell 1999 reported the results of an exercise programme, identical to that in Campbell 1997, and a programme of medication withdrawal, in a study with a factorial design. Donald 2000 in a study with a factorial design also comparing types of floor covering, examined the efficacy of enhanced lower limb strengthening exercises compared with a standard rehabilitative physiotherapy programme, Latham 2003 reported a study with a factorial design examining the effect of progressive resistance quadriceps exercises and the administration of oral vitamin D. Nowalk 2001 compared progressive strength training and conditioning with a Tai Chi programme with a cognitive/behavioural component, and a control group. Reinsch 1992 examined the effects of an exercise programme and a cognitive intervention in a factorial design. Schnelle 2003 reported the results of a programme of exercise associated with management of urinary continence, compared with no intervention. Steinberg 2000 compared four interventions - a cognitive/behavioural intervention either alone, or combined with: exercise, exercise and home safety screening, or exercise and home safety screening and medical assessment.

(b) HOME HAZARD MODIFICATION (9 studies)

Cumming 1999 compared assessment of environmental hazards and supervision of home modifications by an experienced occupational therapist, with no intervention. The study reported in Nikolaus 2003 was similar; participants enrolled while admitted to a rehabilitation unit received home safety assessment and facilitation of elimination of hazards. Pardessus 2002 compared a comprehensive home visit which included assessment and modification of home hazards with "usual care". Stevens 2001 compared the results of no intervention with those of a nurse-led home hazard assessment, free installation of safety devices, and an education programme. Day 2002 using a factorial design, compared a control group with groups receiving exercise, correction of visual deficiency, and home hazard modification, each alone, and in combination.

Three other studies evaluated home hazard modification in combination with other interventions, using a cognitive/behaviour modification approach (Hornbrook 1994; Carter 1997; Steinberg 2000). These studies

included an initial assessment of home safety (this took place before randomisation in Hornbrook 1994). In Hornbrook 1994, the intervention also included weekly group sessions consisting of didactic presentations designed to modify risk taking behaviour and an exercise component. Sessions included individual goal setting, the development of action plans, and subsequent feedback (Stevens 1991). In Carter 1997 both the experimental groups, but not the controls, received an initial home hazard assessment. One experimental group received only brief feedback and pamphlets on home safety and medication use (low intensity), while the second group developed an action plan for the modification of environmental hazards and were encouraged to contact their general practitioners for medication review (high intensity). Home hazard assessment was evaluated in Steinberg 2000 as a component of two of the four intervention packages.

Donald 2000, in a cluster randomised study of factorial design, compared the impact of vinyl flooring and carpet on fall rates in a rehabilitation unit.

(c) COGNITIVE/BEHAVIOURAL INTERVENTIONS (7 studies)
Two studies concentrated on cognitive/behavioural interventions alone. Gallagher 1996 compared two risk assessment interviews and a feedback/counseling interview, with a single baseline assessment interview only. Ryan 1996 compared a one-hour fall prevention education programme delivered to a group, or individually, with a control group receiving only general health promotion information.

The remaining five studies in this category were complex interventions and were also included in the previous two categories. In Carter 1997 and Hornbrook 1994, the cognitive/behavioural intervention was associated with a baseline assessment of home safety and medication optimisation (Carter 1997), or an exercise component (Hornbrook 1994). Reinsch 1992 also combined a cognitive/behavioural intervention with an exercise programme. An information package was the basic intervention in the cumulative comparison of four interventions reported by Steinberg 2000. Nowalk 2001 compared progressive strength training and conditioning with a Tai Chi programme with a cognitive/behavioural component, and a control group.

(d) MEDICATION WITHDRAWAL/ADJUSTMENT (2 studies)
Campbell 1999, in a 2 x 2 factorial design, reported the results of an exercise programme and a placebo-controlled psychotropic medication withdrawal programme. Specific attention to optimisation of medication was also a component, along with home hazard modification, in Carter 1997. Medication withdrawal/adjustment was also included in the majority of the multifactorial interventions listed in sub-section 7 of this section of the review.
(e) NUTRITIONAL/VITAMIN SUPPLEMENTATION (6 studies)
Five studies (Bischoff 2003; Dawson-Hughes 1997; Latham 2003; Pfeifer 2000; Sato 1999) were designed to evaluate the efficacy of Vitamin D supplementation, either alone or with calcium co-supplementation, in fracture prevention; each trial reported falls as a secondary outcome measure. Gray-Donald 1995 studied the efficacy of a 12-week period of high-energy, nutrient-dense dietary supplementation in older people with low body mass index, or recent weight loss.
(f) HORMONAL AND OTHER PHARMACOLOGICAL THERAPIES (2 studies)
Armstrong 1996 reported incidence of falls as a secondary outcome after administration of hormone replacement therapy to calcium replete, post-menopausal women. Vellas 1991 studied the effect of administering a vaso-active medication (raubasine-dihydroergocristine) to older people presenting to their

medical practitioner with a history of a recent fall.
(g) REFERRAL FOR CORRECTION OF VISUAL DEFICIENCY (1 study)
Day 2002, using a factorial design, compared a control group with groups receiving exercise, correction of visual deficiency, and home hazard modification, each alone, and in combination.
(h) CARDIAC PACEMAKER INSERTION FOR SYNCOPE-ASSOCIATED FALLS (1 study)
One trial (Kenny 2001) reported the effectiveness of cardiac pacing in fallers who were found to have cardioinhibitory carotid sinus hypersensitivity following a visit to a hospital emergency department.
(i) EXERCISE, VISUAL CORRECTION AND A HOME SAFETY INTERVENTION (1 study)
Day 2002 randomised community dwelling older people to exercise, vision improvement, home hazard modification or no intervention in a factorial design. Although participants were assessed at baseline, allocation to intervention was by randomisation regardless of presence or absence of risk factor.
(j) MULTIDISCIPLINARY, MULTIFACTORIAL, HEALTH/ENVIRONMENTAL RISK FACTOR SCREENING AND INTERVENTION (21 studies)
These were complex interventions which differed in the details of the assessment, referral, and treatment protocols. In most studies, the initial assessment was made by a health professional (usually a nurse), or other trained person, who assessed the participants, provided advice, and arranged referrals.

In eleven of the studies (Carpenter 1990; Fabacher 1994; Jensen 2002; Jitapunkul 1998; McMurdo 2000; Newbury 2001; Ray 1997; Steinberg 2000; van Rossum 1993; Vetter 1992; Wagner 1994) participants were recruited on the grounds of age or domestic circumstances, but other specific risk factors were not a requirement for admission to the study. In Carpenter 1990 all participants were assessed at onset and the intervention group were visited at regular intervals. Participants developing increasing disability were referred to their family doctor for any interventions required. Fabacher 1994 screened for environmental, medical, functional and psychosocial problems, and gave individual participants in the intervention group feedback, which they were encouraged to discuss with their personal physician. Jensen 2002 in a cluster randomised study conducted in residential care institutions compared 'usual care' with a multi-factorial assessment, staff education, and targeted patient interventions. In Jitapunkul 1998 a non health professional visited participants with a structured questionnaire at three monthly intervals. Participants were referred to a nurse or geriatrician for assessment and interventions if their activities of daily living (ADL) scores declined, or if they fell more than once in the preceding three months. In an institutional care setting, McMurdo 2000 assessed the efficacy of chronic disease assessment, medication review, and seated exercise sessions. Newbury 2001 reported a trial of health assessment of people aged 75 years or older by a nurse, followed by report to the general practitioner, compared with no intervention. Ray 1997 compared a multi-disciplinary assessment by nurse, psychiatrist, and occupational therapist, with usual care in a nursing home setting. There were additional interventions to encourage implementation: team physicians met with patients' physicians, and nursing staff received in-service education sessions. Steinberg 2000 compared four interventions - a cognitive/ behavioural intervention either alone, or combined with exercise, exercise and home safety screening, or exercise, home safety screening and clinical assessment. In van Rossum 1993 the intervention consisted of three-monthly home visits by a public health nurse who gave preventive advice, or referral as necessary. Vetter 1992 had a similar design although the visits were less frequent. Wagner 1994 compared an assessment visit with follow-up interventions targeting risk factors with an assessment visit alone, and with usual care.

The participants in the other ten studies were selected on the basis of a history of falling, or possession of

putative risk factors for falling. Close 1999 identified older people presenting to a hospital emergency department after a fall, and then provided medical assessment and a home visit by a trained occupational therapist. In Coleman 1999 older people attending an ambulatory clinic, who had risk factors for functional decline, received a chronic disease management plan and a programme to reduce polypharmacy. Hogan 2001 assessed the impact of assessment, referral to family doctors, and exercise classes if relevant, compared with a single home visit by a recreational therapist. Kingston 2001 recruited women with a recent fall presenting to an emergency department and compared usual practice (a letter to the patient's doctor with recommendations for any follow up) with health visitor assessment and advice, and individual care management for 12 months. Lightbody 2002 also recruited participants in an Emergency Department, and compared no intervention with a multifactorial assessment by a nurse at a home visit, with referral for further specialist assessment or other action. In the intervention group in Rubenstein 1990, a secondary prevention study, physical and environmental factors were assessed within seven days of a fall and information and recommendations passed on to the primary physician. Shaw 2003 recruited older people with cognitive impairment or dementia and compared no intervention with multifactorial assessment and intervention for any identified risk factor. Tinetti 1994 identified individuals with at least one of the eight risk factors for falling targeted in the intervention. Those randomised to the intervention group were given a combination of medication adjustment, behavioural instructions, and exercise programmes. The intervention in van Haastregt 2000 was a programme of home visits by a community nurse who screened older community dwelling people with a history of falling, offered advice, and arranged physician referral. In Vassallo 2001 participants had been admitted to a geriatric rehabilitation unit, and following assessment and management of fall risk, had correctable risk factors treated, wrist band identification, and had appropriate modification of their ward environment.

(k) SYSTEM MODIFICATIONS TO PREVENT FALLS IN HIGH RISK HOSPITAL PATIENTS (3 studies)

Two hospital-based studies evaluated the effectiveness of a bed alarm system (Tideiksaar 1993) and the use of coloured identification bracelets (Mayo 1994) for the prevention of falls in high risk elderly patients. Donald 2000, in a cluster randomised study of factorial design, in a geriatric rehabilitation unit compared the impact of vinyl or carpet floor coverings on fall rates.

(l) MULTIFACETED INTERVENTION IN NURSING HOME RESIDENTS (1 study)

One cluster randomised trial (Becker 2003) assessed the effectiveness of staff and resident education, including advice on environmental adaptations. In addition residents were offered progressive balance and resistance training and hip protectors, and could choose any combination of intervention, for any length of time, or no intervention other than receiving written information on fall prevention. This trial has not been categorised with (j) "multidisciplinary, multifactorial, health/environmental risk factor screening and intervention" because the interventions were not provided individually on the basis of an initial assessment.

(4) EXCLUDED STUDIES

The Characteristics of Excluded Studies table lists 104 studies which fall into two categories. Thirty-seven non-randomised studies reported falls, or fall-related injuries, as an outcome. Sixty-seven randomised trials originally identified by the search strategy either reported intermediate outcomes of preventive strategies (e.g. balance or muscle strength measures) or did not describe an intervention designed to reduce the risk of falling.

(5) STUDIES AWAITING ASSESSMENT

Fourteen studies are awaiting assessment (Barnett 2003; Buettner 2002; Crome 2000; Hauer 2001; Helbostad (in press); Kerse (in press); L-Ambrose (in press); Lehtola 2000; Lord (in press); Schoenfelder 2000; Schwab 1999; Steadman 2003; Toulotte 2003; Wolf (in press)).

(6) ONGOING STUDIES

We identified 29 references to ongoing trials with falls described as an outcome in the protocol. Some trials may have more than one reference. Six are investigating an exercise or physical therapy intervention (Allegrante; Brown; Grove; Safe-Grip; VIP trial; Voukelatos); in the VIP trial the subjects are visually impaired. Five are recording falling outcomes in trials of vitamin D supplementation (Michie; RECORD; Smith; Swift; Wark), and twelve trials are assessing the effectiveness of multifactorial interventions (Allen; Behrman; Clemson; Dyer; Edwards; Gordon; Haines; Lamb; Lord; SAFER 2; Spice; Torgerson). One study (Healey) is testing the use of care plans for targeting risk factors in patients at risk of falling in elderly care wards. Specific risk factors are targeted in a number of trials. One trial is evaluating the effect of accelerated treatment of cataracts (Harwood), and (Cumming) is evaluating visual improvement (testing followed by appropriate interventions). One trial (Lesser) is studying the effectiveness of vestibular rehabilitation in people with vestibular dysfunction, and the multicentre SAFE PACE 2 trial is studying the effect of cardiac pacing in older people with carotid sinus hypersensitivity. One trial (Moxon) is targeting depression in elderly care homes.

Methodological qualities of included studies

Methodological quality assessment scores for each item, for each included study, are given in Table 03 and Table 04.

In 19 studies (Armstrong 1996; Becker 2003; Campbell 1997; Campbell 1999; Carter 1997; Cumming 1999; Day 2002; Ebrahim 1997; Fabacher 1994; Hogan 2001; Jensen 2002; Latham 2003; Mulrow 1994; Newbury 2001; Robertson 2001a; Rubenstein 1990; Shaw 2003; van Rossum 1993; Vetter 1992) it appeared that the assigned treatment was adequately concealed prior to allocation. In three (Coleman 1999; Means 1996; Steinberg 2000), the assigned treatment was not concealed prior to allocation (C). In the remaining 40 there was inadequate information to judge concealment (B). Cluster randomisation was used in 13 studies (Becker 2003; Carpenter 1990; Coleman 1999; Hornbrook 1994; Jensen 2002; McMurdo 2000; Ray 1997; Reinsch 1992; Steinberg 2000; Stevens 2001; Tinetti 1994; Vassallo 2001; Vetter 1992). In three of these studies (Becker 2003; Jensen 2002; Stevens 2001) the analysis was adjusted to take account of clustering. In the remaining 10 studies the analysis was not adjusted, or it was unclear whether appropriate adjustment had been conducted.

Losses from groups resulting from withdrawal, death, loss to follow-up, or exclusion after randomisation ranged from two per cent to 41 per cent and are described in the Characteristics of Included Studies table. Nine studies did not report any losses (Becker 2003; Cerny 1998; Gallagher 1996; Mayo 1994; Rubenstein 1990; Ryan 1996; Sato 1999; Tideiksaar 1993; Vassallo 2001).

In trials with community-dwelling subjects the outcome of falling was self-reported and the subjects were often not blind to treatment assignment. Blinding was possible, by using placebos or identical tablets, when the intervention involved the administration of drugs (Bischoff 2003; Campbell 1999; Latham 2003; Vellas 1991).

A number of studies did not define a fall, and a variety of definitions were used in those that did. A fall was most frequently defined as 'unintentionally coming to rest on the ground, floor or other lower level; excludes coming to rest against furniture, wall, or other structure' (Becker 2003; Bischoff 2003; Buchner 1997a; Campbell 1997; Campbell 1999; Hornbrook 1994; Nowalk 2001; Mulrow 1994; Robertson 2001a; Stevens 2001; Tinetti 1994; Wolf 1996). This is the definition used in the FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) studies (Buchner 1993).

Active registration of falling outcomes, or use of a diary, was clearly indicated in 35 studies (Becker 2003; Bischoff 2003; Buchner 1997a; Campbell 1997; Campbell 1999; Carter 2002; Close 1999; Cornillon 2002; Cumming 1999; Dawson-Hughes 1997; Day 2002; Donald 2000; Gallagher 1996; Hogan 2001; Hornbrook 1994; Jensen 2002; Kenny 2001; Latham 2003; Lightbody 2002; Mayo 1994; McMurdo 2000; Mulrow 1994; Nikolaus 2003; Nowalk 2001; Robertson 2001a; Rubenstein 1990; Schnelle 2003; Shaw 2003; Steinberg 2000; Stevens 2001; Tideiksaar 1993; Tinetti 1994; van Haastregt 2000; Vassallo 2001; Wolf 1996). In the remaining 27 studies ascertainment of falling episodes was by participant recall, at intervals during the study or at its conclusion, or was not described.

Duration of follow-up varied both between and within studies. It was for a minimum of one year in 38 studies, and for duration of stay in the hospital studies (Donald 2000; Mayo 1994; Tideiksaar 1993; Vassallo 2001). In the remaining studies follow-up was for three months (Bischoff 2003; Gray-Donald 1995; Kingston 2001; Rubenstein 2000; Ryan 1996), four months (Fiatarone 1997; Mulrow 1994; Wolf 1996), five months (Carter 2002), six months (Cerny 1998; Gallagher 1996; Latham 2003; Lightbody 2002; Means 1996; Vellas 1991), eight months (Schnelle 2003), 44 weeks (Campbell 1999) and 48 weeks (Armstrong 1996). Follow-up was for two years in Campbell 1997; Coleman 1999; Ebrahim 1997; McMurdo 1997, three years in Jitapunkul 1998 and Carpenter 1990, four years in Vetter 1992, and for 10 years in Pereira 1998.

The period for which falls were recorded differed markedly between studies, and was not necessarily the same as the total period of follow-up described above. Falls were recorded for a minimum of one year in 37 studies, and in the remaining studies, falls were recorded for shorter periods of time (see Characteristics of Included Studies table for details). In some studies, fall monitoring varied from the overall length of follow-up: in Carpenter 1990 participants were asked about falls in the month prior to the final interview; in McMurdo 2000 falls were monitored for six months after the intervention; in Mulrow 1994 falls were reported at four months; in van Rossum 1993 participants were asked about falls in the last six months of a three year intervention; and 10 years after randomisation the participants in Pereira 1998 were asked to recall the number of falls in the previous year.

Results

(1)EXERCISE/PHYSICAL THERAPY INTERVENTIONS (Comparisons 01 to 03)
(a) EXERCISE/PHYSICAL THERAPY ALONE VERSUS CONTROL (UNTARGETED, COMMUNITY DWELLING)
Eleven studies, involving a total of 1480 participants, reported the results of exercise interventions offered to groups of older community-dwelling people where exercise interventions were not individually prescribed. Pooled data from nine studies (Buchner 1997a; Cerny 1998; Cornillon 2002; Day 2002; Ebrahim 1997; Lord 1995; McMurdo 1997; Pereira 1998; Rubenstein 2000) does not confirm the effectiveness of untargeted exercise

interventions in community dwelling older people based on number of fallers (pooled RR 0.89, 95%CI 0.78 to 1.01). Data from Wolf 1996 were reported as adjusted estimates from a Cox proportional hazards analysis, and raw data to allow pooling were unavailable. Using the FICSIT definition of falling (Buchner 1993), participants exposed to the 15 week Tai Chi intervention had a lower rate of falling than controls (risk ratio 0.51, 95%CI 0.36 to 0.73). When unadjusted for potential baseline risk factors, the reported risk ratio was 0.63, 95%CI 0.45 to 0.89. Using a narrower definition of falling, which discounted minor events such as stumbling, the reported unadjusted risk ratio was no longer statistically significant (risk ratio 0.67, 95%CI 0.41 to 1.09). The computerised balance training intervention was ineffective regardless of which fall definition was used. Falls were monitored for different periods for different patient cohorts; the range was 7 to 20 months. Carter 2002, in a comparison of a twice weekly exercise class with no intervention reported no difference between groups in the number of people falling. Means 1996 recruited 65 participants with a history of falling who all underwent six weeks supervised low to moderate intensity programme designed to improve balance and mobility. Thirty one participants practiced on an obstacle course in addition to the exercise intervention, and 34 did not. No statistically significant difference in the mean number of falls was reported.

(b) EXERCISE/PHYSICAL THERAPY ALONE VERSUS CONTROL (INDIVIDUALLY TARGETED, COMMUNITY DWELLING)

Pooled data from three studies, with a total of 566 participants (Campbell 1997; Campbell 1999; Robertson 2001a), using the same individually tailored programme of progressive muscle strengthening, balance retraining exercises and a walking plan, indicated that this intervention significantly reduced the number of individuals sustaining a fall over a one year period (pooled RR 0.80, 95%CI 0.66 to 0.98). The number of people sustaining a fall resulting in injury was also significantly reduced (pooled RR 0.67, 95%CI 0.51 to 0.89). Seventy-four per cent of participants in the control group and 69 per cent in the exercise group in Campbell 1997 continued for a second year. After two years, the rate of falls remained significantly lower in the exercise group (Campbell 1999a). The relative hazard for all falls in the exercise group was reported to be 0.69 (95%CI 0.47 to 0.97); the relative hazard for a fall resulting in a moderate or severe injury was 0.63 (95%CI 0.42 to 0.95).

Latham 2003 reported the effect of a programme of progressive resistance training of the quadriceps muscle in 222 frail older people. There was no evidence of effectiveness of this intervention alone (RR 0.92, 95% CI 0.73 to 1.16). However, musculoskeletal injuries were more common in the progressive resistance exercise group (RR 3.54, 95% CI 1.36 to 9.19). Fiatarone 1997 reported in abstract a comparison between high intensity progressive resistance training and no intervention in 34 functionally impaired older people. No difference between groups was observed in the frequency of falls in this study.

(c) EXERCISE/PHYSICAL THERAPY ALONE VERSUS CONTROL (UNTARGETED, INSTITUTIONAL CARE)

In a study in long term care facilities (ranging from independent living to skilled nursing care) Nowalk 2001 reported no significant difference in number of falls between a control group and two exercise groups (resistance endurance training or tai chi).

(d) EXERCISE/PHYSICAL THERAPY ALONE VERSUS CONTROL (INDIVIDUALLY TARGETED, INSTITUTIONAL CARE)

From two studies evaluating 248 participants (Donald 2000; Mulrow 1994) an enhanced physiotherapy programme showed no evidence of effectiveness (RR 1.02, 95%CI 0.74 to 1.41) compared to those

receiving the control intervention.
(e) COMPLEX INTERVENTIONS INCLUDING EXERCISE/PHYSICAL THERAPY VERSUS CONTROL (UNTARGETED, COMMUNITY DWELLING)
There were three complex intervention studies which included exercise. In a factorial design, Day 2002 compared group-based exercise, home hazard modification and management of reduced vision. Although group-based exercise alone (see comparison 01.01) was the most potent single intervention in this study, falls were also reduced when exercise was combined with home hazard management, or reduced vision management, or both of these (see comparison 14).

The remaining two trials were cluster randomised; their data could not be pooled. One (Reinsch 1992) evaluated the effectiveness of classes teaching exercise, relaxation and health and safety topics relating to fall prevention, and classes without the exercise component. Results did not demonstrate a statistically significant reduction in number of fallers for either intervention. The other (Steinberg 2000) using a cumulative intervention in which three out of four groups received a monthly one hour exercise class and encouragement to exercise between classes, reported that the intervention strategies could achieve an 18 to 40 per cent reduction in the incidence of falling, but the hazard ratios were not significant.

(f) COMPLEX INTERVENTIONS INCLUDING EXERCISE/PHYSICAL THERAPY VERSUS CONTROL (TARGETED, INSTITUTIONAL CARE)
Schnelle 2003 compared a low intensity functionally oriented exercise and incontinence care programme with usual care in 190 incontinent nursing home residents. There was no significant reduction in the number of fallers between the groups in this study (RR 0.62, 95%CI 0.37 to 1.06); however, there was a trend suggesting benefit.
(2) HOME SAFETY INTERVENTION ALONE VERSUS CONTROL (INDIVIDUALLY TARGETED INTERVENTIONS) (Comparison 04)
Five studies evaluated home safety interventions alone (Cumming 1999; Day 2002; Nikolaus 2003; Pardessus 2002; Stevens 2001). Raw data for the number of participants falling were available from four (Cumming 1999; Day 2002; Nikolaus 2003; Pardessus 2002).

Amongst those participants with a history of falling in the year prior to randomisation, there was a significant reduction in the number of participants sustaining two or more falls during the study period (RR 0.66, 95%CI 0.54 to 0.81). An overall analysis including all participants, fallers and non-fallers prior to randomisation, showed a significant, but smaller, effect (RR 0.85, 95%CI 0.74 to 0.96). In those without a history of falls in the previous year (Cumming 1999) there was no evidence for the effectiveness of home hazard modification (RR 1.03, 95%CI 0.75 to 1.41). In Cumming 1999 the rate of falls away from home was reduced by a similar extent to the reduction in falls at home.

In a cluster randomised study of individual households in a population with mixed fall status, Stevens 2001 was unable to identify a difference in the rate of falls (overall, and falls at home), the rate of fall injuries, or the proportion of fallers in the intervention group compared with the control group after 1 year.

(3)COGNITIVE/BEHAVIOURAL INTERVENTION (Comparisons 05 and 06)
(a) COGNITIVE/BEHAVIOURAL INTERVENTION ALONE VERUS CONTROL

In Gallagher 1996 (100 participants), comparison of the two risk assessment interviews and a feedback/ counseling interview, with a single baseline assessment interview, showed that the intervention had no statistically significant impact on the main outcome measures. In Ryan 1996 (45 participants), analysis of the number of fallers at three months showed no evidence that individual education sessions provided by a trained nurse were more effective than the one hour group discussion of intrinsic and environmental risk factors.

(b) COMPLEX INTERVENTIONS INCLUDING COGNITIVE/BEHAVIOURAL INTERVENTION VERSUS CONTROL

Carter 1997 (658 participants) and Hornbrook 1994 (3182 participants) used a behavioural approach after carrying out an environmental safety assessment. Data have not been pooled from these studies as Hornbrook 1994 is cluster randomised (by household). Both also reported co-interventions; Hornbrook 1994 included group sessions designed to modify risk taking behaviour and an exercise component, and reported survival analyses for sustaining any fall, injury fall, medical care fall, fracture fall, and fall causing hospitalisation. Unadjusted rates for all falls (trialists' analysis) were significantly lower among intervention participants; for other categories of fall (injury falls, medical care falls) there were no statistically significant differences between groups. In Carter 1997 advice on optimising medication was given to the two intervention groups; a low intensity intervention in which advice alone was given on home safety, and a high intensity intervention which included professional formulation of an action plan. There was no evidence of a difference in the number of individuals falling between the control group and either intervention group. However, both interventions were associated with a significant reduction in the number sustaining two or more falls (low intensity intervention RR 0.27, 95%CI 0.08 to 0.95; high intensity intervention RR 0.22, 95%CI 0.05 to 0.98). In a cluster randomised trial, Reinsch 1992 evaluated the effectiveness of classes teaching exercise, relaxation and health and safety topics relating to fall prevention, and classes without the exercise component. The trial did not identify a statistically significant reduction in number of fallers. In another cluster randomised trial (Steinberg 2000), a cumulative intervention in which three out of four groups received encouragement to exercise and a monthly one hour exercise class, the intervention strategies achieved an 18 to 40 per cent reduction in the incidence of falling, but the hazard ratios were not significant in any group.

(4) MEDICATION WITHDRAWAL VERSUS CONTROL (Comparison 07)

Campbell 1999 reported the results of a study of factorial design in which the interventions were an individually tailored exercise programme of progressive muscle strengthening and balance retraining, and a walking plan (also used in Campbell 1997 and Robertson 2001a), and a placebo-controlled medication withdrawal programme. Although the analysis of the effect of medication withdrawal on the number of fallers (Comparisons 02 and 06) does not show significant difference between treatment and control groups, the analysis reported by the investigators, using a Cox proportional hazard regression model, showed that the overall risk of falls was lower for the medication withdrawal group (relative hazard 0.34, 95%CI 0.16 to 0.74).

(5) NUTRITIONAL/VITAMIN SUPPLEMENTATION

(a) NUTRITIONAL SUPPLEMENTATION VERSUS CONTROL (Comparison 08)

There is no evidence from one small trial involving 50 participants (Gray-Donald 1995), for the effectiveness of a programme of oral nutritional supplementation in preventing falls in a group of frail elderly women.

(b) VITAMIN D VERSUS CONTROL (Comparison 09)

Five studies (Bischoff 2003; Dawson-Hughes 1997; Latham 2003; Pfeifer 2000; Sato 1999) evaluated the effect of vitamin D on falling.

Data were pooled from three (Bischoff 2003; Pfeifer 2000; Latham 2003) involving 461 participants. In these studies both intervention and control groups received calcium supplementation; the intervention group in each received oral vitamin D supplementation. There is currently no evidence of the effectiveness of vitamin D supplementation in reducing the number of people who fall amongst community dwelling or hospitalised older people (RR 0.87, 95%CI 0.70 to 1.08). In Pfeifer 2000 the reduction in the number of falls resulting in fracture was not statistically significant (RR 0.48, 95%CI 0.02 to 11.84).

In the two studies that could not be pooled, Sato 1999 (86 participants) administered 1-alpha-hydroxyvitamin D alone to people with Parkinson's disease (Hoehn and Yahr Stage <5) and significantly reduced the number of fracture falls (RR 0.13, 95%CI 0.02 to 0.95), but did not reduce the mean number of falls in the intervention group (WMD 0.10, 95%CI -0.71 to 0.91). In a placebo-controlled trial of administration of vitamin D and calcium supplementation to community dwelling men and women over 65 years, Dawson-Hughes 1997 (445 participants) reported that the number of participants falling did not differ significantly between intervention and control groups. Data were not presented.

(6) HORMONAL AND OTHER PHARMACOLOGICAL THERAPIES
(a) HRT AND CALCIUM VERSUS CALCIUM (Comparison 10)
In calcium replete post-menopausal women (Armstrong 1996, 116 participants), there was no evidence of a protective effect of hormone replacement therapy against falling on at least one occasion during the study period (RR 1.56; 95%CI 0.94 to 2.59).
(b) PHARMACOLOGICAL THERAPY VERSUS CONTROL (Comparison 11)
Vellas 1991 (95 participants) reported that administration of the vaso-active medication raubasine-dihydroergocristine to older people presenting to their medical practitioner with a history of a recent fall, significantly reduced the number of members of the intervention group who reported falls in the six months of therapy (RR 0.48, 95%CI 0.29 to 0.78).
(7) REFERRAL FOR CORRECTION OF VISUAL DEFICIENCY VERSUS CONTROL (Comparison 12)
In Day 2002 there was no evidence that referral for correction of vision in community dwelling older people was effective in reducing the number of people falling (RR 0.95, 95%CI 0.79 to 1.14).
(8) CARDIAC PACEMAKER INSERTION VERSUS CONTROL (Comparison 13)
Cardiac pacing in fallers with cardioinhibitory carotid sinus hypersensitivity (Kenny 2001) was associated with a statistically significant reduction in the number of participants sustaining syncope (RR 0.48, 95% CI 0.32 to 0.73) and in the mean number of falls in twelve months in the intervention group (WMD -5.2, 95%CI -1.0 to -9.4).
(9) EXERCISE, VISUAL CORRECTION, AND HOME SAFETY INTERVENTION (Comparison 14)
In a study using factorial design, Day 2002 examined the effect of exercise, visual correction and a home safety intervention. The impact of these three interventions combined was a significant reduction in the number of participants falling (RR 0.76, 95%CI 0.61 to 0.94). Comparison 14 also shows our analyses of the data for exercise plus vision correction (RR 0.76, 95%CI 0.62 to 0.95), and for exercise plus home hazard management (RR 0.84, 95%CI 0.69 to 1.03). These analyses are somewhat less favourable than the adjusted analyses presented by the authors in their original report.
(10) MULTIDISCIPLINARY, MULTIFACTORIAL, HEALTH/ENVIRONMENTAL RISK FACTOR SCREENING AND INTERVENTION VERSUS CONTROL (comparison 15)

(a) COMMUNITY DWELLING, UNSELECTED (FALLERS AND NON-FALLERS IN THE POPULATION STUDIED)

Of the eight studies which evaluated a multifactorial screening and intervention programme in community dwelling older people who were recruited on the grounds of age and domestic circumstances, without a requirement for the presence of known risk factors, data have been pooled from four trials (Fabacher 1994; Jitapunkul 1998; Newbury 2001; Wagner 1994) involving 1651 participants. The pooled data are homogeneous and show that the interventions are effective in reducing the proportion of fallers in the intervention group (pooled RR 0.73, 95%CI 0.63 to 0.85).

Data were not pooled from the other four studies in this category. In Carpenter 1990 (539 participants), which was cluster randomised by household, the intervention involved an assessment by trained lay volunteers using a disability rating scale; an increase in disability score at a repeat visit was reported to the family medical practitioner. The trialists reported significantly fewer falls in the experimental group during the month before the final interview, but insufficient data were available to calculate an effect size. The fourth of the incremental interventions in Steinberg 2000, also cluster randomised, had a medical screen, home hazard assessment, and exercise. There was no significant difference in the incidence of falling between this group (59 participants) and the control group (63 participants) who received an information package alone. van Rossum 1993 (580 participants) found no difference in the incidence of falls between the intervention and control groups, but no data were provided. In Vetter 1992 (674 participants, cluster randomised by household) 95 of 350 in the intervention group and 65 of 324 in the control group fell.

(b) COMMUNITY DWELLING, TARGETED (POPULATION STUDIED ARE KNOWN FALLERS OR HAVE IDENTIFIED RISK FACTORS PRIOR TO ENROLMENT)

Data were pooled from five studies (Close 1999; Hogan 2001; Kingston 2001; Lightbody 2002; van Haastregt 2000) involving 1176 participants. The pooled data show a significant reduction in the proportion of fallers in the intervention groups (pooled RR 0.86, 95%CI 0.76 to 0.98). Data from two other (cluster randomised) studies in this category were not pooled as the unit of analysis differed from the unit of randomisation. Coleman 1999 (169 participants) reported that screening and intervention in a chronic care clinic provided no improvement in the incidence of falls at 12 or 24 months. Tinetti 1994 (301 participants) reported a significant reduction in the number of fallers in the intervention group, adjusting for age, sex, previous falls, and number of risk factors (adjusted incidence rate ratio 0.69, 95%CI 0.52 to 0.90), but in this study the units of randomisation and analysis appear to have been different, which may have resulted in a narrower confidence interval.

(c) INSTITUTIONAL CARE

Five trials were identified in this comparison group; however, none could be pooled due to cluster randomisation. Overall, the results of these papers fail to provide a clear indication of the effectiveness of multi-disciplinary care within institutions. In Jensen 2002, an appropriately analysed cluster randomised trial of an 11 week multidisciplinary programme including general and resident-specific tailored strategies, reported a reduced incidence of falls in the intervention group (adjusted incidence rate ratio 0.60, 95%CI 0.50 to 0.73). McMurdo 2000 (133 participants), also a cluster randomised study in an institutional setting, reported no difference between intervention and control groups in the percentage of participants falling in the six month period after completion of the intervention. Ray 1997 (482 participants) was also cluster randomised. Data were reported on recurrent falls and injurious falls. The reporting of the data provides insufficient detail to confirm whether the reduction in recurrent falls experienced in the

intervention group was significant. Rubenstein 1990 (160 participants) found no benefit from nurse practitioner assessment and physician referral within seven days of a fall (RR 0.97, 95%CI 0.84 to 1.11). Vassallo 2001 evaluated a multidisciplinary fall assessment in a cluster randomised trial in a geriatric rehabilitation setting, and reported fewer fallers (39/275) in the intervention group, compared with 111/550 in the control group.

(d) COGNITIVELY IMPAIRED (ANY RESIDENCE)

Shaw 2003 in a comparison of multifactorial assessment and intervention in older people with cognitive impairment or dementia could not confirm the effectiveness of this intervention in reducing the number of participants falling in one year (RR 0.92, 95%CI 0.81 to 1.05).

(11) SYSTEM MODIFICATIONS TO PREVENT FALLS IN HIGH RISK HOSPITAL PATIENTS VERSUS CONTROL (Comparison 16 and 17)

Donald 2000 studied the incidence of falls in older people randomised to rooms with vinyl or carpet floor coverings in a rehabilitation hospital setting. The number of participants falling was greater in those assigned to a carpet floor covering. Due to the small size of the study the result was not statistically significant (RR 0.15, 95%CI 0.02 to 1.17). Neither of the two small trials (Tideiksaar 1993; Mayo 1994), examining strategies to prevent falls in hospital patients, showed evidence of benefit of the intervention used. Tideiksaar 1993, assessing the value of bed alarms, gave only the total number of falls in control and treated groups, and reported that there was no significant difference in the number of bed falls between groups. Results for Mayo 1994, presented in our analyses, showed no difference between the two groups.

(12) MULTIFACETED INTERVENTION IN NURSING HOME RESIDENTS

Becker 2003 in a cluster randomised trial (N = 6) involving 981 long stay residents of community nursing homes reported that the number of fallers was less in the intervention group (RR 0.75, 95%CI 0.57 to 0.98, trialists' analysis). The incidence density rate of falls per 1000 resident years was also reduced in the intervention group (RR 0.55, 95%CI 0.41 to 0.73, trialists' analysis).

(13) ECONOMIC EVALUATIONS

Five of the included studies incorporated a comprehensive economic evaluation in the study design and established the cost effectiveness of the intervention (Campbell 1997; Campbell 1999; Cumming 1999; Robertson 2001a; Tinetti 1994). The incremental cost per fall prevented for implementing the home programme of muscle strengthening and balance retraining delivered in a research setting by a physiotherapist (Campbell 1997) was NZ$314 after one year and NZ$265 after two years (at 1995 prices, programme implementation costs only, Robertson 2001c). In Robertson 2001a a district nurse delivered the same exercise programme in a usual healthcare setting and the incremental cost per fall prevented was NZ$1803 (at 1998 prices, programme implementation costs only). When statistically significant hospital admission cost savings as a result of a fall in the exercise group compared with the control group during this trial were incorporated into a cost effectiveness ratio, the cost per fall prevented was NZ$155 (at 1998 prices).

The incremental cost of implementing the psychotropic medication withdrawal programme in a research setting (Campbell 1999) was NZ$538 per fall prevented (at 1996 prices, programme implementation costs only, Robertson 2001b). In an economic evaluation of the home safety intervention of Cumming 1999, the mean cost per fall prevented for those with a fall in the previous year was Australian $3980 (at 1997 prices, incorporating total healthcare resource use for 12 months from randomisation, Salkeld 2000). Rizzo 1996 reported an evaluation of the targeted multifactorial intervention of Tinetti 1994 and concluded that the mean cost per fall prevented was US$1772 (at 1993 prices, incorporating programme development and

implementation costs only).

Discussion

(1) OVERVIEW OF RESULTS

This review has attempted to identify, grade and synthesise the available trials evaluating interventions designed to prevent falls. New evidence continues to accumulate at a rapid rate, with 22 additional trials being added in this update. Most of the 62 included studies involve older people either included on the basis of age or residence, or because they have sustained a recent fall. As a group, therefore, their results allow some tentative generalisation. As the number of studies has increased, the picture begins to emerge that interventions which target an unselected group of older people with a health or environmental intervention on the basis of risk factors or age, are less likely to be effective than those which target known fallers. Even amongst known fallers the risk reductions are small; even where these are statistically significant, the clinical significance and cost effectiveness remain less clear than we would wish. Interventions which target multiple risk factors are marginally effective, but so also are targeted exercise interventions, home hazard modification, and reducing psychotropic medication. Where important individual fall risk factors can be corrected, focused interventions may be more clearly effective. For example, cardiac pacing appears to be clearly effective in older fallers with demonstrated carotid sinus hypersensitivity (CSH). However, to identify 257 potential participants with CSH for the study, Kenny 2001 screened 24,251 people with episodes of a fall or syncope presenting to emergency departments.

There is some evidence that interventions with an apparently limited intention may have an unintended multifactorial component (Cumming 1999). There is limited evidence that interventions which are individually tailored to target risk factors and impairments are more effective than those which are applied as a 'standard package'. However, to date, there is no robust evidence regarding the optimum duration or intensity of interventions, although the effectiveness of the moderate intensity exercise programme used in Campbell 1997, Campbell 1999 and Robertson 2001a, has been replicated in a non-randomised controlled study excluded from this review (Robertson 2001c).

Few studies reported an increase in adverse events or increased falls. There were higher number of falls in the brisk walking group in Ebrahim 1997; all the women in this study had a history of an upper limb fracture in the previous two years. Given this result, brisk walking should not be recommended as a fall prevention intervention in women with a history of falling. Progressive resistance exercises in frailer old people may be associated with increased fatigue, or with muscle injuries requiring medical attention or resulting in temporary limitation in activities of daily living (Latham 2003).

(2) METHODOLOGICAL QUALITY

We used the standard template of the Cochrane Musculoskeletal Injuries Group, specifically modified for this review, to record methodological quality of the included studies, which varied widely. Individual item scores were entered, but no attempt was made to create an overall score; some of the items relating to blinding are of marginal relevance for many of the studies. The fact that the outcome of interest, falling, was not always defined, is a continuing concern. The use of two definitions in Wolf 1996 demonstrated that the definition of falling used can alter the significance of the results. A consensus definition of a fall needs to be adopted in order to facilitate comparisons of research findings on falls.

This is being addressed currently by workpackage 1 of the Prevention of Falls Network Europe (PROFANE).

Methods used for recording falls also varied widely, with active registration of falls as they occurred clearly indicated in only 35 studies. Poor recall may be a problem in the remaining studies, which relied on participant recall at intervals during the study or at its conclusion (Cummings 1988). Both Cummings 1988, and another more recent study, Hale 1993, compared recall with active registration using postcards. Both demonstrated, unexpectedly, that recall was better for the preceding 12 months than for three or six months. In Hale 1993, at three months, six months and one year, retrospectively, only 31 per cent, 44 per cent, and 89 per cent of participants who had reported a fall recalled at least one fall. Sixty-eight per cent of participants who had reported an injury recalled one at the year's end. This empirical evidence supports the possibility of poor recall in the included trials where the follow-up period was short and information about falls was collected retrospectively.

(3) CATEGORISATION OF STUDIES

The reported evidence for the effectiveness of fall/injury prevention strategies is derived from 62 included studies which have a variety of settings, participants, interventions, outcome measures, and methods of analysis. We have grouped these strategies into categories by intervention, and by the status of the study participants, but recognise that the distinctions between categories are not always clear; in that sense they should be considered to be provisional, or exploratory. Cumming 1999, discussing the finding that "an occupational therapy home visit seemed to be equally effective in reducing the risk of falling at home and away from home" hypothesised that "occupational therapists[horizontal ellipsis] take into account the characteristics of the person living with the hazard, such as limited mobility and poor vision, when they assess a home for hazards[horizontal ellipsis] A home visit by an occupational therapist is also likely to have the effect of raising general awareness of falls and their prevention." The same could be said for the interventions carried out by the physiotherapist in Campbell 1997, or the district nurse in Robertson 2001a. Thus, what appears to be a single and specific intervention targeting only a single risk factor, may, in part, be a 'multifactorial' intervention by a trained health professional.

Similarly, we continue to have some difficulty in deciding how best to categorise studies according to the way in which interventions were offered to study participants. Some interventions, for example educational packages and exercise training, may be offered individually or in groups. In some studies where the nature of the intervention was an individual assessment followed by a targeted intervention package, the sampling frame was defined on the basis of age, or membership of an organisation of older people; such a participant group would contain individuals at high risk of falling and others whose risk was lower. In other studies, only people already identified as at high risk of falling were included; in these, the absolute risk of falling in the control group would be expected to be higher. We found some evidence suggestive of this (see comparison 15.01). In some environmental modification, and assessment and targeted intervention studies, the intervention was confined to referral to other agencies; therefore, the potential effect may have been weakened by the recommended intervention not being completed.

(4) POOLING OF DATA

In the first version of this review, data from a number of cluster randomised studies were pooled with individually randomised studies. Cluster randomised trials analysed by individual produce inappropriately

narrow 95% confidence intervals, and standard deviations and standard errors that are too small. If these are then included in the pooled outcome the pooled 95% confidence interval will be too narrow. The majority of cluster randomised studies in this review had not been analysed appropriately and in this version results of cluster randomised studies have been reported in the text but do not appear in the analyses.

(5) EXERCISE INTERVENTIONS

The evidence for effectiveness of group exercise interventions remains limited, apart from the Tai Chi intervention of Wolf 1996. The study of Latham 2003 found no evidence for any effect of lower limb progressive muscle strengthening alone. On the other hand, the three trials from New Zealand (Campbell 1997; Campbell 1999; Robertson 2001a) using an individually tailored exercise programme of progressive muscle strengthening, balance retraining and a walking plan, reported a reduction in falls, number of participants falling, and fall-related injuries. Both the interventions which were effective in reducing falls included balance retraining, indicating that these exercises may be an important component of successful falls prevention programmes.

(6) MODIFICATION OF HOME HAZARDS

The association of domestic hazards with falls in the home has been controversial, despite its face validity (Clemson 1996; Gill 2000; McLean 1996; Northridge 1995; Parker 1996; Sattin 1998). However, six trials with a substantial home hazard modification component (Carter 1997; Cumming 1999; Day 2002; Hornbrook 1994; Nikolaus 2003; Pardessus 2002) have now reported data which support its effectiveness, particularly in those with a history of previous falls. Cumming 1999 warned that "this effect is unlikely to be caused by home modifications alone" since the reduction in falls was not confined to falls inside the home. This is true also of the reduction in the number of participants reporting two or more falls in Carter 1997, where falls in the yard/garden associated with the dwelling were also eligible. Hornbrook 1994 also used a complex intervention. While the evidence supports interventions designed to reduce home hazards, the exact mechanism of the effect remains unclear.

(7) COGNITIVE/BEHAVIOURAL INTERVENTIONS

While cognitive/behavioural components have been included in effective complex interventions, we found no evidence that cognitive/behavioural interventions alone are effective in reducing the frequency of falls in elderly people.

(8) MEDICATION WITHDRAWAL

Campbell 1999 appears to be the only placebo-controlled trial of medication withdrawal for fall prevention so far published. Gradual withdrawal of psychotropic medication significantly reduced risk of falling, but participants in this study were reluctant to comply permanently, and the authors suggest that a much larger trial with sufficient power to investigate the effects of withdrawal of different psychotropic drug types would be justified.

(9) MULTIDISCIPLINARY, MULTIFACTORIAL, HEALTH/ENVIRONMENTAL RISK FACTOR SCREENING AND INTERVENTION

There is now considerable evidence in support of the effectiveness of these complex programmes, although the effect is not large; however, some heterogeneity in results remains, which is not easy to explain. One author, van Haastregt 2000, found that the multifactorial home visit approach appeared ineffective in the Dutch healthcare setting, and noted that the evidence for effectiveness came mostly from studies in the United States. Although there is an obvious overall similarity in approaches among the individual studies in this category, it may be that details of the status of the participants, the context of the intervention, and details of content and presentation are critical. A number of ongoing studies in this

category, (Allen; Behrman; Dyer; Edwards; Gordon; Lamb; SAFER 2; Spice; Torgerson), may help to resolve these uncertainties in the future.

(10) OTHER INTERVENTIONS

The reported effects of vitamin D supplementation (Bischoff 2003; Dawson-Hughes 1997; Latham 2003; Pfeifer 2000; Sato 1999), although not demonstrating significant evidence of effectiveness, continue to be compatible with the possibility that vitamin D deficiency may itself be a remediable risk factor for falling. Further trials are in progress examining that possibility (Michie; RECORD; Smith; Swift; Wark).

Conclusions

Implications for practice

Healthcare purchasers and providers contemplating fall prevention programmes should consider interventions which target both intrinsic and environmental risk factors of individual patients.

The following interventions are likely to be beneficial:

* A programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional (3 trials, 566 participants)
* A 15 week Tai Chi group exercise intervention (1 trial, 200 participants)
* Home hazard assessment and modification that is professionally prescribed for older people with a history of falling (3 trials, 374 participants)
* Withdrawal of psychotropic medication (1 trial, 93 participants)
* Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity (1 trial, 171 participants)
* Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes, in the community both for unselected population of older people (4 trials, 1651 participants), and for older people with a history of falling, or selected because of known risk factors (5 trials, 1176 participants)
* Multidisciplinary assessment and intervention programme in residential care facilities (1 trial, 439 participants).

Interventions of unknown effectiveness:

* Group-delivered exercise interventions (9 trials, 1387 participants)
* Individual lower limb strength training (1 trial, 222 participants)
* Nutritional supplementation (1 trial, 46 participants)
* Vitamin D supplementation, with or without calcium (3 trials, 461 participants)
* Home hazard modification in association with advice on optimising medication (1 trial, 658 participants), or in association with an education package on exercise and reducing fall risk (1 trial, 3182 participants)
* Pharmacological therapy (raubasine-dihydroergocristine, 1 trial, 95 participants)
* Interventions using a cognitive/behavioural approach alone (2 trials, 145 participants)
* Home hazard modification for older people without a history of falling (1 trial, 530 participants)
* Hormone replacement therapy (1 trial, 116 participants)
* Correction of visual deficiency (1 trial, 276 participants).

Interventions unlikely to be beneficial:

* Brisk walking in women with a history of upper limb fracture in the previous two years.

As the benefits in terms of the numbers of falls causing injury or requiring medical care may be quite small, careful prior economic modelling in the context of the local healthcare system is important. In view of the relatively small protective effects which may be present and the limited nature of the evidence, new intervention programmes should continue to receive methodologically robust evaluation.

Implications for research

The individual trials reviewed differed considerably in detail of intervention, and in the health and social status of the participants. Outcome measures and duration of follow-up varied.

Future research should consider these results and provide clear justification for further exploration. In particular:

* Trials should be large enough to be meaningful, i.e. there should be an a priori calculation of sample size.
* The unit of analysis should be the same as the unit of randomisation.
* The evaluation of fall prevention strategies would be enhanced by the development of a consensus document which contains a taxonomy of interventions and outcomes, and which establishes a standard for conduct and reporting of trials. This is now being addressed by the European PROFANE initiative (PROFANE).
* More data are required to confirm whether strategies apparently effective in significantly reducing the numbers of individuals falling are also effective in reducing more serious sequelae of falls, such as fractures.
* Apparently effective interventions may require re-evaluation in different healthcare systems.
* More randomised controlled trials are required to evaluate the effectiveness of falls prevention programmes in institutions such as nursing homes and hospitals.
* Economic evaluation of interventions should be encouraged.

Internal sources of support to the review

* University of York UK

External sources of support to the review

* Health Research Council NEW ZEALAND
* National Institute for Clinical Excellence UK
* Canadian Institute of Health Research (CIHR) Chairs Program, Ottawa CANADA

Notes

Due to its size and complexity we plan to split this review into two reviews: "Interventions for preventing falls in community dwelling older people" and "Interventions for preventing falls in older people in residential care facilities and hospitals". The latter title has been registered and a protocol will be developed. When that protocol is converted into a review the currently published review will be modified

and will become "Interventions for preventing falls in community dwelling older people". Until that happens we will continue to update this review with community based studies; other studies will be placed in the Awaiting Assessment section as they will be incorporated into the new review.

In The Cochrane Library Issue 3, 2001

The title was changed from 'Interventions for preventing falls in the elderly'.

The review was updated to include an additional 22 trials, studying a wider range of interventions, plus 20 ongoing trials.

There is now evidence of effectiveness for more interventions.

In the first version of this review, data from a number of cluster randomised studies were pooled with individually randomised studies. As this results in the estimate of confidence intervals being inappropriately narrow when entered into RevMan, in this update the results of cluster randomised studies have been reported in the text but do not appear in the MetaView analyses.

Where raw data are available the relative risk has been calculated, in line with the statistical policy of the Cochrane Musculoskeletal Injuries group. Where raw data is not available we have reported the statistic used by the trialists.

The list of excluded studies has been rationalised to only include controlled studies. A new co-reviewer, MC Robertson, contributed to this update.

Potential conflict of interest

Three reviewers were investigators for five included studies: WJ Gillespie (Carter 1997), RG Cumming (Cumming 1999) and MC Robertson (Campbell 1997; Campbell 1999; Robertson 2001a). Investigators did not carry out quality assessment on their own studies. No other conflicts are declared.

Acknowledgements

The reviewers would like to thank Kate Rowntree for her support at the editorial base, and Dr Helen Handoll and Leeann Morton for their assistance with the editorial process for earlier versions of the review. We would also like to thank Dr Geoff Murray for his assistance with data extraction and quality assessment. We thank the following for their useful and constructive comments at editorial review: Peter Herbison, Prof Rajan Madhok, Dr Peter Overstall, Dr Jed Rowe, Prof Marc Swiontkowski, and Dr Janet Wale. We are grateful to N. Freeman for her translation of Vellas 1991.

Contribution of Reviewer(s)

LD Gillespie, the guarantor for this review, conceived, designed, and co-ordinated the review, developed the search strategy and carried out the searches, screened search results and obtained papers, screened retrieved papers against inclusion criteria, carried out quality assessment and data abstraction, entered data into RevMan, and wrote the review.

WJ Gillespie conceived and designed the review, screened retrieved papers against inclusion criteria, carried out quality assessment and data abstraction, entered data into RevMan, and wrote the review.

MC Robertson contributed to the appraisal of quality, abstracted data from papers, and commented on drafts of the review. In addition she provided additional data about papers, and a methodological perspective for measurement of outcomes and statistical analyses used in the papers and the economic evaluations.

SE Lamb, RG Cumming and BH Rowe carried out data collection and quality assessment, and commented on drafts of the review.

Most recent changes

This review was substantively updated in Issue 4, 2003:

This version includes an additional 22 trials, studying a wider range of interventions.

There are 14 studies Awaiting Assessment; either because further information is required on falls outcomes, or because they are recently or not yet published.

Fourteen new references for ongoing trials have been added. Additional references have also been added for the ongoing multicentre trials (RECORD, SAFE PACE 2, SAFER 2). The ongoing trial (Leathley) has been added to the included study (Lightbody 2002), Shaw has now been included (Shaw 2003), Kalra recently published as (Steadman 2003 awaiting assessment), and Wolf is in press (awaiting assessment).

Evidence for the effectiveness of home hazard management in people with a history of falling is somewhat strengthened by new data.

Evidence for the effectiveness of exercise programmes and multifactorial assessment/intervention programmes remains unchanged despite the inclusion of a number of new trials, some of which were not successful in reducing falls.

In a highly selected group of fallers with carotid sinus hypersensitivity, cardiac pacing is effective in reducing the frequency of syncope and falls.

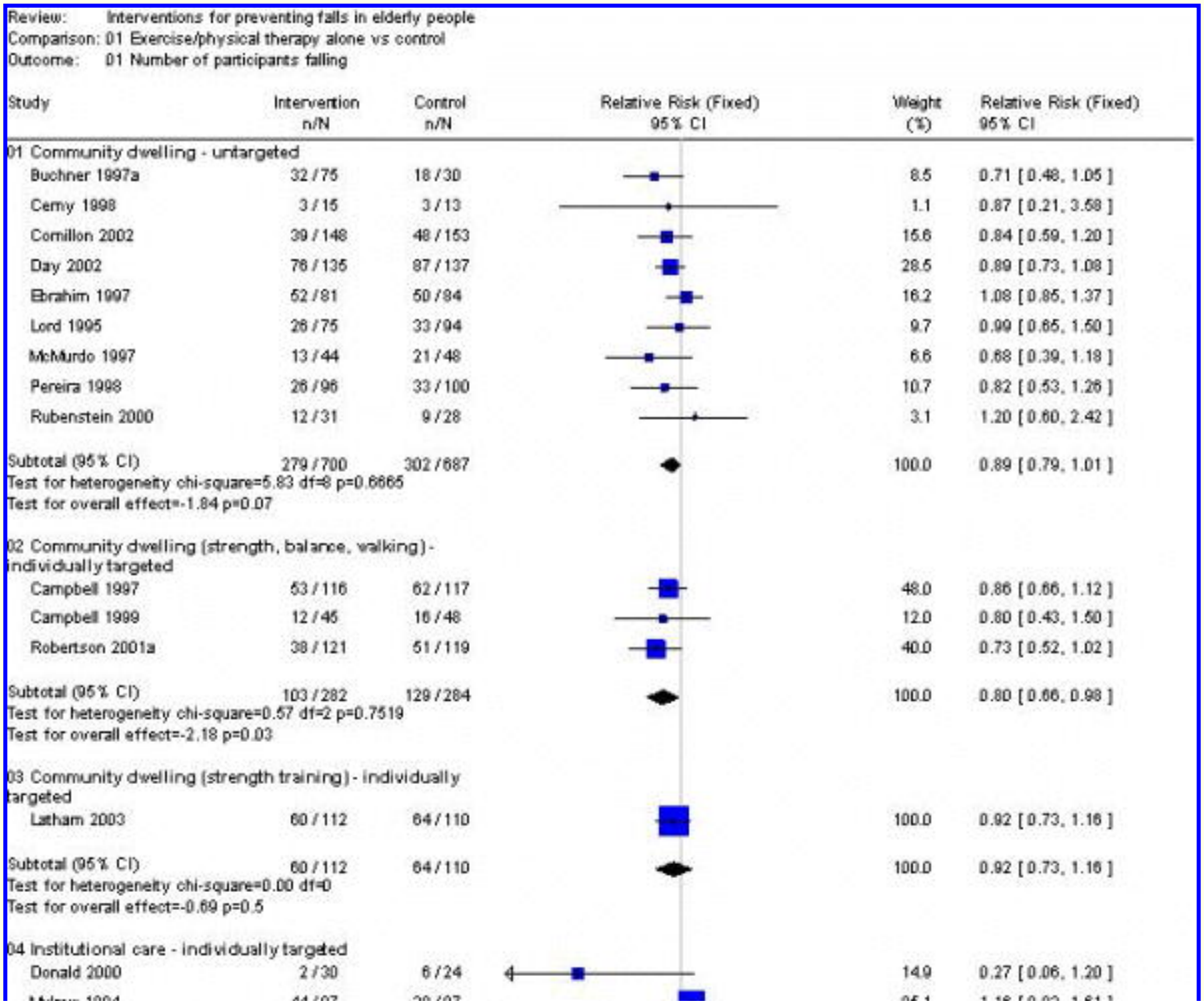
Synopsis

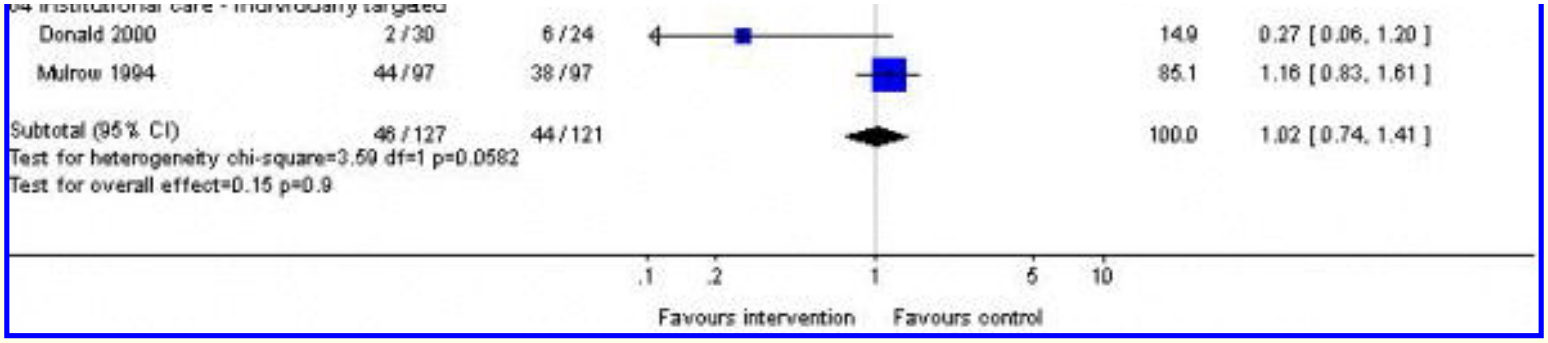
Interventions to prevent falls in elderly people can be effective

Approximately 30 per cent of people over 65 years and living in the community fall each year; the number is higher in institutions. A fifth of incidents require medical attention. Multidisciplinary interventions targeting multiple risk factors are effective in reducing the incidence of falls, as is muscle strengthening combined with balance retraining, individually prescribed at home by a trained health professional. Tai Chi may also be effective. Home hazard assessment and modification by a health professional may reduce falls, especially in those with a history of falling. Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity is likely to be beneficial, as is withdrawal of psychotropic medication. Individually tailored interventions delivered by a health professional are more effective than standard or group delivered programmes.

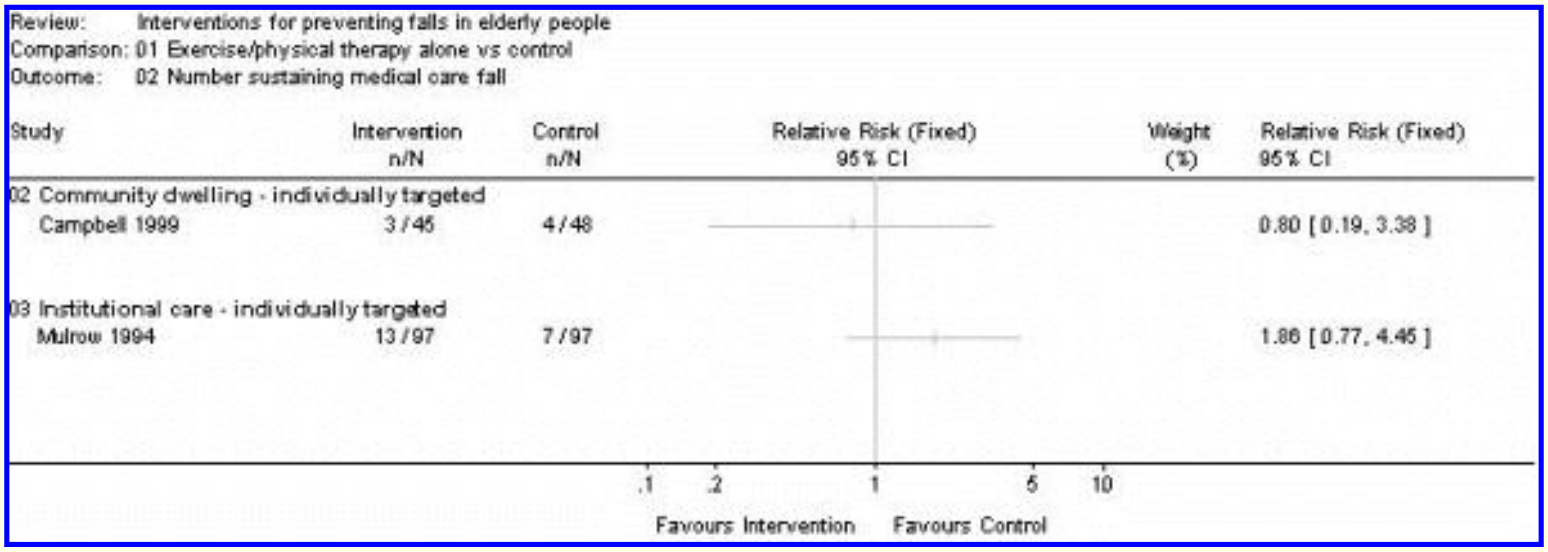
Table of comparisons

Fig 01 Exercise/physical therapy alone vs control

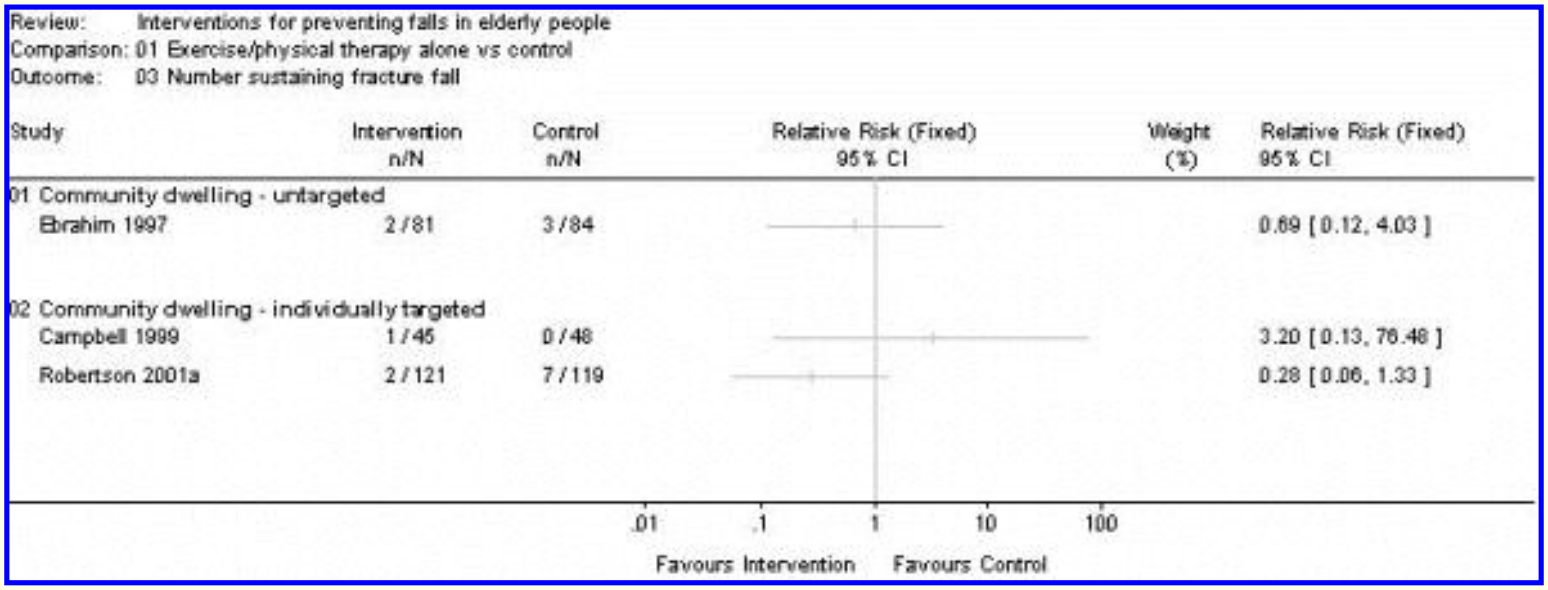




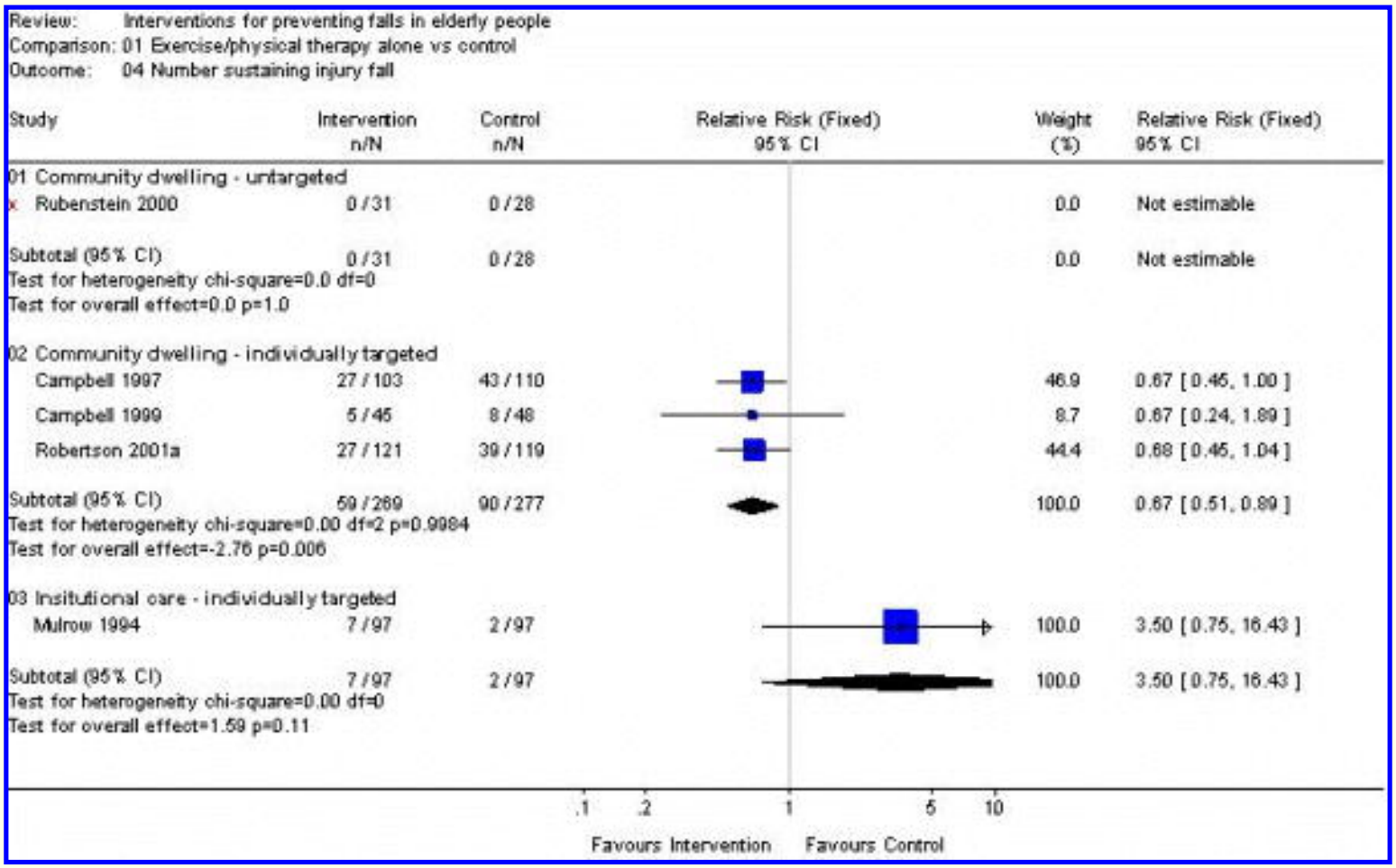
Number of participants falling



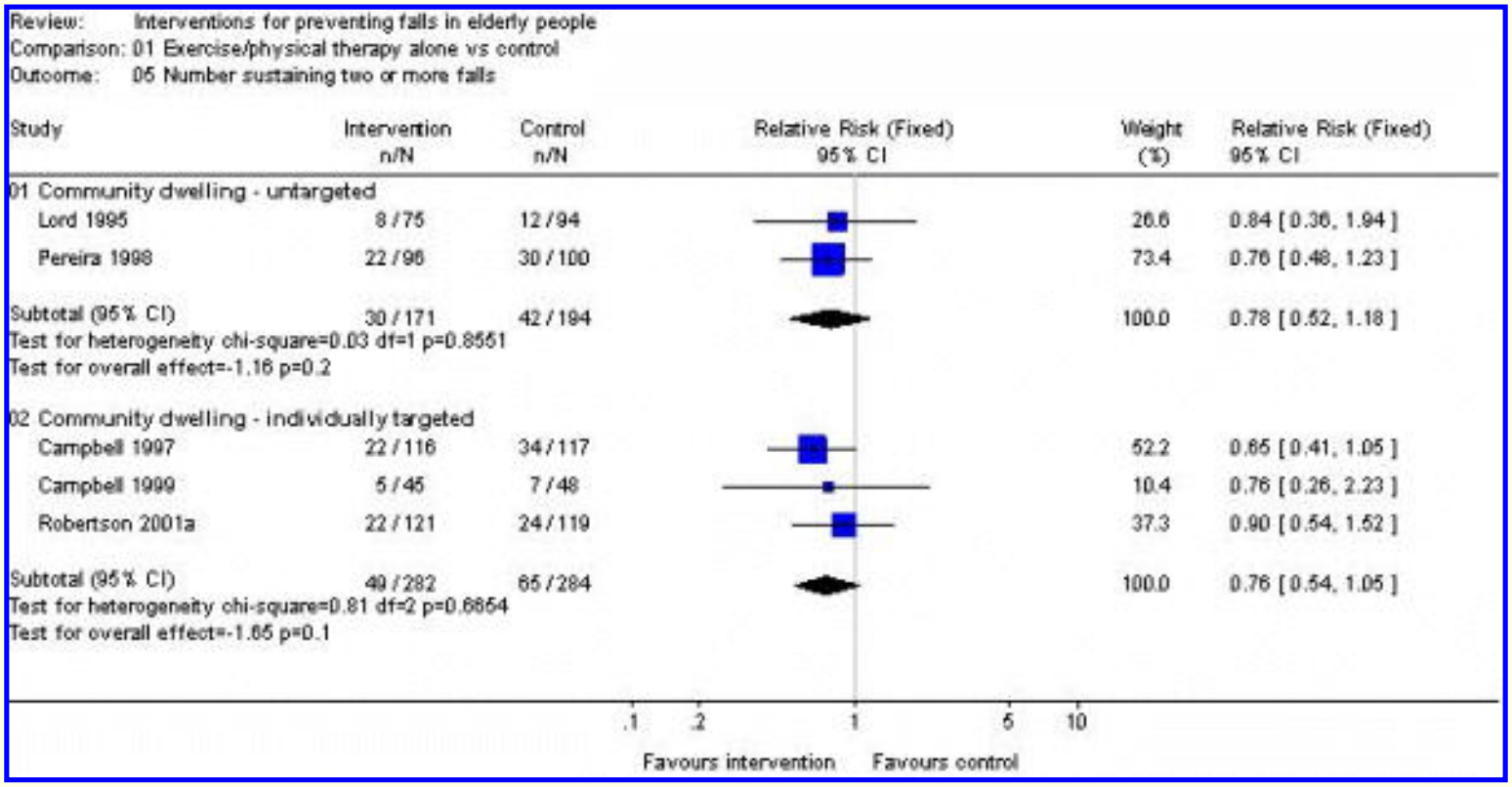
Number sustaining medical care fall



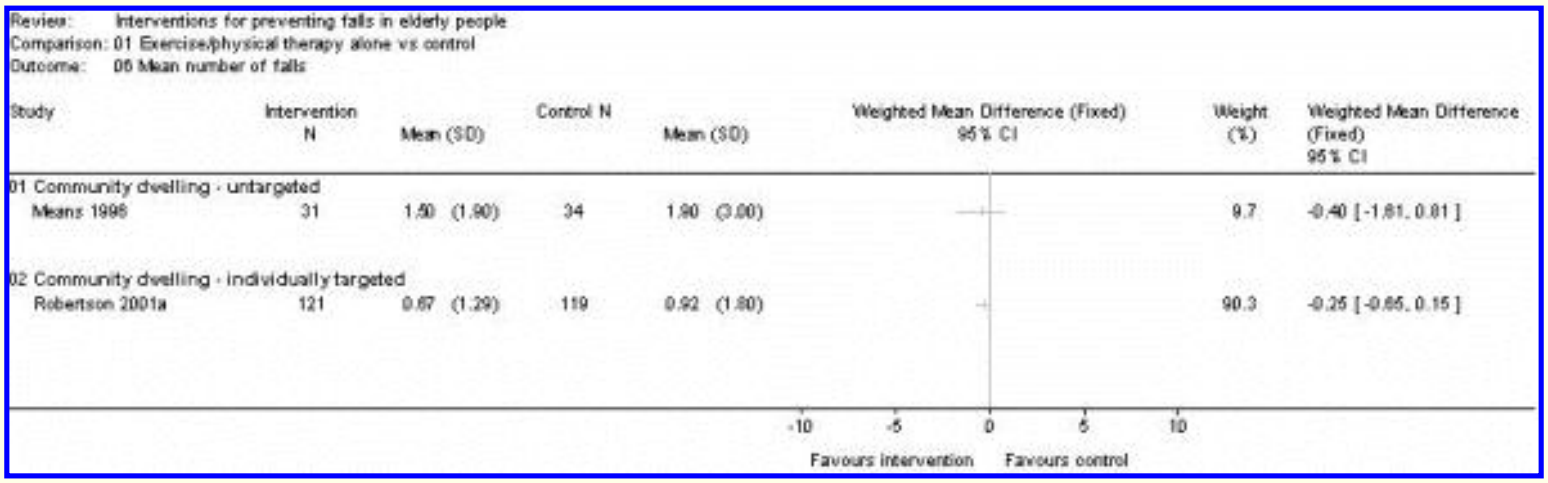
Number sustaining fracture fall



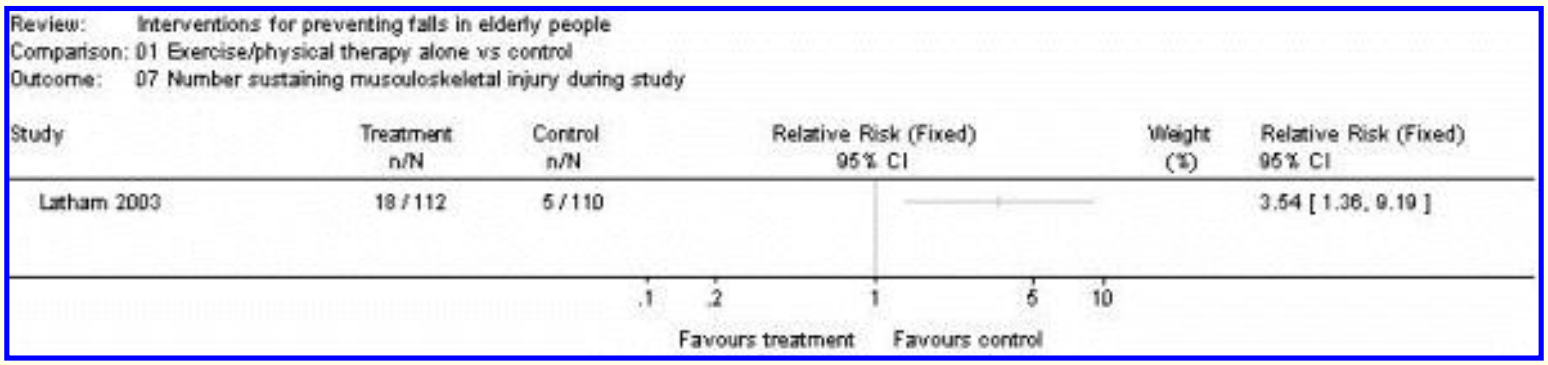
Number sustaining injury fall



Number sustaining two or more falls



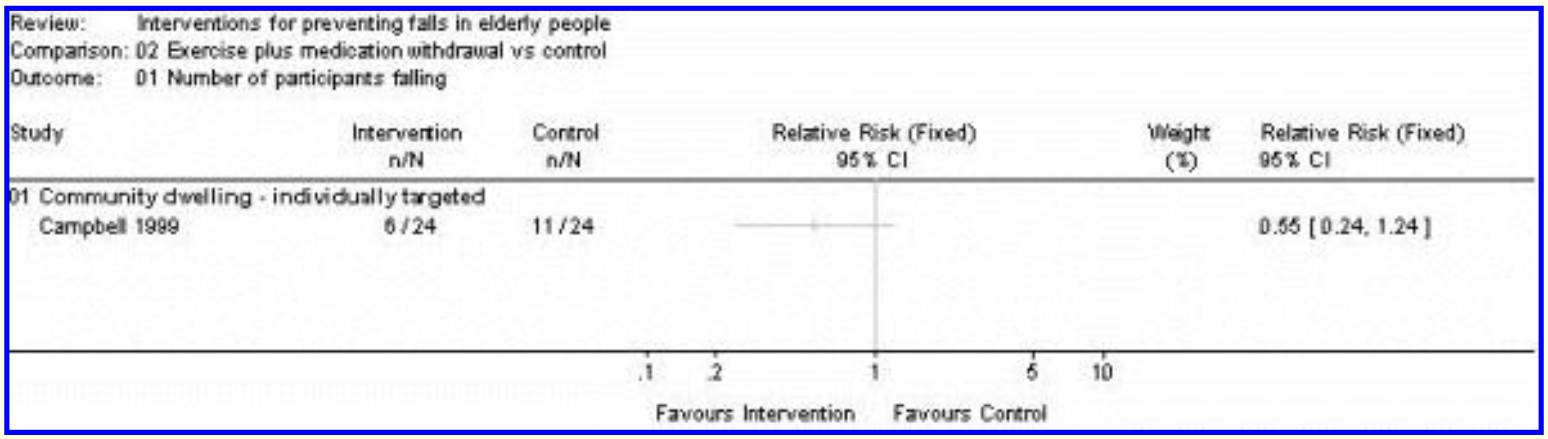
Mean number of falls



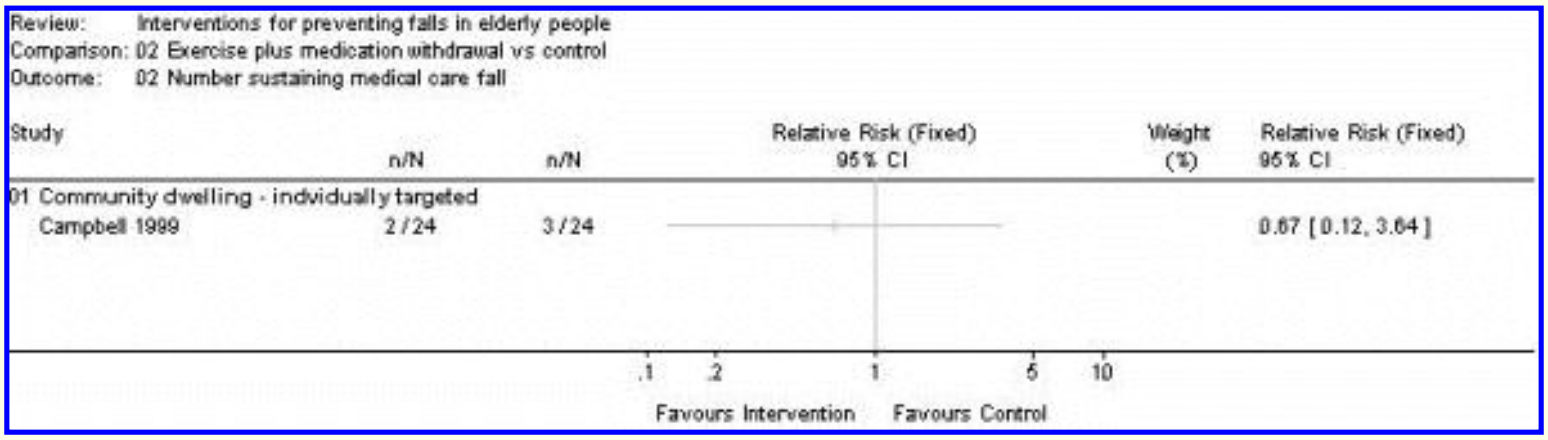
Number sustaining musculoskeletal injury during study

Table of comparisons

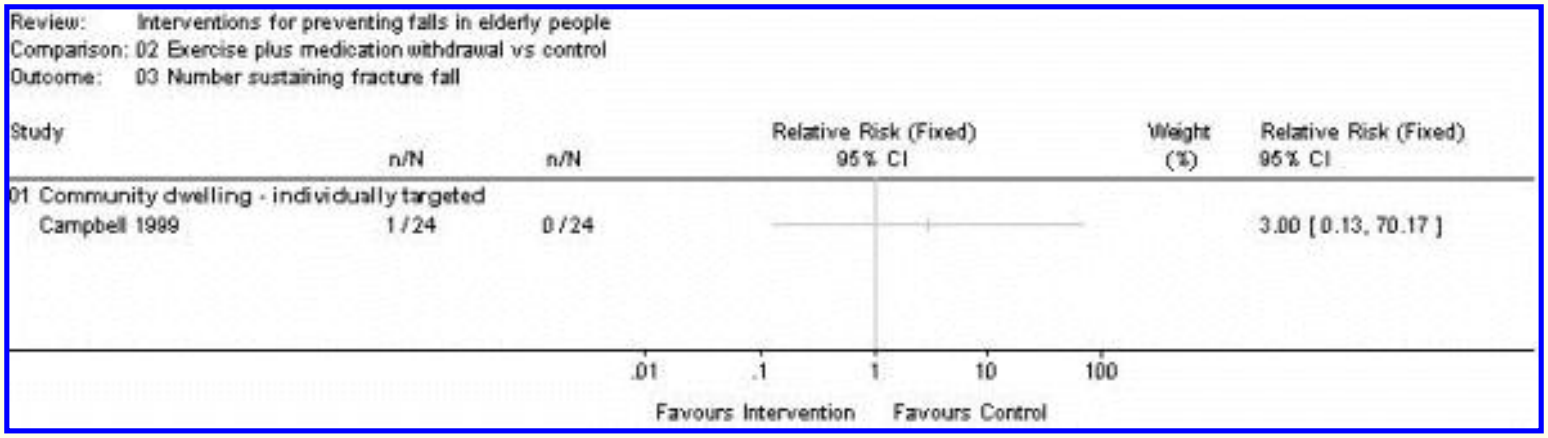
Fig 02 Exercise plus medication withdrawal vs control



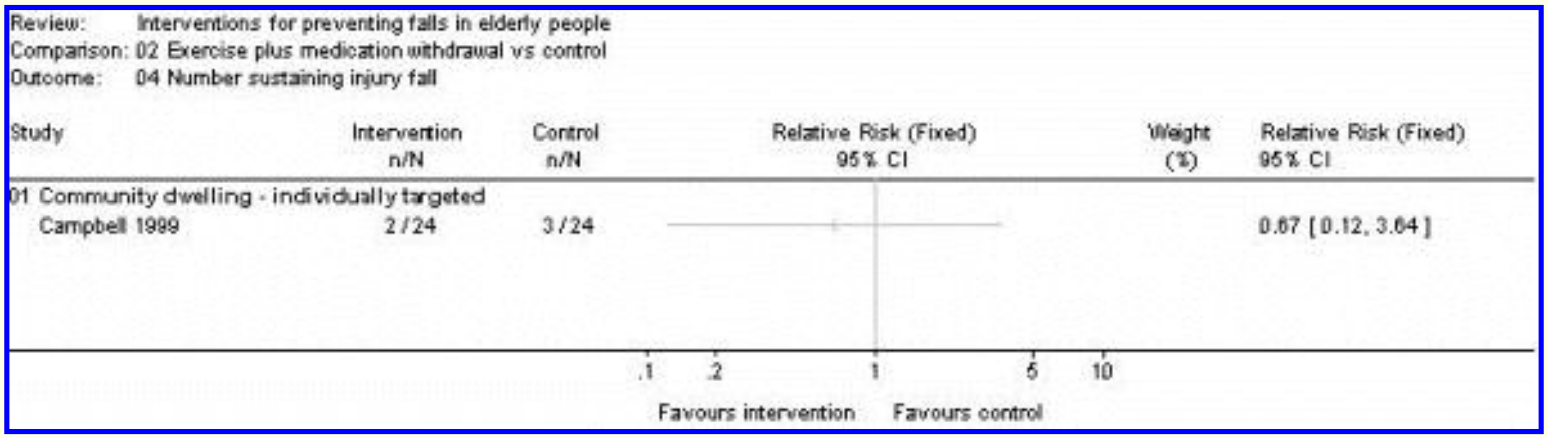
Number of participants falling



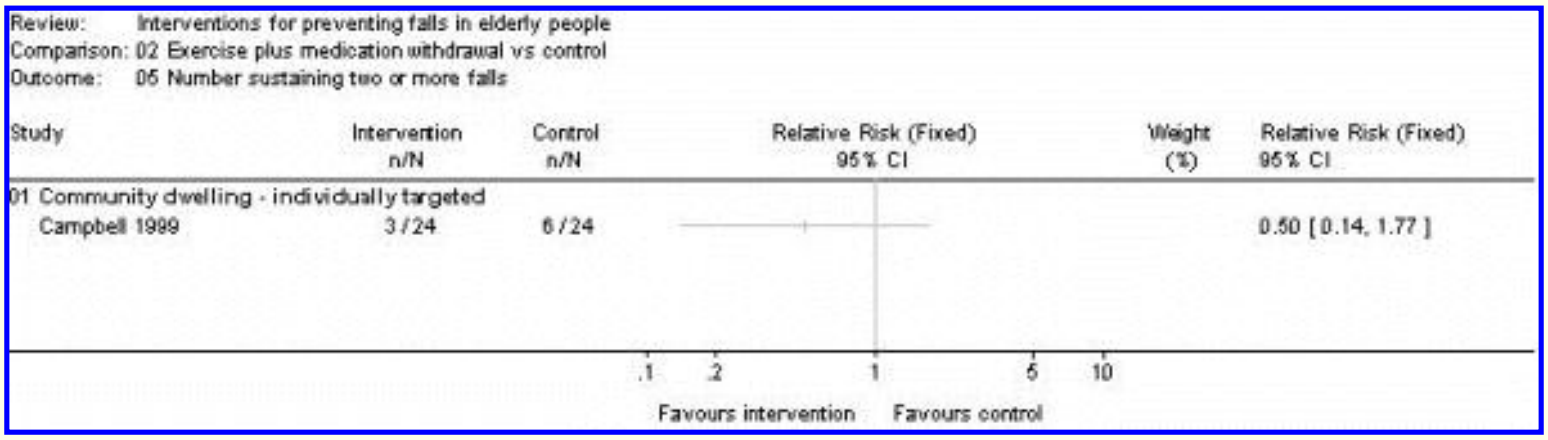
Number sustaining medical care fall



Number sustaining fracture fall



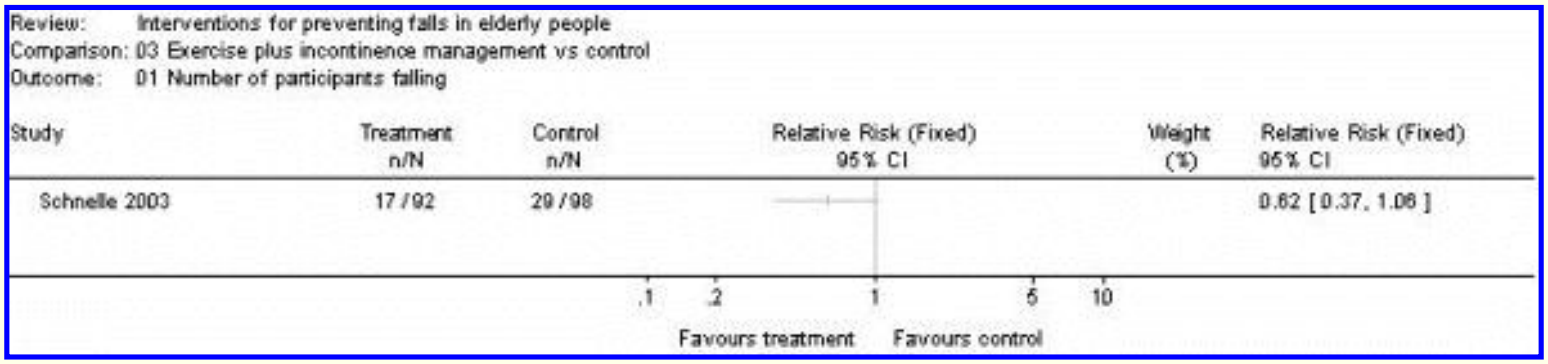
Number sustaining injury fall



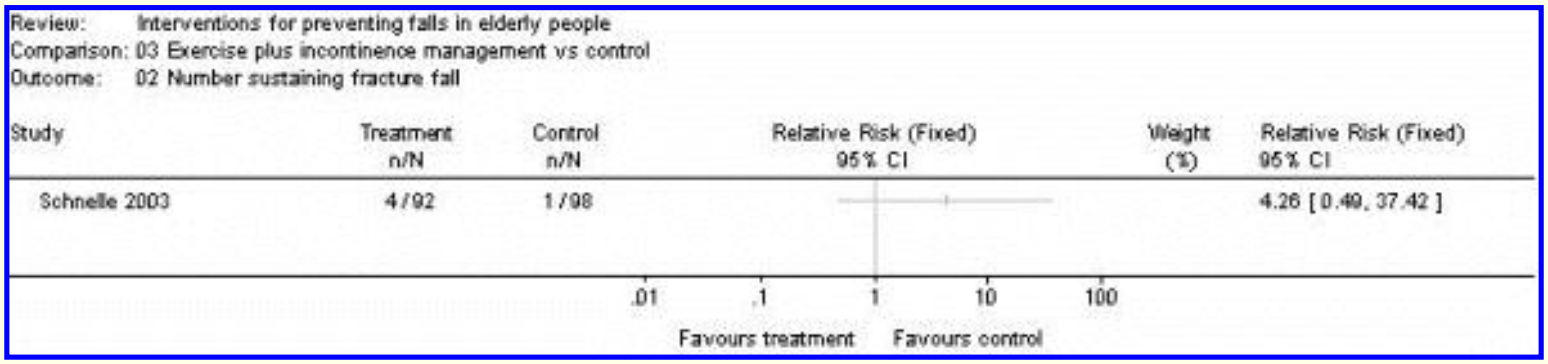
Number sustaining two or more falls

Table of comparisons

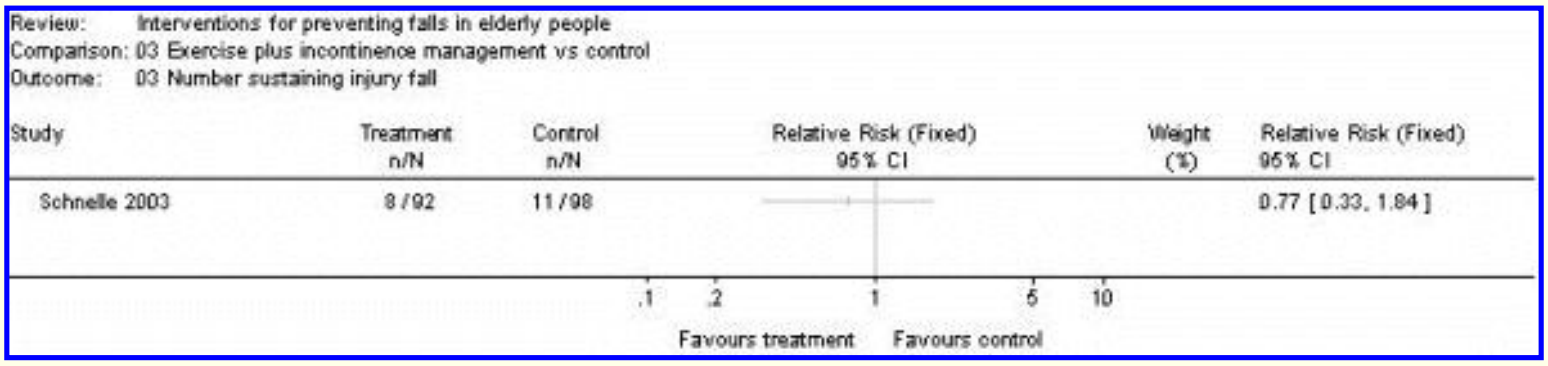
Fig 03 Exercise plus incontinence management vs control



Number of participants falling



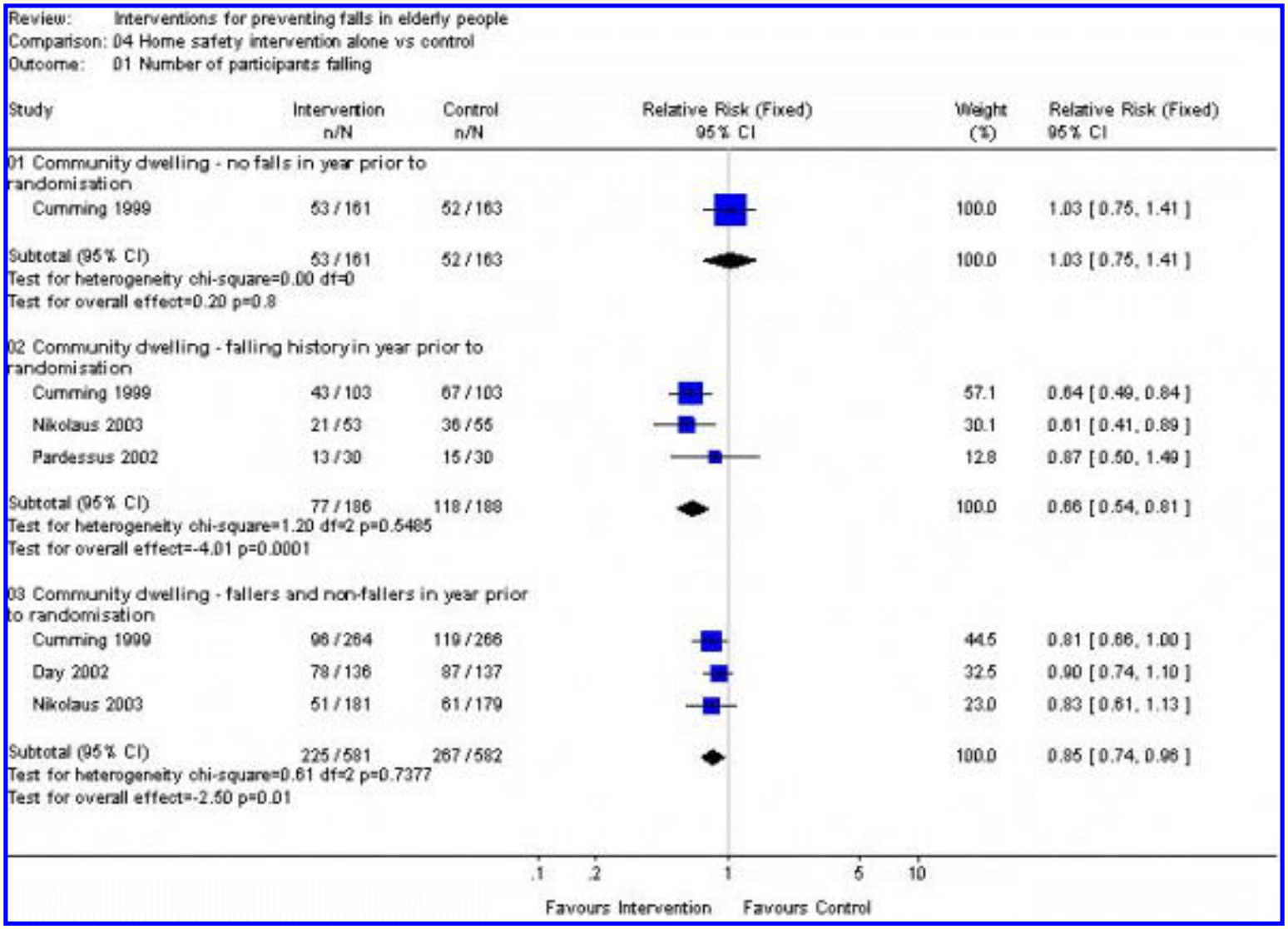
Number sustaining fracture fall



Number sustaining injury fall

Table of comparisons

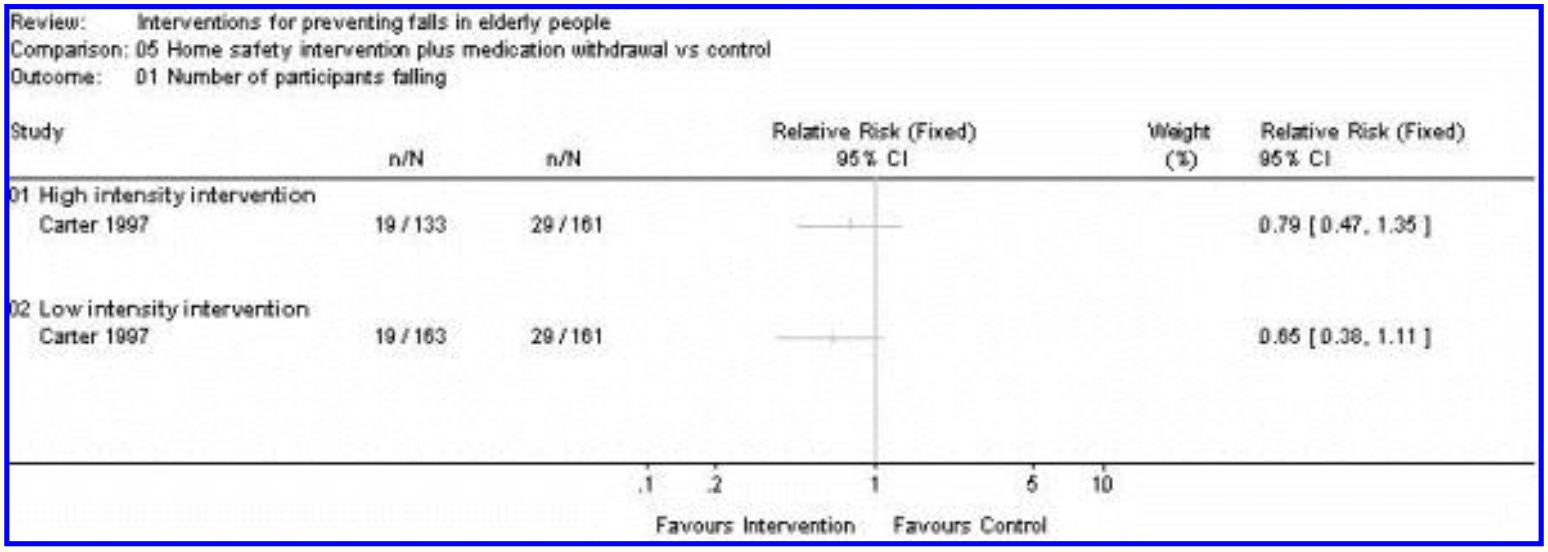
Fig 04 Home safety intervention alone vs control



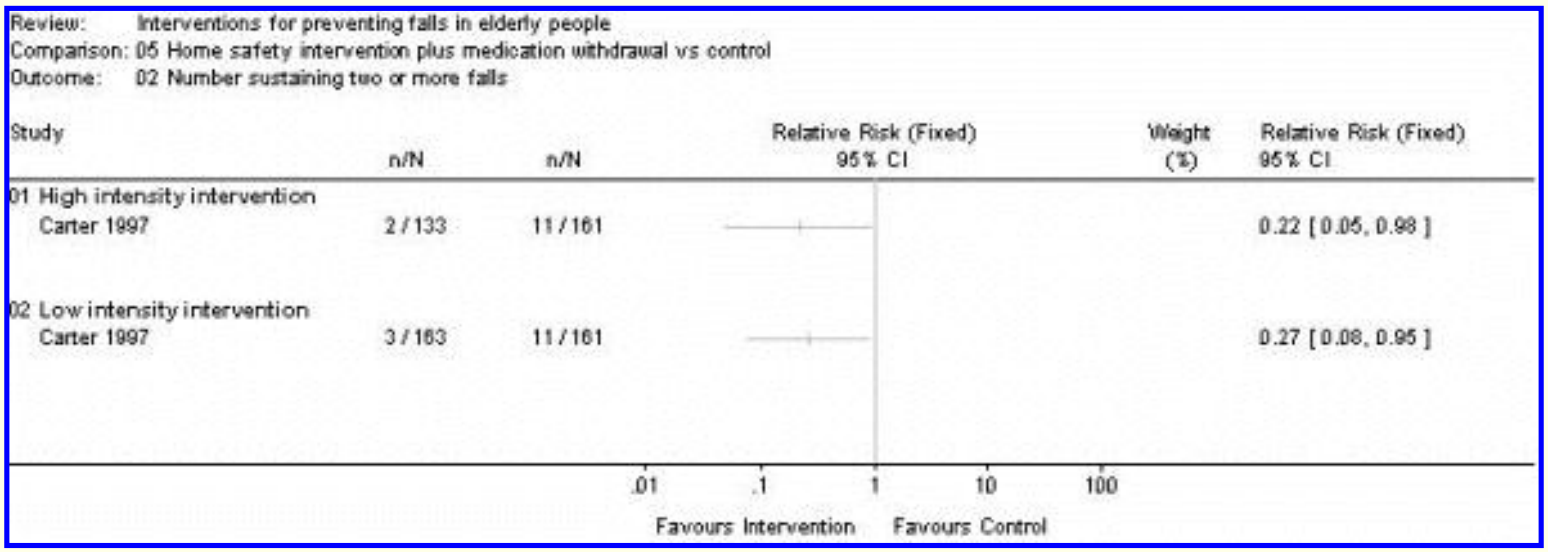
Number of participants falling

Table of comparisons

Fig 05 Home safety intervention plus medication withdrawal vs control



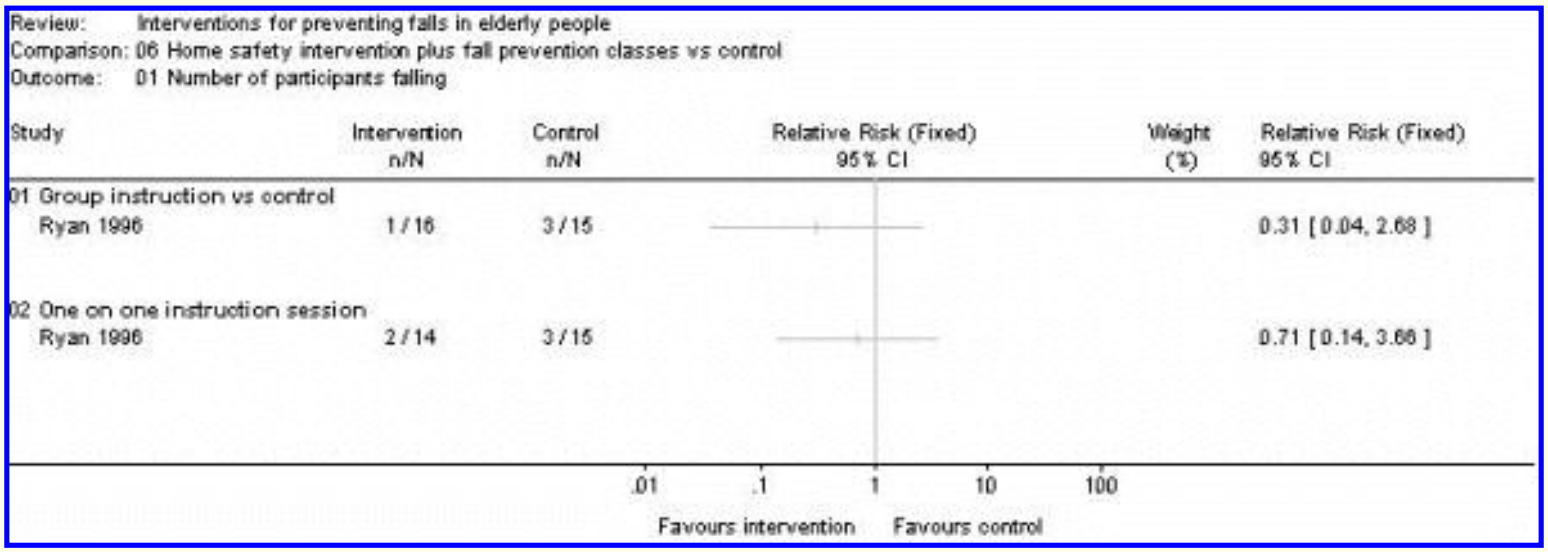
Number of participants falling



Number sustaining two or more falls

Table of comparisons

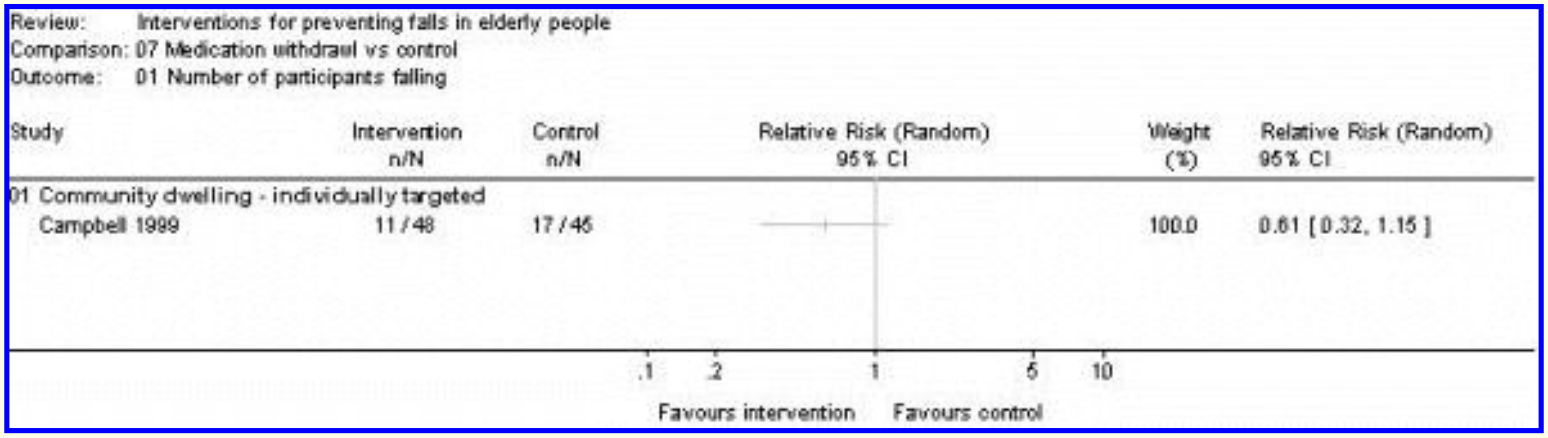
Fig 06 Home safety intervention plus fall prevention classes vs control



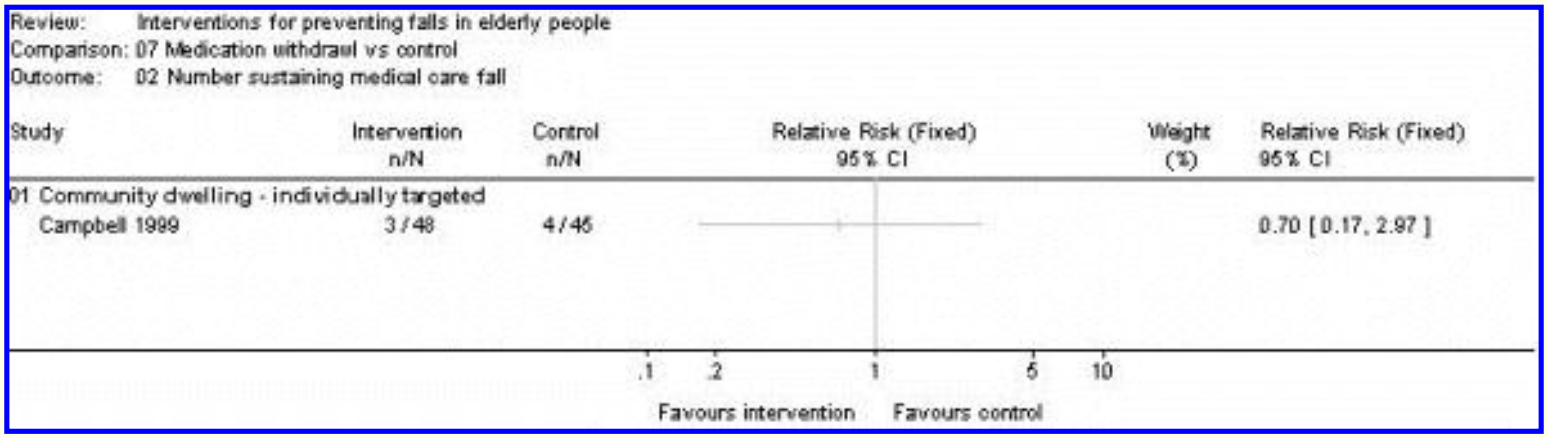
Number of participants falling

Table of comparisons

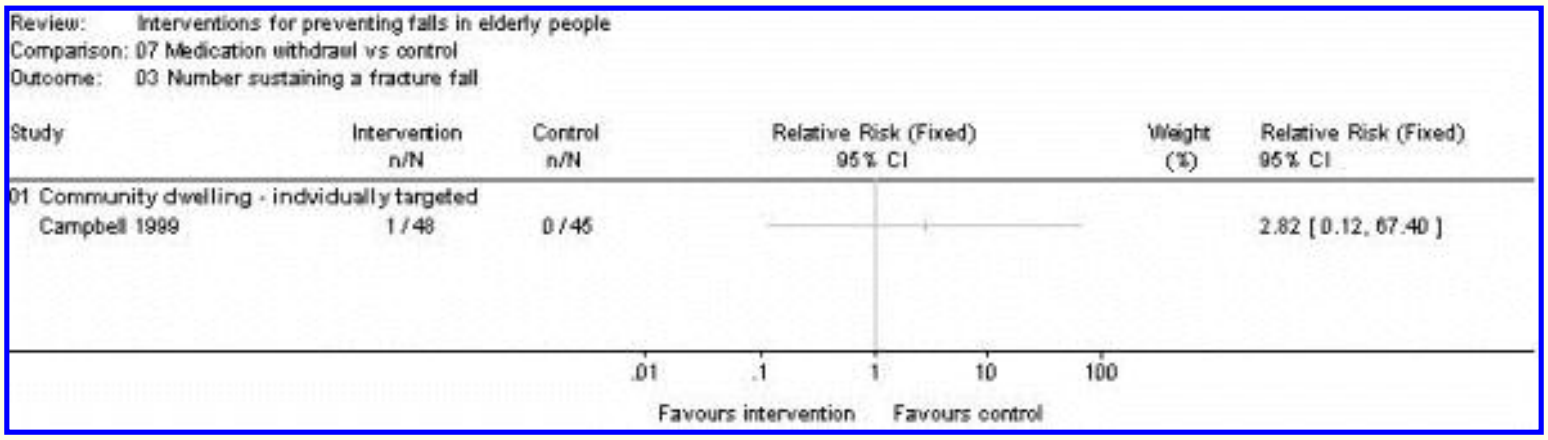
Fig 07 Medication withdrawl vs control



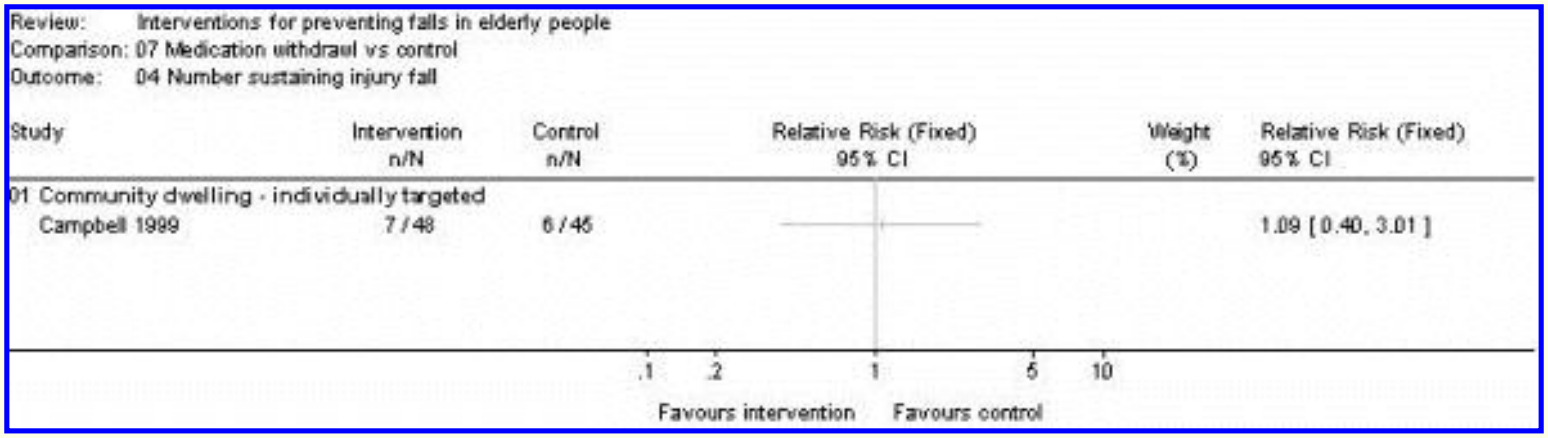
Number of participants falling



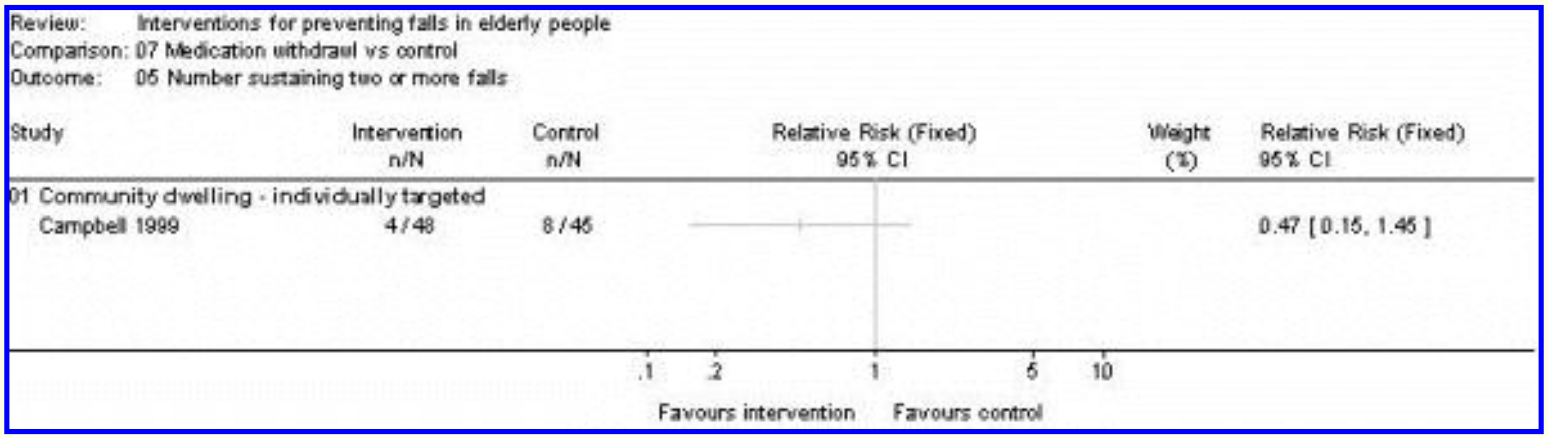
Number sustaining medical care fall



Number sustaining a fracture fall



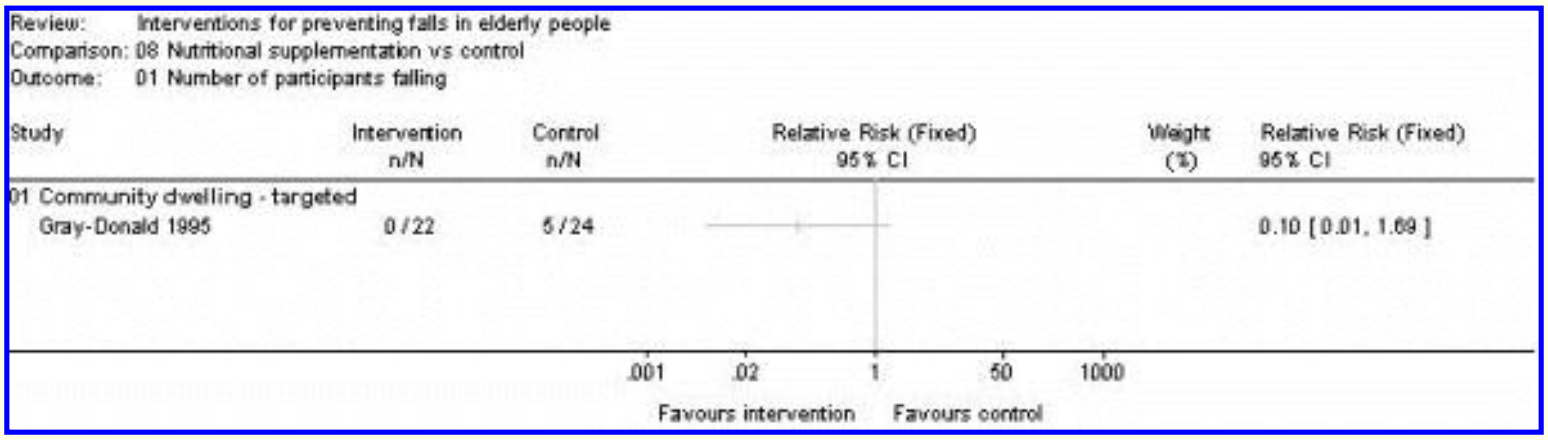
Number sustaining injury fall



Number sustaining two or more falls

Table of comparisons

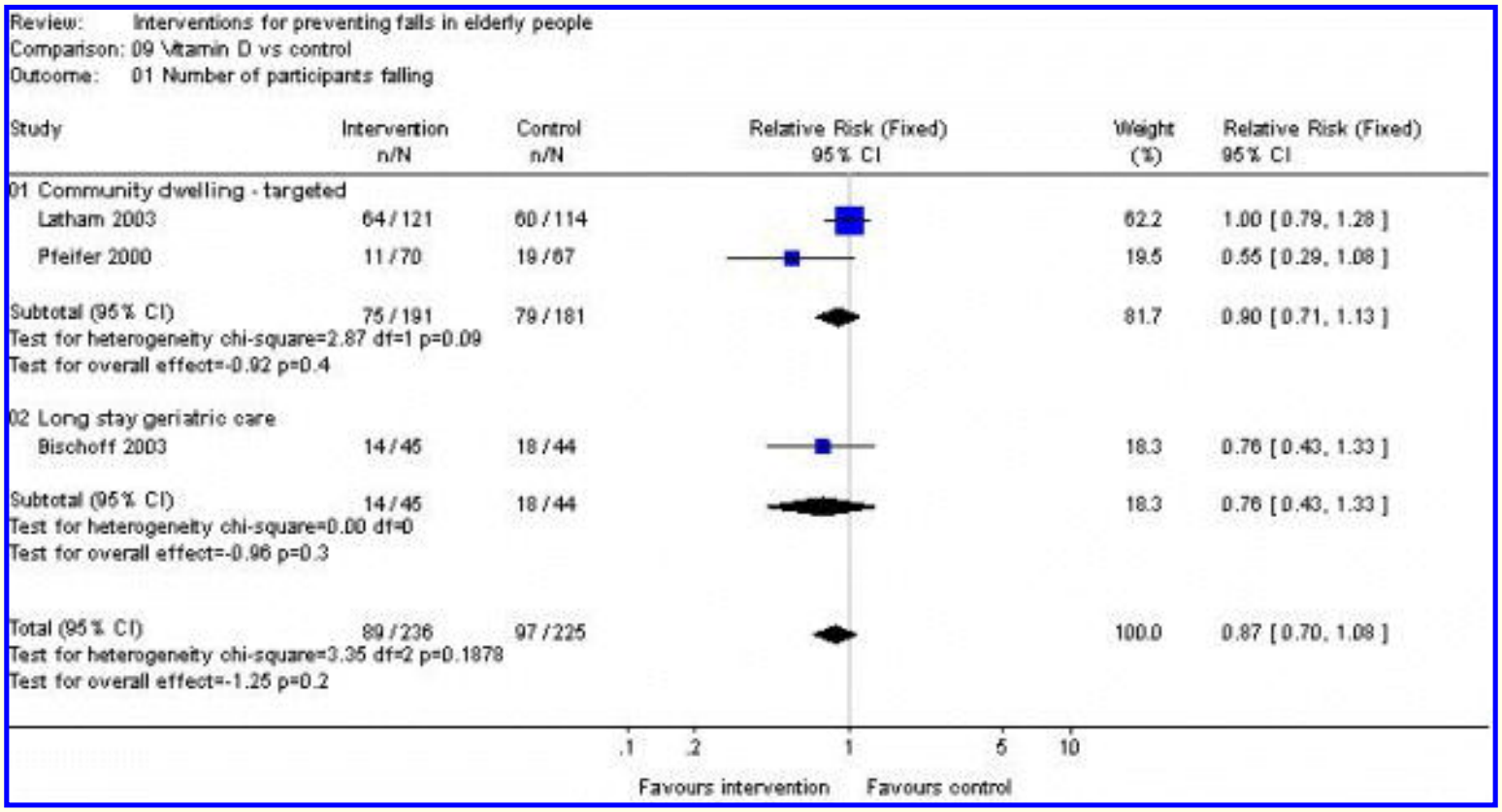
Fig 08 Nutritional supplementation vs control



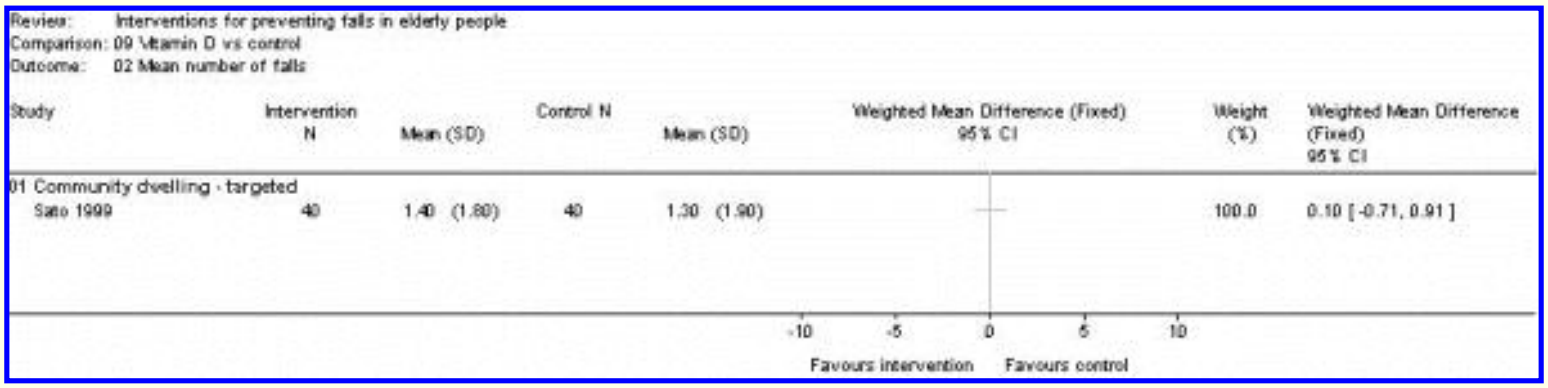
Number of participants falling

Table of comparisons

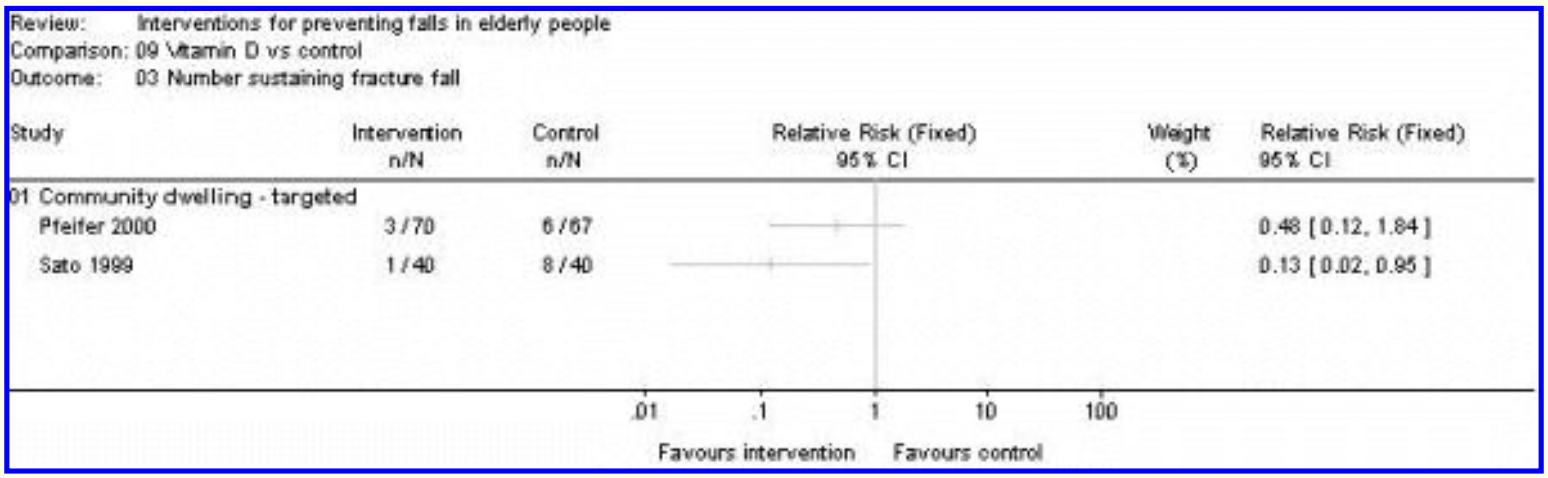
Fig 09 Vitamin D vs control



Number of participants falling



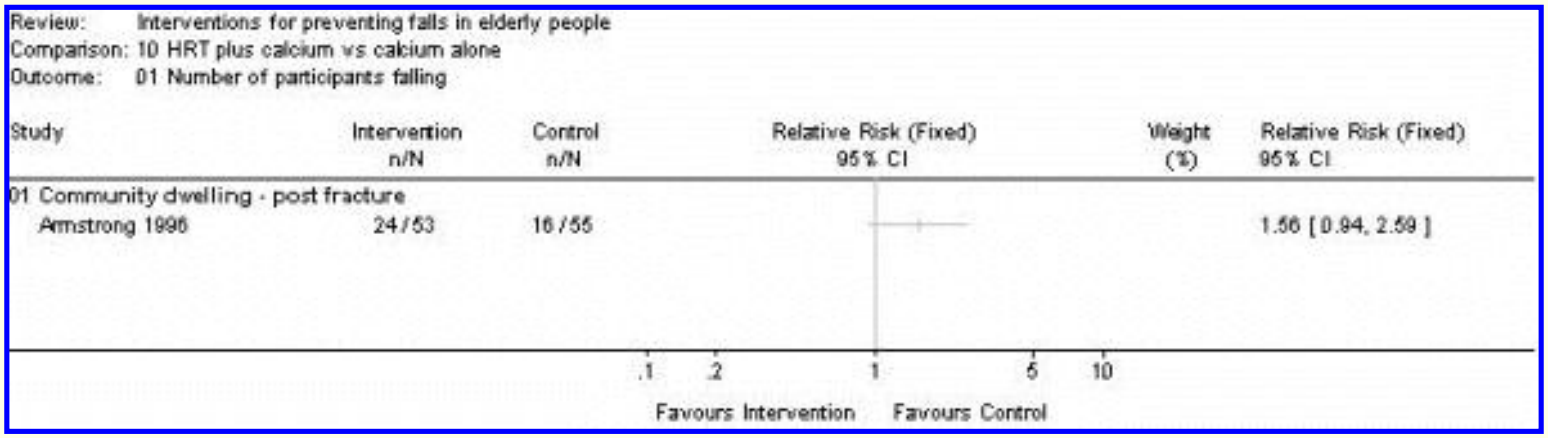
Mean number of falls



Number sustaining fracture fall

Table of comparisons

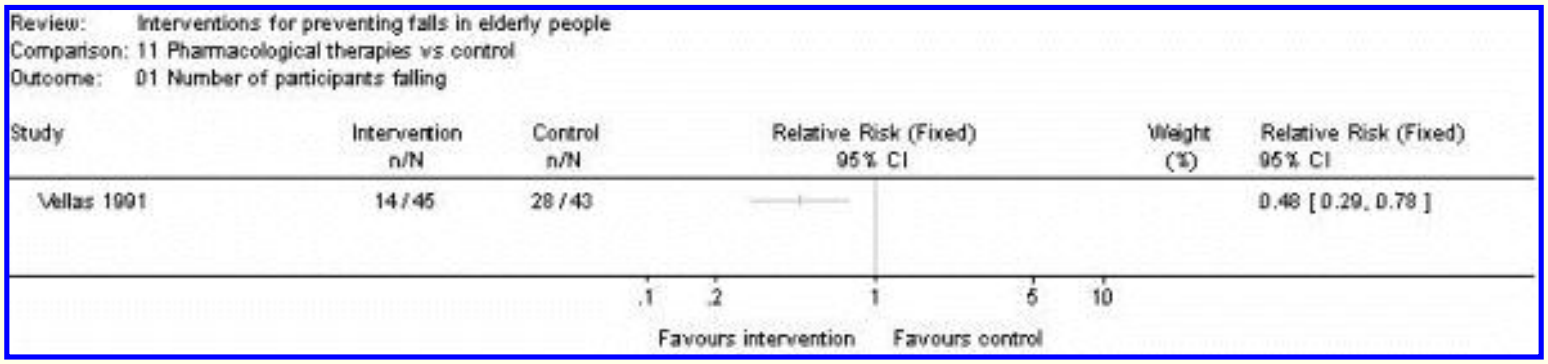
Fig 10 HRT plus calcium vs calcium alone



Number of participants falling

Table of comparisons

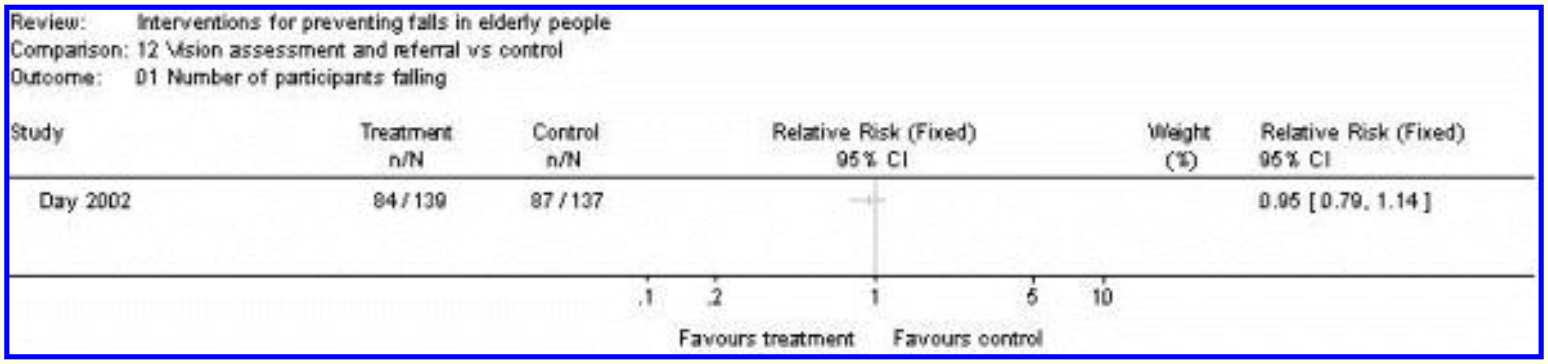
Fig 11 Pharmacological therapies vs control



Number of participants falling

Table of comparisons

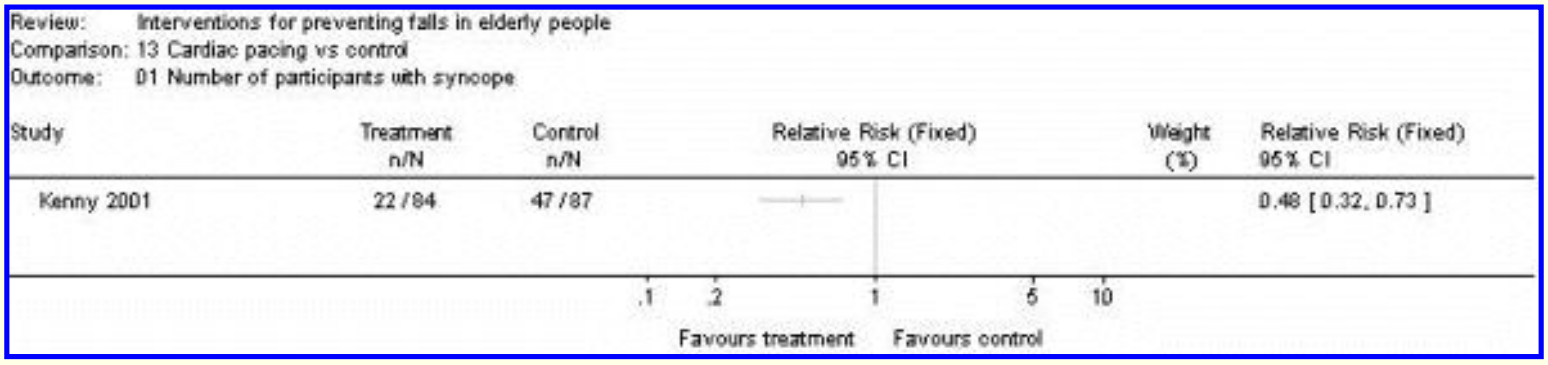
Fig 12 Vision assessment and referral vs control



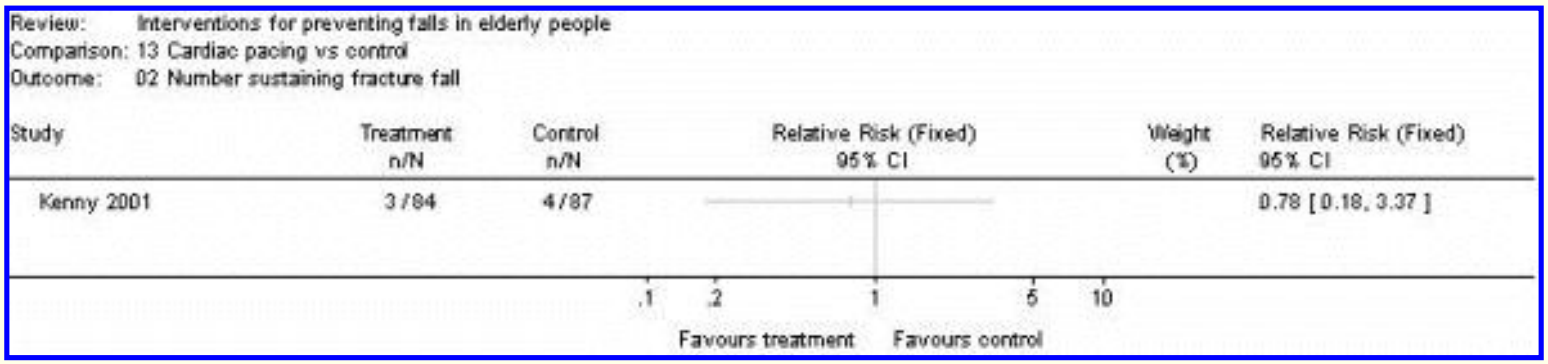
Number of participants falling

Table of comparisons

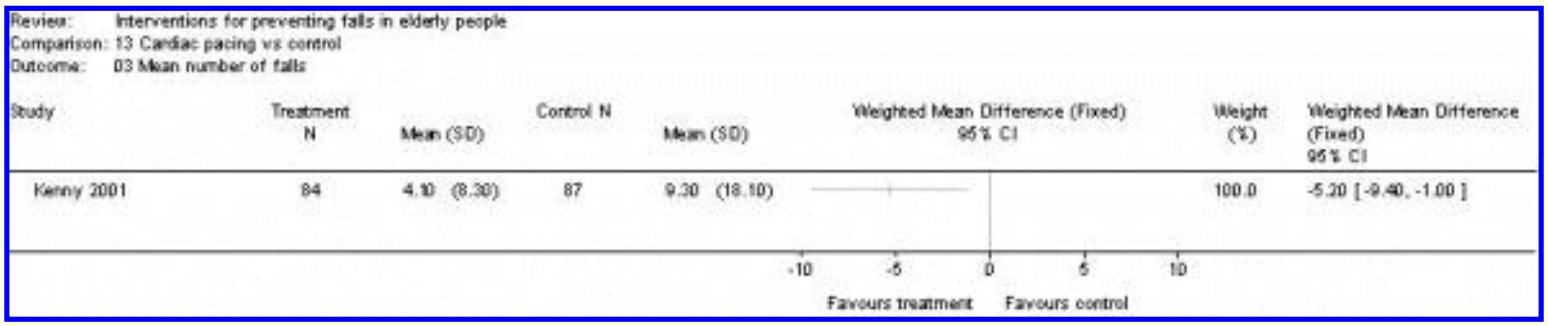
Fig 13 Cardiac pacing vs control



Number of participants with syncope



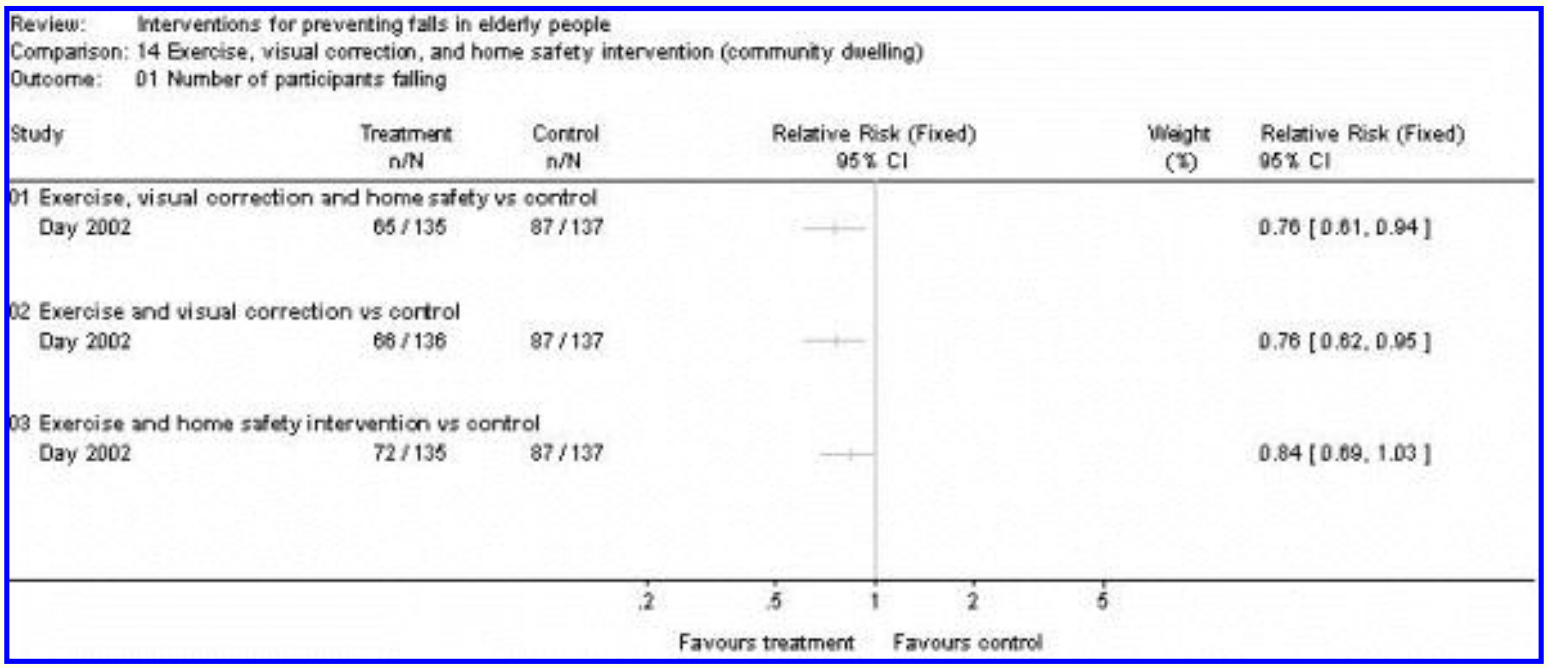
Number sustaining fracture fall



Mean number of falls

Table of comparisons

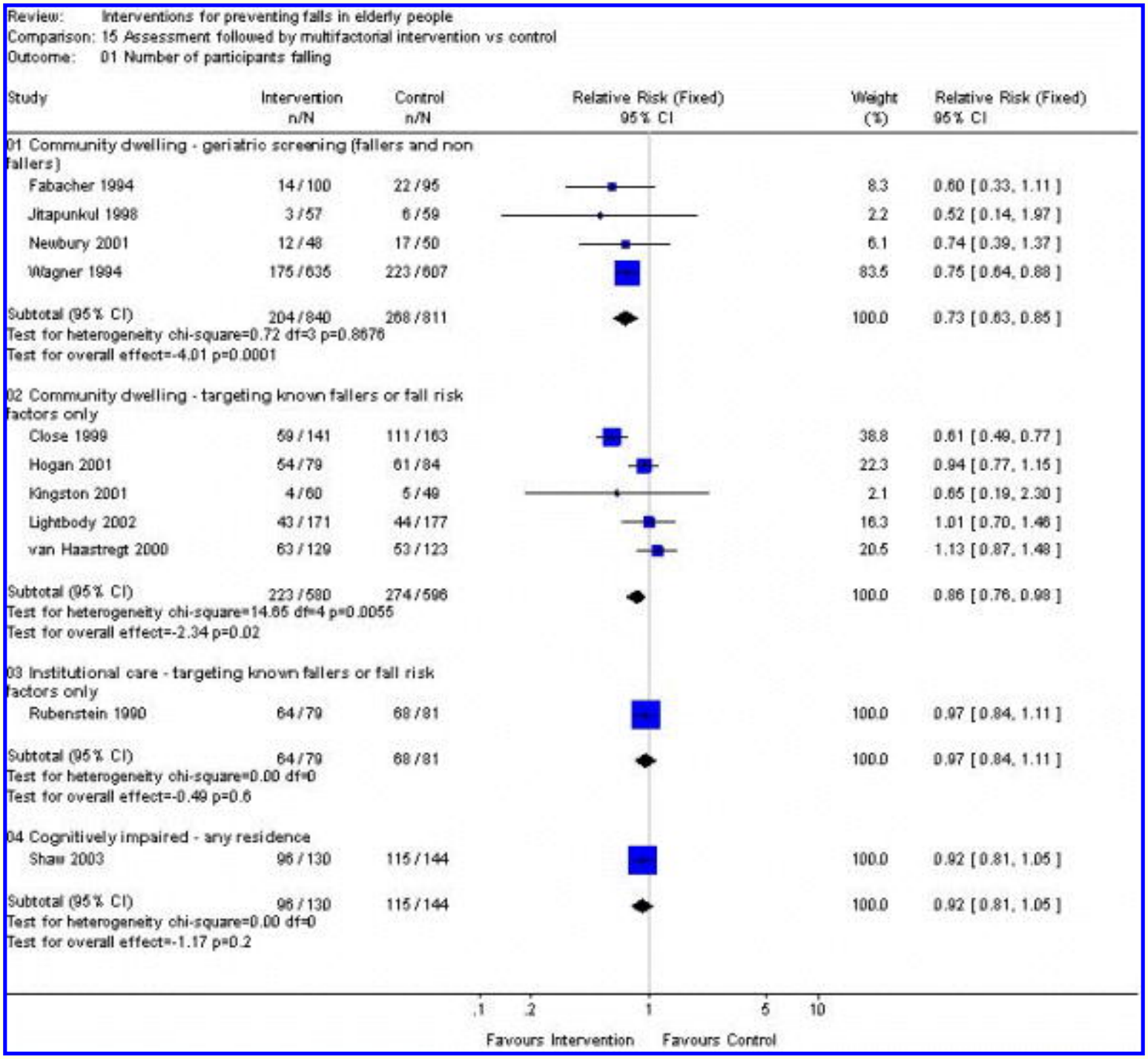
Fig 14 Exercise, visual correction, and home safety intervention (community dwelling)



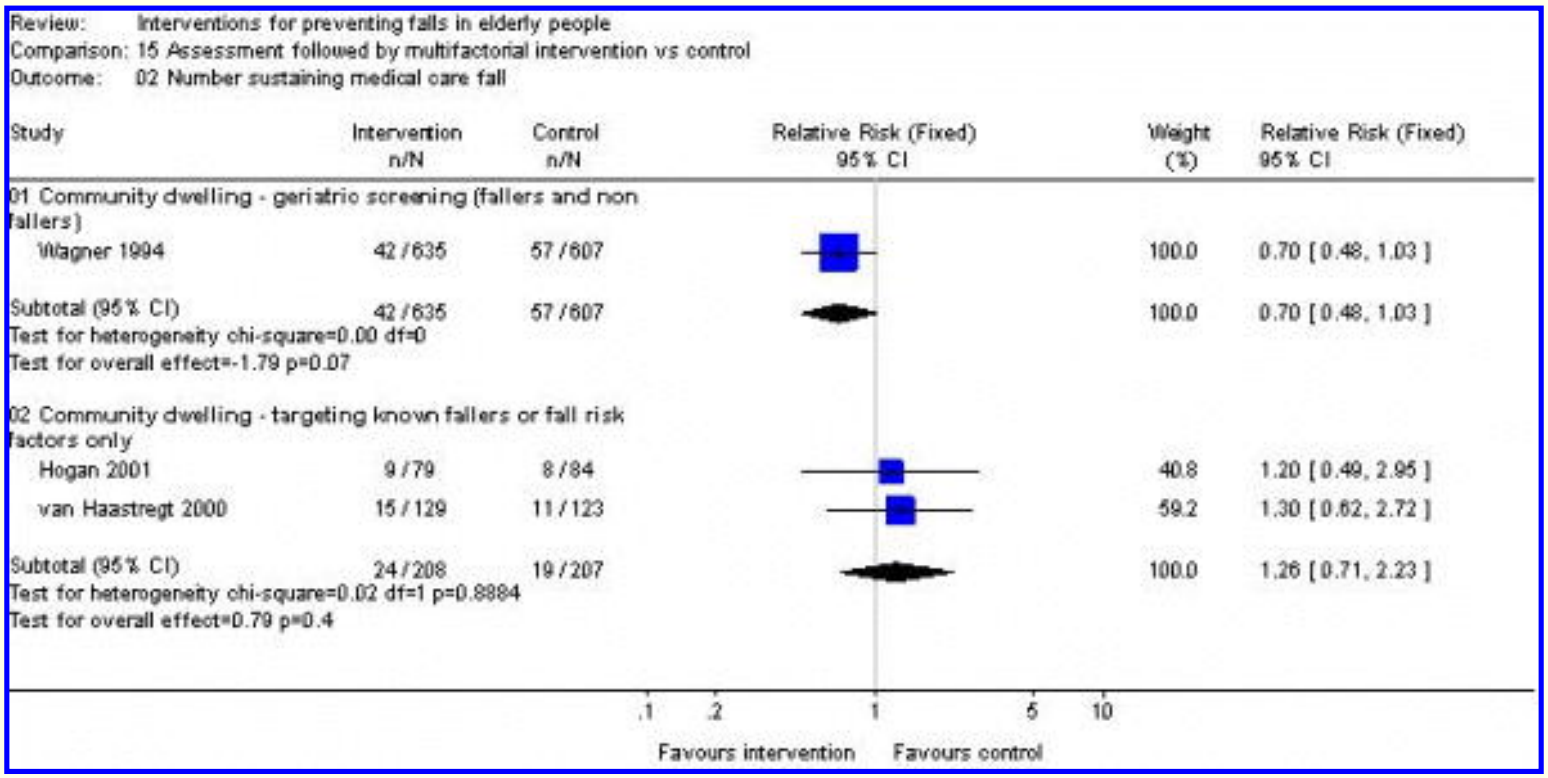
Number of participants falling

Table of comparisons

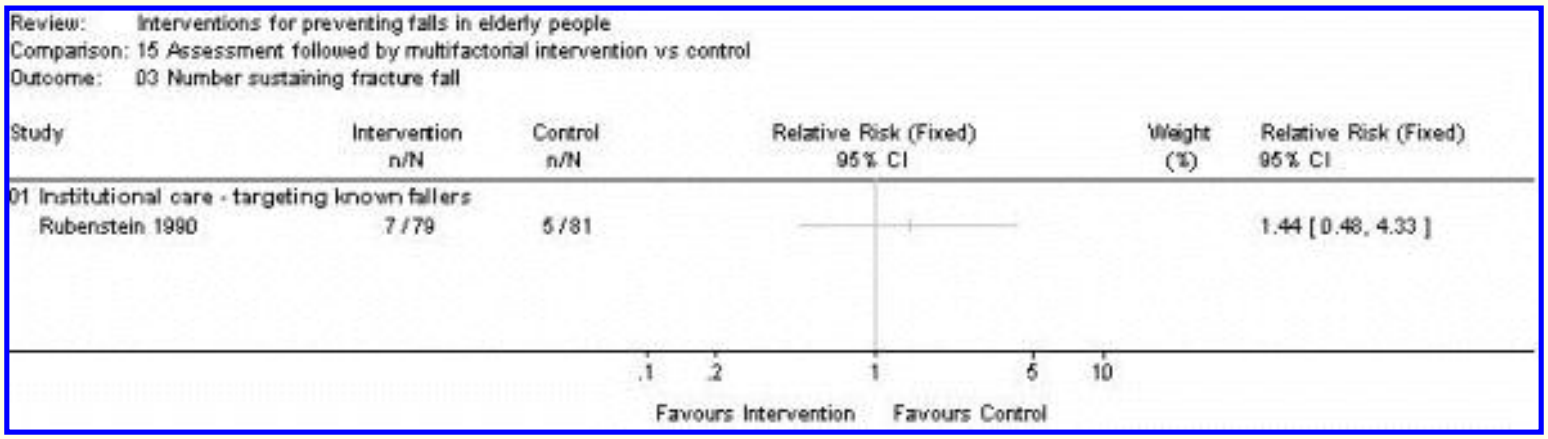
Fig 15 Assessment followed by multifactorial intervention vs control



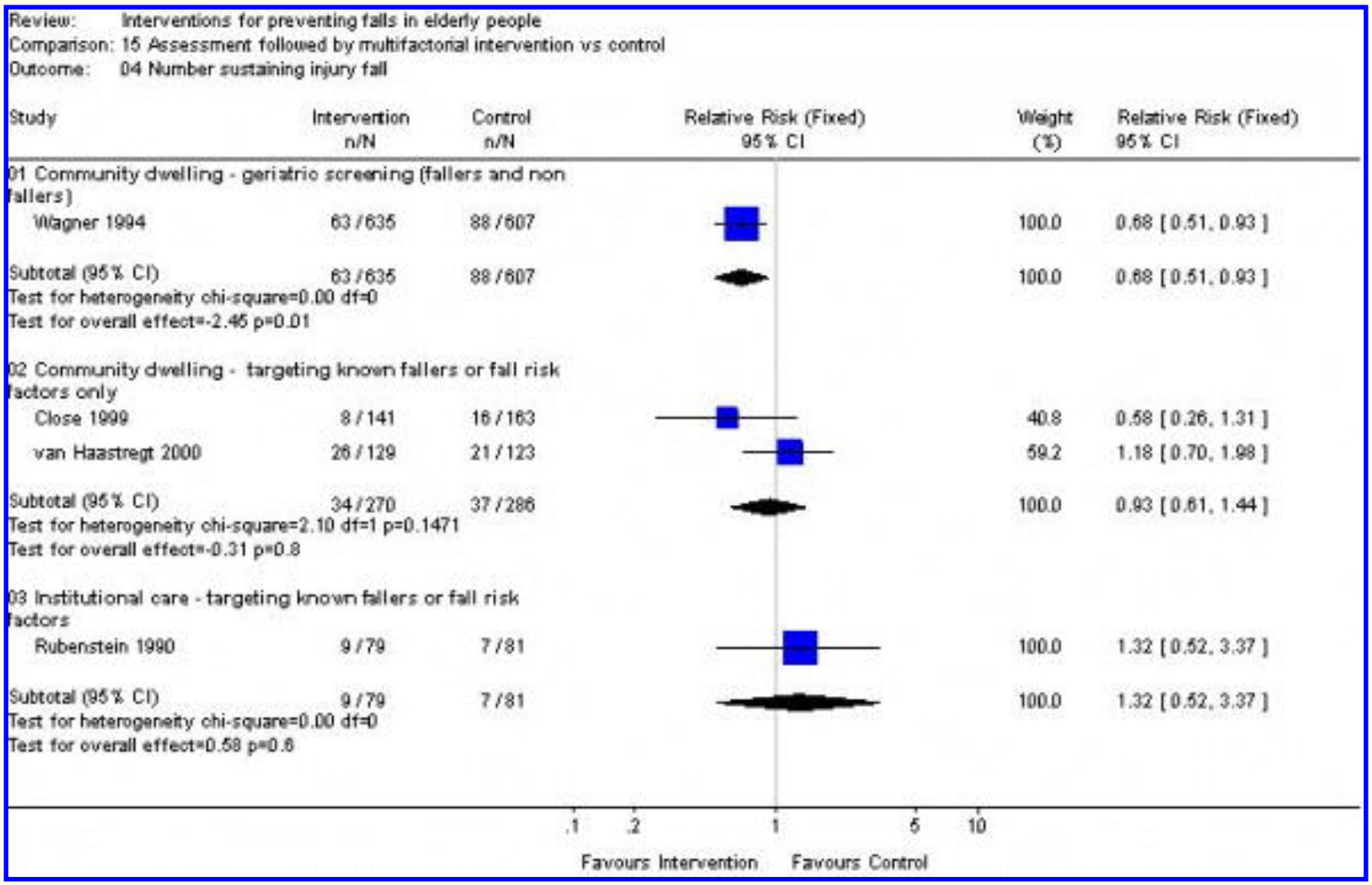
Number of participants falling



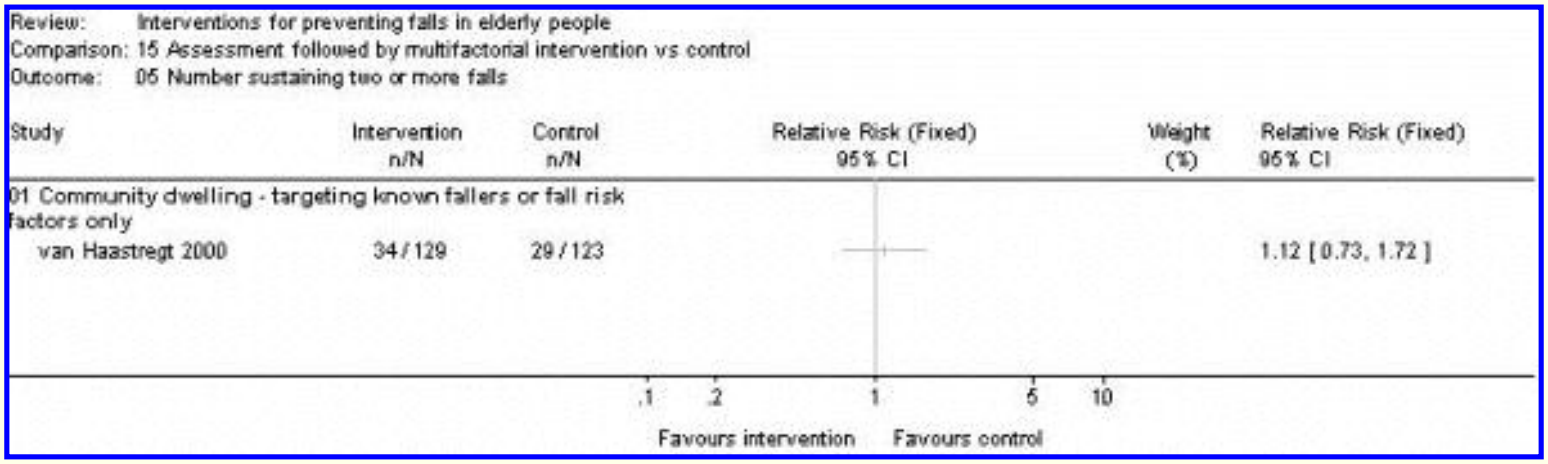
Number sustaining medical care fall



Number sustaining fracture fall



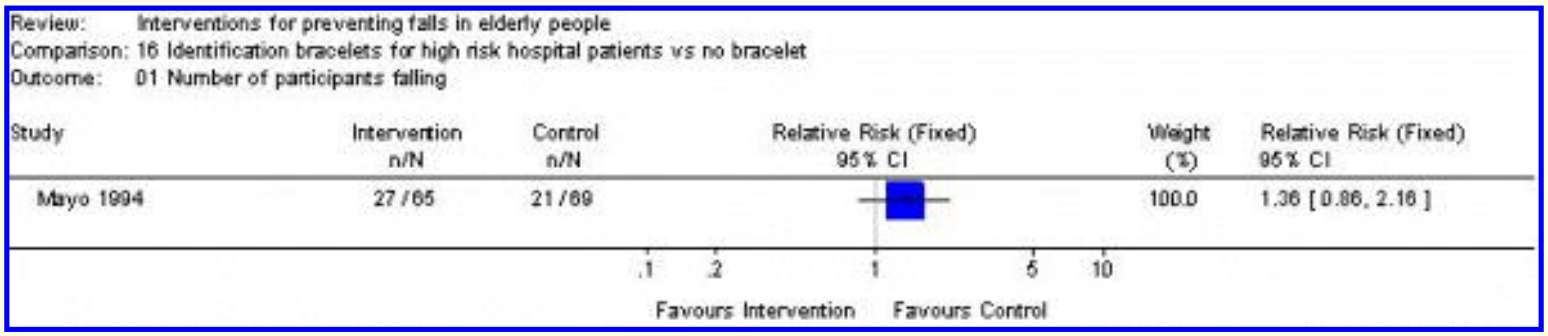
Number sustaining injury fall



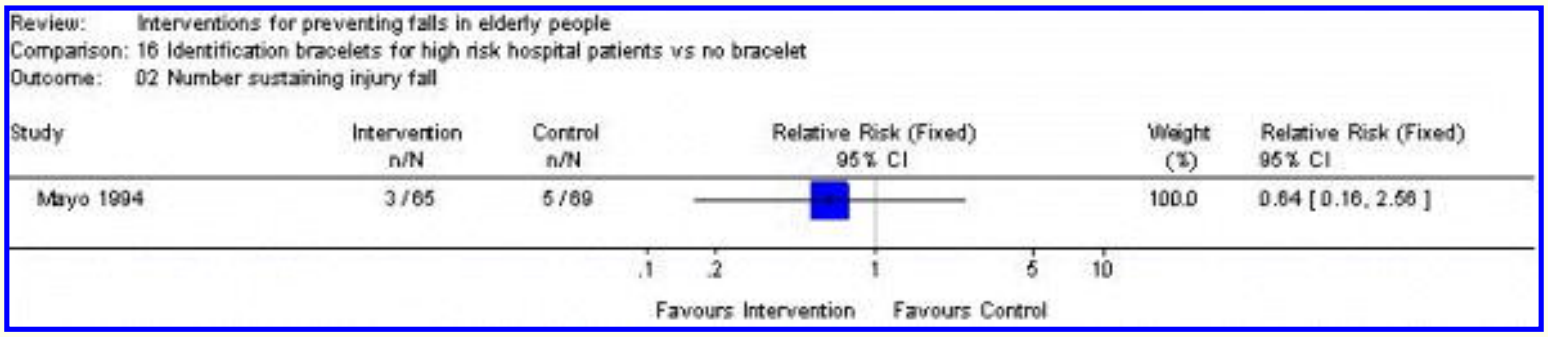
Number sustaining two or more falls

Table of comparisons

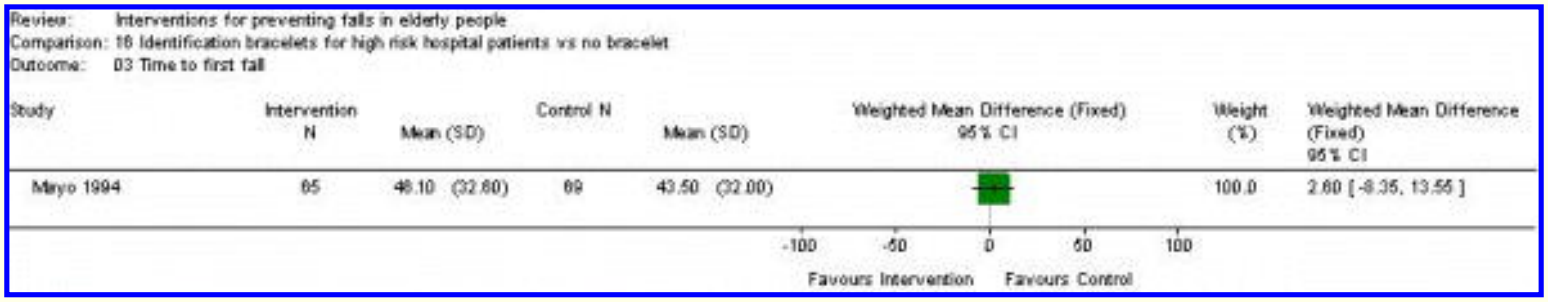
Fig 16 Identification bracelets for high risk hospital patients vs no bracelet



Number of participants falling



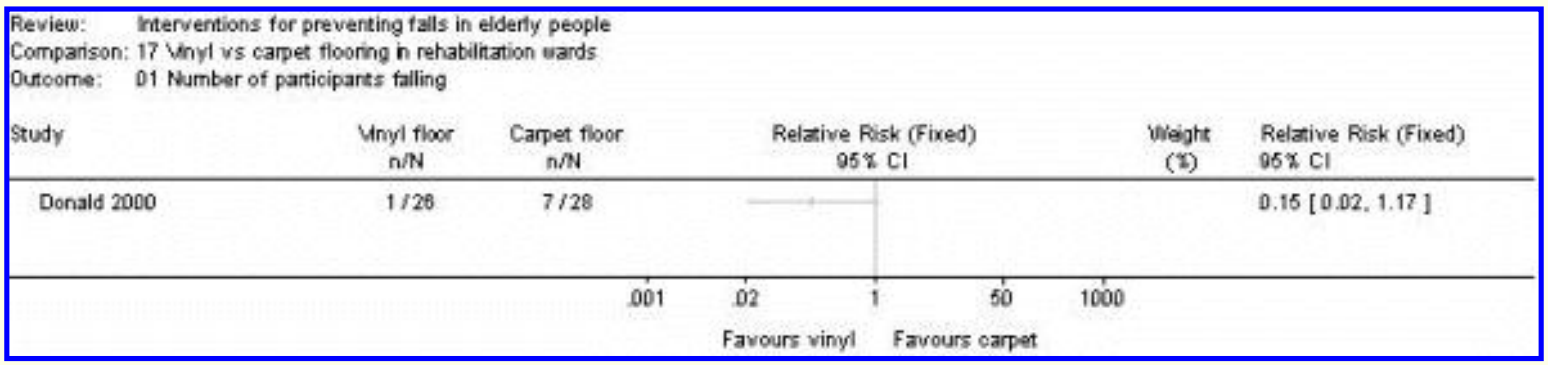
Number sustaining injury fall



Time to first fall

Table of comparisons

Fig 17 Vinyl vs carpet flooring in rehabilitation wards



Number of participants falling

Characteristics of included studies

Study: Armstrong 1996

Methods: Randomised controlled trial.

Randomised by phone using 'computer generated pseudo-random numbers'. Blocked, stratified randomisation.

Partial blinding.Losses: 8 of 116 (7%). Analysis by intention to treat.

Participants: Setting: community, United Kingdom.

N=116.

Sample: post menopausal women recruited following a distal forearm fracture treated at hospital.

Age: mean (SD) 60.9 (5.8) years.

Inclusion criteria: white (North European) ethnic origin.

Exclusion criteria: history of breast or endometrial cancer, otosclerosis, known liver disease, uncontrolled cardiac failure of hypertension, Rotor or Dubin-Johnson syndrome; inability to collaborate with handgrip strength and balance assessments; history of balance disorders; severe anaemia, angina, or chronic obstructive airways disease; current or recent therapy with HRT, corticosteroids anti-epileptic drugs; chronic alcoholism; hyperparathyroidism.

Interventions: a. HRT (Prempak C 0.625 mg or Premarin 0.625 mg) and calcium (Sandocal 1000 mg).

b. Control: Calcium (Sandocal 1000 mg). For part of the study, an HRT placebo was also given to this group.

Outcomes: Length of follow-up 48 weeks. Falls data collected at 12 weekly intervals.

1. Number of participants falling during the study.

Notes:

Allocation concealment: A

Study: Becker 2003

Methods: Randomised controlled trial. Cluster randomised by city government official using sealed envelopes.

Losses: none reported.

Intention to treat analysis.

Participants: Setting: nursing homes, Germany.

N=981

Sample: men and women requiring long term care in 6 nursing homes.

Age: mean (SD) intervention group 83.5 (7.5), control group 84.3 (6.9) years.

Inclusion criteria: all levels of mobility and cognitive status included.

Exclusion criteria: if admitted for post hospital care, geriatric rehabilitation or palliative care.

Interventions: a. Staff training (60 minute course and written information on falls and fall prevention) and monthly feedback (fallers, fall rates, severe injuries). Could discuss problems with study nurse in person or by telephone; environmental adaptations (76 items e.g. lighting, chair and bed heights, floor surfaces, clutter, grab bars for toilets and bathrooms, proper use of walking aids).

Hip protectors (Safety Pants or Safehip, patients' choice) offered to residents who could stand with or without assistance or who occasionally tried to rise from a chair unattended (5 protectors per subject, to be worn from arising until going to bed).

In addition residents could choose any combination of the following, for any length of time: written information on fall prevention; personal fall consultation if not bed or chair-bound introducing idea of 2 months exercise and use of hip protectors; group exercise programme (balance and progressive resistance exercises using ankle weights and dumbbells, 75 minutes 2 x per week).

Outcomes: Length of follow-up 365 days from a specified date.

Falls and fall sheets completed daily by nursing staff and supervised regularly by study nurse.

1. Number of participants falling

2. Number with 2 or more falls

3. Fall rate per 1000 person years

4. Time to first fall

5. Number of hip fractures

6. Number of non hip fractures

Notes:

Allocation concealment: A

Study: Bischoff 2003

Methods: Randomised controlled trial. Double blind. Randomised by an independent statistician in groups of four.

Losses: 33 of 122 (27%)

Intention to treat analysis.

Participants: Setting: long stay geriatric care units in two acute hospitals, Switzerland.

N=122

Sample: elderly institutionalised women waiting placement in nursing homes.

Age: mean 85 years.

Inclusion criteria: aged 60 and over, able to walk 3 m with or without a walking aid.

Exclusion criteria: primary hyperparathyroidism, hypocalcaemia, hypercalciuria, renal insufficiency, previous treatment with HRT, calcitonin, fluoride or bisphosphonates in previous 24 months, or fracture or stroke in the previous 3 months.

Interventions: a. Vitamin D plus calcium carbonate (400 IU cholecalciferol per tablet), for 12 weeks.

b. Control: two tablets of 600 mg calcium carbonate per tablet.

Tablets looked identical in both groups. Administered twice a day with breakfast and dinner.

Outcomes: Length of follow-up 12 weeks (duration of intervention) or until discharged to nursing home. Falls recorded by staff using a falls protocol (date, time, circumstances, injuries).

1. Number of participants falling

2. Number of falls

Also measured but not considered in this review were multiple serum biochemical values, overall musculoskeletal function using a summed score on various measures e.g. strength, timed up & go test.

Notes:

Allocation concealment: B

Study: Buchner 1997a

Methods: Randomised controlled trial.

Randomised by 'variation of randomly permuted blocks'.

Randomised to 7 groups: 6 intervention groups (3 FICSIT, 3 MoveIT), and 1 control group.

Only FICSIT and control groups reported in this paper.

Losses: 15 of 105 (14%) (14 from intervention groups).

Intention to treat analysis.

Participants: Setting: community, Seattle, USA.

N=105

Sample: HMO members (FICSIT intervention groups only).

Age: mean 75 years.

Inclusion criteria: aged between 68 and 85 years;

unable to do 8 step tandem gait test without errors; below 50 th percentile in knee extensor strength for height and weight.

Exclusion criteria: active cardiovascular, pulmonary, vestibular, and bone disease; positive cardiac stress test; body weight >180% ideal; major psychiatric illness; active metabolic disease; chronic anaemia; amputation; chronic neurological or muscle disease; inability to walk; dependency in eating, dressing, transfer or bathing; terminal illness; inability to speak English or complete written forms.

Interventions: Supervised exercise classes 1 hour x 3 per week for 24-26 weeks followed by unsupervised exercise.

a. Six months endurance training (ET) (stationary cycles) with arms and legs propelling wheel

b. Six months strength training (ST) classes (using weight machines for resistance exercises for upper and lower body)

c. Six months ST plus ET

d. Control: usual activity levels but 'allowed to exercise after 6 months'.

Exercise sessions started with a 10 to 15 minute warm-up and ended with a 5 to 10 minute cool down.

Outcomes: Length of follow-up: variable, from randomisation to the end of study funding (0-25 months, median 18 months). Fall outcomes reported for any exercise (all 3 groups combined) compared with control group (states 'a priori decision').

Falls reported immediately by mail, also monthly postcard return; telephone follow-up if no postcard received.

1. Number of fallers at 1 year

2. Time to first fall

3. Number of falls per person

Notes: Seattle FICSIT trial [Province 1995]

Only 1.3% of original sample randomised.

Falls not primary outcome.

Other outcomes assessed at end of intervention (6 months) then "control group allowed to exercise after 6 months". 7 of 30 subjects did.

Allocation concealment: B

Study: Campbell 1997

Methods: Randomised controlled trial.

Allocation schedule developed using computer generated numbers. Assignment by independent person off site.

Losses: 20 of 233 (9%).

Intention to treat analysis.

Participants: Setting: community, Dunedin, New Zealand.

N=233

Sample: women identified from general practice registers.

Age: mean (SD) 84.1 (3.1) years

Inclusion criteria: at least 80 years old; community living.

Exclusion criteria: cognitive impairment; not ambulatory in own residence; already receiving physiotherapy.

Interventions: Baseline health and physical assessment for both groups.

a. 1 hour visits by physiotherapist x 4 in first two months to prescribe home based individualised exercise and walking programme.

Exercise 30 minutes x 3 per week plus walk outside home x 3 per week. Encouraged to continue for 1 year.

Regular phone contact to maintain motivation after first 2 months.

b. Control: social visit by research nurse x 4 in first two months. Regular phone contact.

Outcomes: Length of follow-up: 12 months and 24 months.

Falls recorded daily on postcard calendars, mail registration monthly by postcard, telephone follow-up.

1. Number of participants falling at 1 year and 2 years

2. Number with injury fall at 1 and 2 years

3. Number with 2 or more falls

4. Mean rate of falls (falls/per year)

5. Fall rate per 100 person years

6. Number complying with intervention

7. Deaths

Notes: Otago Exercise Programme manual can be ordered from http://www.acc.co.nz/injury-prevention

Allocation concealment: A

Study: Campbell 1999

Methods: Randomised controlled trial, 2 by 2 factorial design. Allocation schedule developed using computer generated numbers. Assignment by independent person off site.

Losses: 21 of 93 (23%).

Intention to treat analysis.

Participants: Setting: community. Dunedin, New Zealand.

N=93

Sample: men (N=22) and women (N=77) identified from general practice registers.

Age: mean (SD) 74.7 (7.2) years

Inclusion criteria: at least 65 years old; currently taking a benzodiazepine, any other hypnotic, or any antidepressant or major tranquillizer; ambulatory in own residence; not receiving physiotherapy; thought by GP to benefit from psychotropic medication withdrawal.

Exclusion criteria: cognitive impairment.

Interventions: Baseline assessment.

a. Gradual withdrawal of psychotropic medication over 14 week period plus home based exercise programme.

b. Psychotropic medication withdrawal with no exercise programme

c. No change in psychotropic medication plus exercise programme

d. No change in psychotropic medication, no exercise programme.

Exercise programme: 1 hour physiotherapist visits x 4 in first two months to prescribe home based individualised exercises (muscle strengthening and balance retraining exercises 30 min x 3 per week) and walking x 2 per week.

Regular phone contact to maintain motivation.

Study capsules created by grinding tablets and packing into gelatin capsules. Capsules containing inert and active ingredients looked and tasted the same.

Outcomes: Length of follow-up: 44 weeks. Falls recorded daily on postcard calendars, mail registration monthly by postcard, telephone follow-up.

1. Number of participants falling

2. Number sustaining medical care fall

3. Number sustaining fracture fall

4. Number sustaining injury fall

5. Number sustaining 2 or more falls

6. Number sustaining 1 or more falls indoors

7. Fall rate per 100 person years

8. Number sustaining an adverse effect

9. Number who complied with intervention

Notes: Only 19% randomised.

Psychotropic medications recorded one month after completion of study.

Eight of the 17 who had taken the placebo for 30 weeks had restarted one month after end of study.

Otago Exercise Programme manual can be ordered from http://www.acc.co.nz/injury-prevention

Allocation concealment: A

Study: Carpenter 1990

Methods: Prospective randomised controlled trial.

Women randomised by random number tables and husbands allocated to same group.

Losses: 172 of 539 (32%).

Analysis by intention to treat.

Participants: Setting: community, Andover, United Kingdom.

N=539

Sample: women (N=351) and men (N=188) recruited from patient lists of two general medical practices. The sample represents 89.5% of those in the age group in the participating practices.

Age: 75 years or over. 23 men and 49 women were over 85 years.

Inclusion criteria: aged 75 years and over; living in Andover area.

Exclusion criteria: living in residential care.

Interventions: a. Visit by trained volunteers for dependency surveillance using Winchester disability rating scale. The intervention was stratified by degree of disability on the entry evaluation. For those with no disability, the visit was every six months; for those with disability, three months. Scores compared with previous assessment and referral to GP if score increased by 5 or more.

b. Control: no disability surveillance between initial and final evaluation.

Outcomes: Measured at 3 years

1. Total number of falls in each group in the month before the final interview.

Also measured but not considered in this review: number of participants admitted to institutions during the study period; mean (SD) length of stay in institutions; number of participants admitted to institution for more than 6 months; death during the study period.

Notes:

Allocation concealment: B

Study: Carter 1997

Methods: Randomised controlled trial.

Losses: 200 of 658 (30%).

Analysis by intention to treat not possible.

Participants: Setting: community, Hunter Valley, Australia.

N=658

Sample: men and women identified by 37 general practitioners as meeting inclusion criteria.

Age: 70 or older.

Inclusion criteria: aged 70 years or older; able to speak and understand English; living independently at home, in a hostel, or in a retirement village.

Exclusion criteria: psychiatric disturbance affecting comprehension of the aims of the study.

Interventions: a. Brief feedback on home safety plus pamphlets on home safety and medication use (low intensity intervention).

b. Action plan for home safety plus medication review (high intensity intervention).

c. Control: no intervention during study period but intervention after the end of the study period.

Outcomes: Length of follow-up 1 year.

1. Number sustaining a fall with or without injury.

2. Number sustaining a fall resulting in injury.

3. Number sustaining a fall resulting in medical treatment.

4. Number sustaining another event resulting in injury or medical treatment.

Notes: Unpublished study.

Allocation concealment: A

Study: Carter 2002

Methods: Randomised controlled trial. Randomised by computer generated programme.

Losses: 13 of 93 (14%)

Intention to treat not possible.

Participants: Setting: community, Vancouver, Canada.

N=93

Subjects: community dwelling osteoporotic women.

Inclusion criteria: aged 65 to 75 years; residents of greater Vancouver; osteoporotic (based on BMD).

Exclusion criteria:< 5 years post menopause; weighed > 130% ideal body weight; other contraindications to exercising; already doing > 8 hours/week moderate to hard exercise; planning to be out of city > 4 weeks during 20 week programme.

Interventions: a. Exercise class (Osteofit) for 40 minutes, 2 x per week, for 20 weeks in community centres. Classes of 12 per instructor.

8 to 16 strengthening and stretching exercises using Theraband elastic bands and small free weights. Bimonthly social seminar.

Control: usual routine activities and bimonthly social seminar separate from intervention group.

Outcomes: Length of follow-up 20 weeks (duration of intervention).

Falls recorded in falls calendars returned monthly.

1. Number of falls.

Also measured but not included in this review: static and dynamic balance and quadriceps strength.

Notes:

Allocation concealment: B

Study: Cerny 1998

Methods: Randomised controlled trial. Randomised by coin toss but some clusters e.g. couples or two ladies dependent on another for transport.

Losses: none described

Intention to treat analysis not possible.

Participants: Setting: community, California, USA.

N=28

Sample: community dwelling well-elderly.

Age: mean (SD) 71 (4) years.

Inclusion criteria: none described.

Exclusion criteria: none described.

Interventions: a. Exercise programme of progressive resistance, stretching, aerobic and balance exercises and brisk walking over various terrains for 1 and a half hours, 3 x weekly, for 6 months.

b. Control: no intervention.

Outcomes: Follow-up at 3 months and 6 months

1. Number of participants falling.

Notes: Other outcomes analysed as pre-post intervention: strength, range of motion, balance and gait.

Allocation concealment: B

Study: Close 1999

Methods: Randomised controlled trial.

Randomised by random numbers table and list held independently of the investigators.

Losses: 93 of 397 (23%)

Intention to treat analysis not possible

Participants: Setting: community, London, United Kingdom.

N=397

Sample: community dwelling individuals presenting at A&E after a fall. Admitted patients not recruited until discharge.

Age: mean (SD) 78.2 (7.5) years

Inclusion criteria: aged at least 65 years; history of falling.

Exclusion criteria: cognitive impairment (AMT <7) and no regular carer (for informed consent reasons); speaking little or no English; not living locally.

Interventions: a. Medical and occupational therapy assessments and interventions.

Medical assessment to identify primary cause of fall and other risk factors present (general examination and visual acuity, balance, cognition, affect, medications). Intervention and referral as required. Home visit by occupational therapist (functional assessment and environmental hazards). Advice, equipment and referrals as required.

b. Control: usual care only

Outcomes: Follow-up every 4 months for 1 year. Falls diary

1. Number of participants falling

2. Number with injury fall

3. Number sustaining 3 or more falls

4. Number of falls

Also measured but not considered in this review: doctor and hospital visits, and admissions; function.

Notes:

Allocation concealment: B

Study: Coleman 1999

Methods: Randomised controlled trial. Cluster randomisation by physician practice.

Losses: 56 of 169 (33%)

Intention to treat analysis.

Participants: Setting: HMO members, Washington, USA.

N=169

Sample: community dwelling men and women in 9 physician practices in an ambulatory clinic.

Age: mean 77 years.

Inclusion criteria: at least 65 years old; high risk of being hospitalised or of developing functional decline; community dwelling

Exclusion criteria: living in nursing home; terminal illness; moderate to severe dementia or "too ill" (physician's judgment)

Interventions: a. Half-day Chronic Care Clinics every 3-4 months in 5 practices focusing on planning chronic disease management (physician and nurse); reducing polypharmacy and high risk medications (pharmacist); patient self management/support group.

b. Control: usual care (4 practices)

Outcomes: Follow-up 24 months. Falls recorded retrospectively by questionnaire at 12 and 24 months.

1. Percentage of participants falling

Notes:

Allocation concealment: C

Study: Cornillon 2002

Methods: Randomised controlled trial.

Randomised by random number tables.

Losses: 5 of 303 (1.7%)

Intention to treat analysis possible.

Participants: Setting: community, St Etienne, France.

N=303

Subjects: community dwelling and independent in ADL (83% female).

Age: mean 71 years.

Inclusion criteria: >65 years old; living at home; ADL independent; consented.

Exclusion criteria: cognitively impaired (MMSE <20); obvious disorder of walking or balance.

Interventions: a. Information on fall risk, and balance and sensory training in groups of 10-16. One session per week for 8 weeks. Session started with foot and ankle warm-up (walking on tip toe and on heels etc), walking following verbal orders, walking bare foot on different surfaces, standing on one leg with eyes open and shut, practicing getting up from the floor.

b. Control

Outcomes: Follow-up 12 months. Falls and fall related injuries recorded on 6 monthly falls calenders.

1. Number of participants falling

2. Mean number of falls (no standard deviation)

3. Mean number of medical care falls (no standard deviation).

Notes:

Allocation concealment: B

Study: Cumming 1999

Methods: Randomised controlled trial

Stratified block randomisation.

Losses: 142 of 530 (27%)

Intention to treat analysis.

Participants: Setting: community, Sydney, Australia.

N=530

Sample: community dwelling subjects recruited in hospital wards, clinics, and day care centres.

Age: mean (SD) 77 (7.2) years.

Inclusion criteria: aged at least 65 years; living in the community and within geographically defined study area.

Exclusion criteria: cognitively impaired and not living with someone who could give informed consent and report falls; if OT home visit already planned as part of usual care.

Interventions: a. One home visit by experienced occupational therapist assessing environmental hazards (standardised form) and supervision of home modifications. Telephone follow up after 2 weeks.

b. Control: usual care

Outcomes: 12 month follow up with monthly falls calendar.

1. Number of fallers (by location of fall, home or away)

2. Compliance with recommendations

Notes:

Allocation concealment: A

Study: Dawson-Hughes 1997

Methods: Randomised controlled trial.

Stratified block randomisation using random numbers tables.

Losses: 56 of 445 (13%).

Intention to treat analysis.

Participants: Setting: community, Boston, MA, USA.

N=445

Sample: men (N=199) and women (N=246) recruited by direct mailings and presentations (sample frame not given).

Age: mean age 71 years

Inclusion criteria: aged 65 years and over.

Exclusion criteria: current cancer or hyperparathyroidism; a kidney stone in last 5 years; renal disease; bilateral hip surgery; therapy with a bisphosphonate, calcitonin, oestrogen, tamoxifen, or testosterone in past 6 months, or fluoride in past 2 years; femoral neck bone mineral density more than 2 SD below the mean for subjects of the same age and sex; dietary calcium intake exceeding 1500 mg per day; laboratory evidence of kidney disease.

Interventions: a. Calcium citrate malate (500 mg elemental calcium) and cholecalciferol (700 IU vitamin D) orally, daily at bedtime for 3 years

b. Control: double placebo tablets

Outcomes: Length of follow-up 3 years. Postcard sent in after any fall. Telephone call to verify circumstances. Subjects reported any additional falls at 6 monthly follow-up visit. Non vertebral fractures reported at 6 monthly follow-up visit and verified by review of Xray reports or hospital records.

1. Number of participants falling during study

2. Number of falls per subject

3. Fall related non-vertebral fractures

Also measured at 6 month intervals, but not considered in this review, were bone mineral density, biochemical assays, and other measures.

Notes:

Allocation concealment: B

Study: Day 2002

Methods: Randomised controlled trial. Factorial design.

Randomised by "adaptive biased coin" technique, to ensure balanced group numbers (computer generated by an independent third party by telephone).

Losses: 17 of 1107 (1.5%).

Intention to treat analysis.

Participants: Setting: community, Melbourne, Australia.

N=1107

Sample: community dwelling men and women identified from electoral roll (59.8% female).

Age: mean (SD) 76.1 (5.0)

Inclusion criteria: living in own home or apartment or leasing similar accommodation and able to make modifications; aged 70 and over.

Exclusion criteria: if not expected to remain in area for 2 years (except for short absences); had participated in regular to moderate physical activity with a balance component in previous 2 months; unable to walk 10-20 m without rest or help or having angina; had severe respiratory or cardiac disease; had a psychiatric illness prohibiting participation; had dysphasia; had recent major home modifications; had an education and language adjusted score >4 on the short portable mental status questionnaire; or did not have approval of their general practitioner.

Interventions: a. Exercise: weekly class of 1 hour for 15 weeks plus daily home exercises. Designed by physiotherapist to improve flexibility, leg strength and balance (or less demanding routine depending on subject's capability).

b. Home hazard management: hazards removed or modified by participants or City of Whitehorse's home maintenance programme. Staff visited home, provided quote for work including free labour and materials up to $A 100.

c. Vision improvement: assessed at baseline using dual visual acuity chart. Referred to usual eye care provider, general practitioner or local optometrist if not already receiving treatment for identified impairment.

d. a+b

e. a+c

f. c+b

g. a+b+c

h. No intervention. Received brochure on eye care for over 40 year olds.

Outcomes: Length of follow-up 18 months.

Falls reported using monthly postcard to record daily falls. Telephone follow-up if calendar not returned within 5 working days of the end of each month, or reporting a fall.

1. Time to first fall

2. Number of fallers

Notes:

Allocation concealment: A

Study: Donald 2000

Methods: Randomised controlled trial, 2 by 2 factorial design. Stratified by fall risk and randomised by "randomized envelopes".

Losses: 9 of 54 (17%)

Intention to treat analysis.

Participants: Setting: hospital, Gloucester, UK.

N=54

Sample: individuals admitted to one elderly care rehabilitation ward over an 8 month period, 81% female.

Age: mean 82.9 years.

Inclusion criteria: elderly patients referred for rehabilitation.

Exclusion criteria: none.

Interventions: a. Assigned to ward area with vinyl floor covering and conventional physiotherapy (functional based physiotherapy, once or twice daily).

b. As above (a) plus seated leg strengthening exercises (hip flexors and ankle dorsiflexors).

c. Assigned to ward area with carpet and conventional physiotherapy.

d. As above (c) plus seated leg strengthening exercises (hip flexors and ankle dorsiflexors).

Outcomes: Length of follow-up: variable depending on length of hospital admission.

1. Number of participants falling during admission

2. Number of fracture falls.

Also measured at admission and discharge, but not considered for this review: Barthel scores, hip and ankle strength, timed walk and functional reach test.

Notes:

Allocation concealment: B

Study: Ebrahim 1997

Methods: Randomised controlled trial.

Randomly assigned using prepared envelopes containing computer generated allocation.

Losses: 68 of 165 (41%).

Intention to treat analysis not possible.

Participants: Setting: UK

N=165

Sample: post menopausal women identified from A&E and orthopaedic fracture clinic records.

Inclusion criteria: fractured upper limb in last 2 years

Exclusion criteria: on bisphosphonates for osteoporosis; life expectancy <1 year; cognitive impairment; too frail for brisk walking or to travel for measurements

Interventions: a. Initial advice on general health/diet. Encouraged to build up to brisk walking 40 minutes x 3 per week.

b. Control: initial advice on general health/diet. Upper limb exercises to improve post-fracture function.

Outcomes: Length of follow-up 2 years. Results reported for 1 and 2 year follow-up.

Falls monitored by monthly telephone calls.

1. Number of participants falling

2. Total number of falls

3. Number sustaining fracture fall

Also measured, but not considered in this review were bone mineral density, vertebral fractures, physical capacity.

Notes:

Allocation concealment: A

Study: Fabacher 1994

Methods: Randomised controlled trial.

Randomised with randomly generated assignment cards in sealed envelopes.

Losses: 59 of 254 (23%).

Intention to treat analysis not possible.

Participants: Setting: community, California, USA.

N=254

Sample: men (N=248) and women (N=6) aged over 70 years and eligible for veterans medical care. Identified from voter registration lists and membership lists of service organisations.

Age: mean 73 years

Inclusion criteria: aged 70 years and over; not receiving health care at Veterans Administration Medical Centre.

Exclusion criteria: known terminal disease, dementia.

Interventions: a. Home visit by health professional to screen for medical, functional, and psychosocial problems, followed by a letter for participants to show to their personal physician. Targeted recommendations for individual disease states, preventive health practices.

b. Control: follow-up telephone calls for outcome data only.

Outcomes: Measured at 4 monthly intervals for one year, by structured interview for active arm and by telephone for controls.

1. Number of individuals falling.

Notes:

Allocation concealment: A

Study: Fiatarone 1997

Methods: Randomised controlled trial. Method of randomisation not described.

Losses: 4 of 34 (11%)

No intention to treat analysis.

Participants: Setting: community, USA

N=34

Sample: frail older people (94% female).

Age: mean 82

Inclusion criteria: community dwelling older people; moderate to severe functional impairment

Exclusion criteria: none given.

Interventions: a High intensity progressive resistance training exercises in own home. Two weeks of instruction and then weekly phone calls. 11 different upper and lower limb exercises with arm and leg weights, 3 days per week for 16 weeks.

b. Control: wait list control. Weekly phone calls.

Outcomes: Length of follow-up 16 weeks (duration of intervention).

Falls identified weekly by phone (assumed).

1. Falls

Also measured, but not considered in this review: strength, gait velocity, self-reported activity level, Attitude towards Ageing on the PGC Morale Scale, bed days, health care visits.

Notes:

Allocation concealment: B

Study: Gallagher 1996

Methods: Randomised controlled trial.

Method of randomisation not described.

Observers unblinded at 6 months.

Losses: none described.

Intention to treat analysis not possible

Participants: Setting: community, Victoria, British Columbia, Canada.

N=100

Sample: men (N=20) and women (N=80) community dwelling volunteers

Age: mean 73.8 years (control group); 75.4 years (intervention group).

Inclusion criteria: aged 60 years or over; sustained a fall in previous 3 months.

Exclusion criteria: none described.

Interventions: a. Two risk assessment interviews of 45 minutes each. One counseling interview of 60 minutes showing video and booklet and results of risk assessment.

b. Control: baseline interview and follow-up only. No intervention.

Outcomes: Length of follow-up 6 months. Calendar postcards completed and returned every two weeks for six months. Telephone follow up of reported falls.

1. Mean number of falls per group

Also measured, but not considered in this review were fear of falling, self-efficacy, social function, health services use, and quality of life.

Notes:

Allocation concealment: B

Study: Gray-Donald 1995

Methods: Randomised controlled trial.

Method of randomisation not described. Stratified by gender and nutritional risk criteria.

Losses: 4 of 50 (8%)

Intention to treat analysis.

Participants: Setting: community, Quebec, Canada.

N=50

Subjects: men and women recruited from those receiving long term home help services.

Age: mean (SD) 77.5 (8) years.

Inclusion criteria: aged over 60 years; requiring community services; elevated risk of undernutrition (excessive weight loss or BMI <24 kg/m2).

Exclusion criteria: alcoholic; terminal illness.

Interventions: a. 12 week intervention of high energy nutrient dense supplements provided by dietitian. Two 235 ml cans per day (1045-1480 kj per can) for 12 weeks.

b. Control: visits only (encouragement and suggestions about improving diets).

Outcomes: Retrospectively monitored at 6 and 12 weeks.

1. Number of participants falling

Notes:

Allocation concealment: B

Study: Hogan 2001

Methods: Randomised controlled trial. Computer generated sequence concealed in locked cabinet prior to randomisation. Stratified by number of falls in previous year: 1 or >1.

Losses: 24 of 163 (15%)

Intention to treat analysis.

Participants: Setting: community, Calgary, Canada.

N=163

Sample: high risk community dwelling men and women (71% women)

Age: mean (SD) 77.6 (6.8)

Inclusion criteria: fall in previous 3 months; living in the community; age 65 years and over; ambulatory (with or without aid); mentally intact (able to give consent).

Exclusion criteria: qualifying fall resulted in lower extremity fracture, resulted from vigorous or high-risk activities, because of syncope or acute stroke, or while undergoing active treatment in hospital.

Interventions: a. One in-home assessment by a geriatric specialist (doctor, nurse, physiotherapist or OT) lasting 1-2 hours. Intrinsic and environmental risk factors assessed. Multidisciplinary case conference (20 minute). Recommendations sent to patients and patients' doctor for implementation. Subjects referred to exercise class if problems with balance or gait and not already attending an exercise programme. Given instructions about exercises to do at home.

b. Control: One home visit by recreational therapist.

Outcomes: Length of follow-up: 12 months. Falls recorded on monthly calenders (47.8% returned). Also retrospective recall at 3, 6 months (at visit) and 12 months (by phone).

1. Number of participants falling

2. Number sustaining medical care fall

3. Number sustaining injury fall

4. Number sustaining 3 or more falls

5. Time to first fall

6. Mean number of falls per participant (SD)

7. Mean number of injurious falls

8. Number who complied with treatment

9. Death

Notes:

Allocation concealment: A

Study: Hornbrook 1994

Methods: Cluster randomised controlled trial.

Losses: 156 of 3182 (5%) in the intervention group.

Intention to treat analysis not possible.

Participants: Setting: community, USA.

N=3182

Sample: independently living members of HMO, men (N=1971) and women (N=1211), recruited by mail.

Age: mean (SD) 73 (6) years.

Inclusion criteria: over 65 years; ambulatory; living within 20 miles of investigation site; consenting.

Exclusion criteria: blind; deaf; institutionalised; housebound; non-English speaking; severely mentally ill; terminally ill; unwilling to travel to research centre.

Interventions: a. Home visit, safety inspection (prior to randomisation), hazards booklet, repair advice, fall prevention classes (environmental, behavioural, and physical risk factors), financial and technical assistance.

b. Control: home visit, safety inspection (prior to randomisation), hazards booklet.

Outcomes: Measured over 24 months, using monthly diaries, and quarterly mail/telephone contacts.

Length of follow up was not uniform. Data available for proportion with or without falls over time, and rate of falls per 1000 person years.

1. Number of participants falling.

2. Number sustaining medical care fall.

3. Number sustaining fracture fall.

4. Number sustaining injury fall.

5. Number sustaining 2 or more falls.

6. Number sustaining near fall.

7. Fall rate per 1000 person years.

8. Number complying with treatment programme.

4. Fracture falls.

5. Hospitalised falls.

Notes:

Allocation concealment: B

Study: Jensen 2002

Methods: Cluster randomised controlled trial. Nine residential care facilities divided into group A and group B based on age, number of residents, type of setting, and record of previous falls. Random allocation conducted by person with no knowledge of the study, using two sealed envelopes containing letter A or B. Before draw the first to be drawn was designated to be the intervention group.

Losses: 78 of 402 (19%)

Intention to treat analysis not possible.

Participants: Setting: institutions, Umea, Sweden.

N=9 residential care facilities, total N=402 residents at randomisation.

Age: median 83 years, range 65-100.

Subjects: Nine elderly care facilities; frail elderly people with physical or cognitive impairment, 72% female,

Inclusion criteria: Institution: more than 25 residents

Residents: age 65 and over.

Exclusion criteria: none listed.

Interventions: Multifactorial, multidisciplinary baseline assessment in all facilities: prescribed drugs, delirium, MMSE, Barthel score, mobility, hearing, vision, depression, miscellaneous diseases. Residents classed as high or low risk of falling. Environmental hazards screened using checklist.

a. Intervention for 11 weeks targeting staff and residents at high risk of falling and those at lower risk who fell during intervention period: 4 hour staff educational session, environmental hazard modification, exercises for strength, balance and to promote safe movement, provision and repair of aids, medication modification, provision of hip protectors, post fall problem solving conferences, staff guidance.

b. Control: usual care.

Outcomes: Follow-up 34 weeks. Falls registered by nurses and aides, if witnessed or reported, using structured report designed for study.

1. Number of people falling

2. Number of falls

3. Time to first fall

4. Number sustaining injury fall.

Notes:

Allocation concealment: A

Study: Jitapunkul 1998

Methods: Randomised controlled trial.

Method of randomisation not described.

Losses: 44 of 160 (28%)

Participants: Setting: community, Thailand.

N=160

Sample: community dwelling men and women recruited from a sample for a previous study.

Age: mean (SD) years 76.1 (5.9) intervention; 75.1 (5.7) control.

Inclusion criteria: at least 70 years old; living at home.

Exclusion criteria: none stated.

Interventions: a. Home visit from non health professional with structured questionnaire. 3 monthly visits for 3 years. Referred to nurse/geriatrician (community based) if Barthel ADL index and/or Chula ADL index declined 2 or more points, or subject fell more than once during previous 3 months. Nurse/ geriatrician would visit, assess, educate, prescribe drugs/aids, provide rehabilitation programme, make referrals to social services, and other agencies.

b. Control: no intervention. Visit at the end of 3 years

Outcomes: Measured at the end of 3 years. Falls during last 3 months only.

1. Number of participants falling

Notes:

Allocation concealment: B

Study: Kenny 2001

Methods: Randomised controlled trial.

Randomised in blocks of eight, method of randomisation not described.

Losses: 16 of 175 (9%)

Intention to treat analysis not possible

Participants: Setting: Cardiovascular Investigation Unit, UK.

N=175

Subjects: individuals presenting at A&E with non-accidental fall (60% female).

Age: mean (SD) 73 (10)

Inclusion criteria: aged 50 years and over, history of a fall, diagnosed as having cardioinhibitory CSH by carotid sinus massage.

Exclusion criteria: cognitive impairment, medical explanation of fall within 10 days of presentation, an accidental fall, blind, lived >15 miles from A&E, had contraindication to CSM, receiving medications known to cause a hypersensitive response to CSM.

Interventions: a. Pacemaker (rate drop response physiologic dual-chamber pacemaker: Thera RDR, Medtronic, Minneapolis, Minnesota).

b. Control: no pacemaker

Outcomes: Follow-up 1 year after randomisation.

1. Number of falls

2. Number of injurious falls

Also measured but not considered in this review were number of episodes of syncope.

Notes: Out of 71,299 A&E attendees screened, 1624 received carotid sinus massage and 175 agreed to be randomised

Allocation concealment: B

Study: Kingston 2001

Methods: Randomised controlled trial. Method of randomisation not described.

Losses: 17 of 109 (16%)

Intention to treat analysis not possible

Participants: Setting: A&E, Staffordshire, UK.

N=109

Age: mean 71.9 years

Subjects: community dwelling women attending A&E with a fall.

Inclusion criteria: female, aged 65-79, history of a fall, discharged directly to own home.

Exclusion criteria: male, admitted from A&E to hospital or any form of institutional care.

Interventions: a. Rapid Health Visitor intervention within 5 working days of index fall: pain control and medication, how to get up after a fall, education about risk factors (environmental and drugs, alcohol etc), advice on diet and exercise to strengthen muscles and joints. Also care managed on individual basis for 12 months post index fall.

b. Control: usual post fall treatment i.e. letter to GP from A&E detailing the clinical event, any interventions carried out in hospital and recommendations about follow-up.

Outcomes: Follow-up 12 weeks. No description of how falls monitored, presumably retrospective at day 4 and week 12.

1. Number of participants falling

Also measured but not considered for this review, SF36 assessment at day 4 and 12 weeks.

Notes:

Allocation concealment: B

Study: Latham 2003

Methods: Randomised controlled trial.

Factorial design. Stratified block randomisation; six per block. Randomised to one of four treatment arms in block using a computerised central randomisation scheme. Biostatistician generated the randomisation sequence.

Losses: 43 of 243 (17%)

Intention to treat analysis.

Participants: Setting: Five hospitals in Auckland, New Zealand and Sydney, Australia.

N=243

Subjects: frail older people recently discharged from hospital.

Age: mean 79 years.

Inclusion criteria: considered frail (one or more health problems e.g. dependency in an ADL, prolonged bed rest, impaired mobility, or a recent fall); no clear indication or contraindication to either of the study treatments.

Exclusion criteria: poor prognosis and unlikely to survive 6 months; severe cognitive impairment; physical limitations that would limit adherence to exercise programme; unstable cardiac status; large ulcers around ankles that would preclude use of ankle weights; living outside hospitals' geographical zone; not fluent in English.

Interventions: a. Exercise: quadriceps exercises using adjustable ankle cuff weights 3 x per week for 10 weeks. First 2 sessions in hospital, remainder at home. Monitored weekly by physiotherapist: alternating home visit with telephone calls.

b. Exercise control: frequency matched telephone calls and home visits from research physical therapist including general enquiry about recovery, general advice on problems, support.

c. Vitamin D: single oral dose of six 1.25 mg calciferol (300,000 IU).

d. Vitamin D control: placebo tablets.

Outcomes: Follow-up 6 months.

Falls recorded in fall diary with weekly reminders for first 10 weeks. Nurses examined fall diaries and sought further details about each fall at 3 and 6 month visits. Reminder phone call between visits.

1. Number of participants falling

2. Number of falls

3. Fall rate in person years

4. Time to first fall

5. Adverse events

Also measured but not considered for this review, self assessed health (physical component score of SF36), Barthel index, Falls self efficacy scale, Adelaide activities profile, quadriceps strength, timed walking test, timed up&go test, Berg balance test.

Notes: Detailed description of exercise regimen given in paper.

Allocation concealment: A

Study: Lightbody 2002

Methods: Randomised controlled trial.

Method of randomisation not described. "block-randomised consecutively into groups".

Losses: 34 of 348 (10%).

Intention to treat analysis not possible.

Participants: Setting: hospital, Liverpool, UK.

N=348

Subjects: consecutive patients attending A&E with a fall (74.4% women).

Age: median (IQR) 75 (70-81).

Inclusion criteria: age > 65 years,

Exclusion criteria: admitted to hospital as result of index fall, living in institutional care, refused or unable to consent, lived out of the area.

Interventions: a. Multifactorial assessment by falls nurse at one home visit (medication, ECG, blood pressure, cognition, visual acuity, hearing, vestibular dysfunction, balance, mobility, feet and footwear, environmental assessment). Referral for specialist assessment or further action (relatives, community therapy services, social services, primary care team. No referrals to day hospital or hospital outpatients). Advice and education about home safety and simple modifications e.g. mat removal.

Control: usual care.

Outcomes: Length of follow-up 6 months.

Falls, injury and treatment recorded in diary. Postal questionnaire at 6 months to collect data. GP records and hospital databases searched.

1. Number of people falling

2. Number of falls

3. Number sustaining injury fall.

Notes: Assessment of risk factors: medication, ECG, blood pressure, cognition, visual acuity, hearing, vestibular dysfunction, balance, mobility, feet and footwear. Environmental assessment.

Falls reported in diary and by questionnaire different.

Allocation concealment: B

Study: Lord 1995

Methods: Randomised controlled trial. Pre-randomisation prior to consent, from a schedule of participants in a previous study.

Losses: 19 of 194 (10%), all from intervention group.

Inadequate data for intention to treat analysis.

Participants: Setting: community, Australia.

N=194

Sample: women, recruited from a schedule from a previous epidemiologic study. Fitness level not defined.

Age: range 60-85 years (mean (SD) 71.6 (5.4) years.

Inclusion criteria: living independently in the community

Exclusion criteria: unable to use English.

Interventions: a. Twice weekly exercise programme (warm-up, conditioning, stretching, relaxation) lasting 1 hour, over a 12 month period.

b. Control: no intervention.

Outcomes: Measured over 12 months. Fall ascertainment questionnaires sent out every 2 months. Telephone call if questionnaire not returned.

1. Number of participants falling.

2. Number of participants sustaining 2 or more falls.

3. Number of participants sustaining 1 or more falls indoors.

4. Number sustaining non-accidental falls.

5. Number sustaining "balance falls".

Notes:

Allocation concealment: B

Study: Mayo 1994

Methods: Randomised controlled trial. Method of randomisation not described.

Losses: none

Analysis by intention to treat.

Participants: Setting: rehabilitation hospital inpatients, Canada. N=134

Sample: men and women; falling status - high risk.

Age: mean (SD) years 70.9 (12.6) intervention, 72.9 (11.8) control.

Inclusion criteria: one or more perceived risk factors for falls or fractures. Primary: stroke, ataxia, history of multiple falls, incontinence. Secondary: aged over 80, use of topical eye preparations, anticonvulsants, vitamin supplements, anti-ulcer medications.

Exclusion criteria: none described.

Interventions: a. During hospital stay, identification bracelets worn to identify "high risk faller".

b. Control: no identification bracelet.

Outcomes: Length of follow-up variable - duration of hospital admission.

Falls recorded by incident reports.

1. Number of participants falling.

2. Number of participants sustaining injury fall.

3. Time to first fall.

Notes:

Allocation concealment: B

Study: McMurdo 1997

Methods: Randomised controlled trial. States 'randomly allocated'.

Losses: 26 of 118 (22%) over 2 years.

Intention to treat analysis not possible.

Participants: Setting: community, Dundee, United Kingdom.

N=118

Sample: community dwelling post menopausal women recruited by advertisement.

Age: mean 64.5 years (range 60-73 years).

Exclusion criteria: conditions or drug treatment likely to affect bone

Interventions: 45 minute exercise programme of weight bearing exercise to music, 3 x weekly, 30 weeks per year, over 2 years, with 1000 mg calcium carbonate daily.

b. Control: 1000 mg calcium carbonate daily.

Outcomes: Length of follow-up 2 years

1. Number of women falling

Also measured, but not considered in this review: bone mineral density

Notes:

Allocation concealment: B

Study: McMurdo 2000

Methods: Randomised controlled trial. Cluster randomisation of nine residential homes.

Losses: 49 of 133 (37%).

Intention to treat analysis not possible.

Participants: Setting: institutional care, Dundee, United Kingdom.

N=133

Sample: men and women in 9 residential homes for elderly people.

Age: mean (SD) 84.9 (6.9) years in intervention group; 83.7 (6.7) years in control group.

Inclusion criteria: aged 70 years and over; resident in participant nursing home.

Exclusion criteria: MMSE score <12

Interventions: a. Falls risk factor assessment and modification x 2 (at start and 6 months) blood pressure, medication review, visual acuity, ambient lighting levels; seated exercise sessions for balance, strength and flexibility 30 minutes x 2 weekly for 6 months.

b. Control: reminiscence sessions 30 minutes x 2 per week for 6 months.

Outcomes: Length of follow-up 1 year.

Staff recorded falls daily on a calendar from 7-12 months.

1. Number of participants falling

2. Mean number of falls (no SD)

3. Number complying with treatment

4. Falls per person week

Notes:

Allocation concealment: B

Study: Means 1996

Methods: Randomised trial nested within a pre-test post-test experimental design.

Losses: 34 of 99 (33%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, Arkanas, USA.

N=99

Sample: volunteers recruited from Veterans Administration medical centre outpatient clinics.

Age: mean (SD) 75 (5) years.

Inclusion criteria: age 65 years or over; ambulatory for at least 30 feet; community dwelling; able to comprehend instructions and give informed consent; history of 1 or more falls in previous year.

Interventions: a. Exercise programme including obstacle course training.

b. Control: exercise programme without obstacle course training.

Outcomes: Length of follow-up 6 months

1. Mean number of falls per participant in each group, with standard deviation.

Notes:

Allocation concealment: C

Study: Mulrow 1994

Methods: Randomised controlled trial. Randomisation blocked and stratified by nursing home.

Losses: 14 of 194 (7%).

Inadequate data for intention to treat analysis.

Participants: Setting: one academic nursing home and 8 community nursing homes, USA.

N=194

Sample: elderly residents dependent in at least 2 activities of daily living. Falling status on entry not

defined.

Age: mean (SD) 79 (8) years.

Inclusion criteria: age over 60 years; resident in a nursing home for at least 3 months; dependent in at least 2 activities of daily living.

Exclusion criteria: Terminal illness; severe dementia; known assaultive behaviour pattern; currently or recently having physiotherapy.

Interventions: a. 30-45 minute one on one physiotherapy session x 3 weekly for 4 months.

b. Control: 30-45 minute one on one friendly visit x 3 weekly for 4 months.

Outcomes: Length of follow-up 1 year but only results at 4 months reported.

Falls identified from patient charts and/or incident reports.

1. Number of participants falling.

2. Number sustaining medical care fall.

3. Number sustaining injury fall.

4. Total number of falls in each group.

5. Number sustaining adverse effect.

6. Number who complied with treatment programme.

7. Death during study.

Notes: San Antonio FICSIT trial [Province 1995]

Allocation concealment: A

Study: Newbury 2001

Methods: Randomised controlled trial. Randomisation by random numbers in sequentially numbered sealed envelopes.

Losses: 11 of 100 (11%)

Intention to treat analysis.

Participants: Setting: community, Adelaide, Australia.

N=100

Sample: every 20th name in an age-sex register of community dwelling patients registered with 6 general practices (63% female).

Age: range 75 - 91 years; median age in intervention group 78.5, control group 80 years.

Inclusion criteria: aged 75 years and over; living independently in the community.

Exclusion criteria: none.

Interventions: a. Health assessment of people aged 75 years or older by nurse (75+HA). Problems identified were counted and reported to patient's GP. No reminders or other intervention for 12 months.

b. No 75+HA until 12 months

Outcomes: Falls identified retrospectively when 75+HA repeated at 12 months.

1. Number of participants falling.

Numerous other outcome measures recorded but not included in this review.

Notes: 75+HA introduced in Australia November 1999 as part of Enhanced Primary Care package. Similar to "health check" for patients in this age group in the United Kingdom.

Allocation concealment: A

Study: Nikolaus 2003

Methods: Randomised controlled trial. Randomised by "sealed envelopes containing group assignments using a random number sequence".

Losses: 81 of 360 (23%)

Intention to treat analysis.

Participants: Setting: enrolled in hospital but community based intervention, Germany.

N=360

Sample: frail "older people" admitted to a geriatric clinic who normally lived at home (73.3% female).

Age: mean (SD) 81.5 (6.4).

Inclusion criteria: lived at home before admission and able to be discharged home; with at least two chronic conditions e.g. osteoarthritis or chronic cardiac failure, stroke, hip fracture, parkinsonism, chronic pain, urinary incontinence, malnutrition; functional decline (unable to reach normal range on at least one assessment test of ADL or mobility).

Exclusion criteria: terminal illness; severe cognitive decline; living >15 km from clinic.

Interventions: a. Comprehensive geriatric assessment + at least 2 home visits (from interdisciplinary home intervention team (HIT). One home visit prior to discharge to identify home hazards and prescribe technical aids if necessary. At least one more visit (mean 2.6, range 1-8) to inform about possible fall risks in home, advice on changes to home environment, facilitate changes, and teach use of technical and mobility aids.

b. Control: comprehensive geriatric assessment alone. No home visit until final assessment at one year. Usual postdischarge management by GPs.

Outcomes: Length of follow-up 1 year. Falls recorded in falls diary and by monthly telephone calls.

1. Number of participants falling

2. Number sustaining injury fall

3. Number sustaining 2 or more falls

4. Fall rate per 100 person years

5. Injury fall rate per 100 person years

6. Compliance with recommendations.

Notes: Home intervention team consisted of 3 nurses, physiotherapist, occupational therapist, social worker and secretary. Usually two members at first home visit (OT + nurse or OT + physiotherapist depending on anticipated needs and functional limitations).

Allocation concealment: B

Study: Nowalk 2001

Methods: Randomised controlled trial, stratified by age and gender. Randomised by permuted blocks (block size = 9). Performed separately for each site.

Losses: 32 of 112 (29%)

Intention to treat analysis not possible.

Participants: Setting: senior housing facilities (independent living to skilled nursing care), USA.

N=112

Sample: residents of 2 long term care facilities (87% female).

Age: mean 84 years.

Inclusion criteria: resident of facility; age 65 years or over; cognitively able to be tested; ambulatory with or without assistive device; able to follow simple directions; co-operative; capable of participating in group exercises.

Exclusion criteria: unable or willing to complete the baseline assessments.

Interventions: a. "Fit NB Free" individualised progressive strength training and conditioning (treadmill, walking, bicycling, weight lifting) 3 x weekly for 13 to 28 months depending on date of enrolment. Could also participate in control activities.

b. "Living and Learning/Tai Chi": behavioural and psychotherapeutic methods to modulate fear of falling (nurse and social worker 1 x per month) and Tai Chi 3 x per week throughout programme. Could also participate in control activities.

c. Control: basic enhanced programme: "Walk-Along" programme to encourage interaction between staff and residents while walking (1 x per month), "Pill Talk" to discuss medications commonly used by seniors (frequency not described), "Music and Memories" using music of their past to stimulate pleasant memories (frequency not described).

Outcomes: Length of follow-up variable depending on time of enrolment (mean (SD) 21.9 (4.6) months), range 13 -28 months.

Falls identified from incident reports.

1. Number of participants falling

2. Time to first fall

3. Number who complied with programme

4. Death during study.

Notes:

Allocation concealment: B

Study: Pardessus 2002

Methods: Randomised controlled trial. Randomised using random numbers table.

Losses: 9 of 60 (15%)

Intention to treat analysis.

Participants: Setting: recruited in hospital, community dwelling, France.

N=60

Sample: individuals hospitalised for a fall.

Age: mean (SD) 83.2 (7.7)

Inclusion criteria: hospitalised for a "mechanical" fall; living at home.

Exclusion criteria: cognitive impairment (MMSE <24); falls due to cardiac, neurologic, vascular or therapeutic problems; without a phone; lived > 30 km from hospital.

Interventions: a. Comprehensive 2 hour home visit with physical medicine doctor, rehabilitation doctor and OT prior to discharge. Assessment of ADLs, IADLs, transfers, mobility inside and outside, use of stairs. Environmental hazards identified and modified where possible. If not, advice given. Discussion of social support. Referrals for social assistance.

b. Control: usual care.

Outcomes: Length of follow-up 1 year. Falls identified by monthly telephone calls.

1. Number of participants falling

2. Mean number of falls per participant.

Notes:

Allocation concealment: B

Study: Pereira 1998

Methods: Randomised controlled trial 1982-85.

Reporting 10 year follow-up.

Losses: 31 of 229 (14%).

Intention to treat analysis not possible.

Participants: Setting: community, Pittsburgh, USA

N=229 randomised - 198 available for 10 year follow-up.

Sample: healthy volunteers

Age: mean 57 years at randomisation. Mean (SD) at follow-up 70 (4) years.

Inclusion criteria: 1 year post menopause; aged between 50 and 65 years.

Exclusion criteria: on HRT; unable to walk.

Interventions: a. 8 week training period with organised group walking scheme x 2 weekly. Also encouraged to walk x 1 weekly on their own. Building up to 7 miles per week total.

b. Control: no intervention

Outcomes: Reporting 10 year follow-up.

Falls in the previous 12 months ascertained by telephone interview.

1. Number of participants falling

2. Number sustaining 2 or more falls

Also measured, but not considered in this review were self reported walking; functional status; sport and exercise index; chronic diseases and conditions.

Notes:

Allocation concealment: B

Study: Pfeifer 2000

Methods: Double blind randomised controlled trial. Method of randomisation not described.

Losses: 11 of 148 (7%)

Intention to treat analysis not possible.

Participants: Setting: community, Germany

N=148

Sample: healthy ambulatory community living women recruited through advertisement.

Age: 70 years or older

Inclusion criterion: 25-hydroxycholecalciferol serum level below 50 nmol/litre.

Exclusion criteria: hypercalcaemia, primary hyperparathyroidism, osteoporotic extremity fracture, treatment with bisphosphonate, calcitonin, vitamin D or metabolites, oestrogen, tamoxifen in past 6 months; fluoride in last 2 years; anticonvulsants or medications possibly interfering with postural stability or balance; intolerance to vitamin D or calcium; chronic renal failure; drug, alcohol, caffeine, or nicotine abuse; diabetes mellitus; holiday at different latitude.

Interventions: An 8 week supplementation at the end of winter

a. 600 mg elemental calcium (calcium carbonate) plus 400 IU vitamin D

b. Control: 600 mg calcium carbonate

Outcomes: Length of follow-up 1 year. Falls and fractures monitored retrospectively by questionnaire at 1 year.

1. Number of participants falling

2. Number of sustaining fracture fall

Also measured, but not considered in this review were body sway parameters, and biochemical measures.

Notes:

Allocation concealment: B

Study: Ray 1997

Methods: Randomised controlled trial of 7 pairs of nursing homes matched by number of beds and randomised within pairs. Statistician generated sealed envelope, random assignments for each pair.

Losses: 25 of 499 (5%)

Intention to treat analysis.

Participants: Setting: nursing homes, Tennessee, USA

N=499

Sample: residents at high risk of falling

Age: mean 82 years

First level inclusion criteria (for nursing homes): 80 - 250 beds; not specialising in psychiatric or short stay skilled nursing care; not in the lowest tercile of psychotropic drug use (Medicaid data); no more than one violation on the most recent Health Care Financing Administration survey.

Second level inclusion criteria (for nursing homes): administrative stability; agreement to participate from medical director and other physicians whose patients made up 25% or more of residents; agreement to appoint a falls co-coordinator for 2-4 hours per week; able to provide study data.

Inclusion criteria (for subjects): at least 65 years of age; fallen in past year; expected to stay in home for 6 months; with possible safety domain problem

Exclusion criteria: bed bound

Interventions: a. Multidisciplinary patient safety assessment by nurse, psychiatrist, OT (environmental and personal safety, wheelchairs, psychotropic drugs, transferring and ambulation) and individualised treatment planning.

Interventions at nursing home level to encourage implementation: team physicians meeting with patient's physicians; inservice education for nurses.

b. Control: usual care. Offered inservices on fall prevention after follow-up period

Outcomes: Follow-up 365 days in home from time of assessment. Falls recorded from incident reports and medical records.

1. Number of recurrent fallers (2 or more falls during follow up)

2. Number of injurious falls (serious injuries e.g. fractures, head injuries with altered consciousness, joint dislocations, sprains, sutured lacerations)

3. Change in function

4. Mortality

Notes:

Allocation concealment: B

Study: Reinsch 1992

Methods: Randomised controlled trial. Randomisation by senior centre rather than by individual participant.

Losses: 46 of 230 (20%).

Intention to treat analysis not possible.

Participants: Setting: community, California, USA.

N=230 men and women

Sample: recruited from senior centres

Age: mean (SD) 74 (6.0) years.

Inclusion criteria: over 60 years of age

No exclusion criteria listed.

Interventions: a. "Stand up/step up" exercise programme, with preliminary stretching exercise. 1 hour, x 3 days per week, for 1 year.

b. Cognitive-behavioural intervention, consisting of relaxation training, reaction time training and health and safety curriculum. 1 hour, x 1 day per week, for 1 year.

c. Exercise (2 meetings per week) and cognitive intervention (x 1 meeting per week) for 1 year.

d. Discussion control group. 1 hour, x 1 day per week, for 1 year.

Outcomes: Length of follow-up 1 year.

Falling ascertained by recall, at weekly intervals.

1. Number of participants falling.

2. Number sustaining injury fall.

3. Number sustaining medical care fall.

4. Number sustaining fracture fall.

5. Number sustaining 2 or more falls.

Notes:

Allocation concealment: B

Study: Robertson 2001a

Methods: Randomised controlled trial. Allocation schedule developed using computer generated numbers. Assignment by independent person off site.

Losses: 29 of 240 (12%)

Intention to treat analysis.

Participants: Setting: community, West Auckland, New Zealand

N= 240

Sample: men and women living at home, identified from computerised registers at 17 general practices (30 doctors)

Age: mean (SD) 80.9 (4.2), range 75 - 95 years

Inclusion criteria: aged 75 years and older

Exclusion criteria: inability to walk around own residence; receiving physiotherapy at the time of recruitment; not able to understand trial requirements

Interventions: a. Home exercise programme, individually prescribed by district nurse in conjunction with her district nursing duties (see Notes).

Visit from nurse at 1 week (1 hour) and at 2, 4 and 8 weeks and 6 months (half hour) plus monthly telephone call to maintain motivation.

Progressively difficult strength and balance retraining exercises plus walking plan. Participants expected to exercise 3 x weekly and walk 2 x weekly for 1 year.

b. Control: usual care

Outcomes: Length of follow-up 1 year. Active fall registration with daily calendars returned monthly + telephone calls.

1. Number of participants falling.

2. Number sustaining 2 or more falls.

3. Number sustaining fracture fall.

4. Number sustaining injury fall.

5. Time to first fall.

6. Mean number of falls per participant.

7. Fall rate per 100 person years.

8. Death during study.

9. Mean number of falls per year (SD)

10. Number sustaining an adverse effect

11. Number who complied with programme

Notes: District nurse had no previous experience in exercise prescription. Received 1 weeks' training from research group's physiotherapist, who also made site visits and phone calls to monitor quality.

Otago Exercise Programme manual can be ordered from http://www.acc.co.nz/injury-prevention

Allocation concealment: A

Study: Rubenstein 1990

Methods: Randomised controlled trial. Randomised with computer generated, randomly sequenced cards in sealed envelopes.

Losses: none described.

Analysis appears to be by intention to treat.

Participants: Setting: institution, California, USA.

Sample: men and women in long term residential care

N=160

Age: mean (SD) 87 (8) years

Inclusion criteria: sustained a fall within previous seven days.

Exclusion criteria: inability to walk, severe dementia, poor understanding of English.

Interventions: a. Nurse practitioner assessment within 7 days of a fall, followed by physician recommendations for action, and referral for intervention if appropriate.

b. Control group: usual care

Outcomes: Falls recorded in daily log.

Length of follow-up 2 years.

1. Number of participants falling.

2. Number sustaining fracture fall.

3. Number sustaining injury fall.

4. Mean number of falls per participant.

5. Death during study.

Notes:

Allocation concealment: A

Study: Rubenstein 2000

Methods: Randomised controlled trial. Randomised in blocks of 16-20 at 3-6 month intervals, using randomly generated sequence cards in sealed envelopes.

Losses: 4 of 59 (7%).

Intention to treat analysis.

Participants: Setting: community, California, USA

N=59

Sample: men recruited from Veterans Administration ambulatory care centre (volunteers).

Age: mean 74 years

Inclusion criteria: aged 70 years and older; ambulatory; with at least 1 fall risk factor: lower limb weakness, impaired gait, impaired balance, more than 1 fall in previous 6 months.

Exclusion criteria: exercised regularly; severe cardiac or pulmonary disease; terminal illness; severe joint pain; dementia; medically unresponsive depression; progressive neurological disease.

Interventions: a. Exercise sessions (strength, endurance and balance training) in groups of 16-20, 3 x 90 minute sessions per week for 12 weeks

b. Control: usual activities

Outcomes: Follow up for 3 months from randomisation.

No active fall registration. Fall ascertainment for intervention group at weekly classes. Controls phoned every 2 weeks.

1. Number of fallers

2. Number of falls

3. Number sustaining injury falls

4. Fall rate per 1000 person years

Notes:

Allocation concealment: B

Study: Ryan 1996

Methods: Randomised controlled trial. Method of randomisation not described.

Losses: none described.

Assume intention to treat analysis.

Participants: Setting: community, USA

N=45

Sample: rural and urban dwelling women. Volunteers from senior meal sites.

Inclusion criteria: at least 65 years of age; living alone in own home; ambulatory with or without assistive devices; with telephone for follow up.

Interventions: Interview and physical assessment by nurse prior to randomisation.

a. 1 hour fall prevention education programme discussing personal (intrinsic) and environmental (extrinsic) risk modification in small groups of 7-8 women (nurse led).

b. Same educational programme but individual sessions with nurse.

c. Controls received health promotion presentation (no fall prevention component) in small groups of 7-8.

Outcomes: Follow-up monthly for 3 months.

1. Number of fallers

2. Number of falls

3. Number of fall related injuries

4. Number of fall prevention changes made

Notes: Pilot research. Primarily to test methodology of a fall prevention education programme and resulting changes in fall prevention behaviour.

Allocation concealment: B

Study: Sato 1999

Methods: Double-blind randomised study. Randomisation by computer generated random numbers.

Losses: none described

Intention to treat not possible.

Participants: Setting: community dwelling, Japan

N=86 (35 men, 51 women)

Sample: elderly people with Parkinson's disease (mean Hoehn and Yahr Stage 3)

Age: mean 70.6 years, range 65-88.

Inclusion criteria: aged 65 or over

Exclusion criteria: history of previous non-vertebral fracture; non-ambulatory (Hoehn and Yahr Stage 5 disease); hyperparathyroidism, renal osteodystrophy, impaired renal, cardiac or thyroid function; therapy with corticosteroids, estrogens, calcitonin, etidronate, calcium, or vitamin D for 3 months or longer during the previous 18 months, or at any time in the previous 2 months.

Interventions: a. 1 alpha (OH) Vitamin D3 1.0 mcg daily for 18 months

b. Control: identical placebo.

Outcomes: Length of follow-up 18 months. Number of falls per subject 'recorded' during 18 months.

1. Mean number of falls (SD)

2. Number of participants sustaining a fracture fall

3. Number sustaining a fall related hip fracture

Also measured, but not considered in this review were bone mineral density, and biochemical measures.

Notes:

Allocation concealment: B

Study: Schnelle 2003

Methods: Randomised controlled trial. Randomised within nursing homes by "computerized programs".

Losses: 18 of 190 (9%)

Intention to treat not possible.

Participants: Setting: nursing homes, California, USA.

N=190 (85% female)

Sample: residents of four nursing homes.

Age: mean (SD) intervention group 87.3 (8.0) years, controls 88.6 (6.7) years.

Inclusion criteria: incontinence of urine, able to follow a simple one-step instruction.

Exclusion criteria: catheterised, on Medicare Part A reimbursement for postacute skilled care or terminal illness.

Interventions: a. FIT intervention (low intensity, functionally oriented exercise and incontinence care) provided every 2 hours from 8.00 am and 4.00 pm for 5 days a week, for 8 months (see notes for further details).

Controls: usual care.

Outcomes: Length of follow-up 8 months. Falls identified from patient records weekly.

1. Number of participants falling

2. Number of falls

3. Number of participants sustaining falls with skin injury

4. Number of participants sustaining a fracture

5. Number of participants sustaining other fall related injuries

6. Number of fall related skin injuries

7. Number of fall related fractures

8. Number of fall related other injuries

9. Number of falls per 1000 resident weeks

10. Number of fall related skin injuries per 1000 resident weeks

11. Number of fall related fractures per 1000 resident weeks

12. Number of other fall related injuries per 1000 resident weeks.

Also measured, but not considered in this review: several other selected acute conditions associated with physical inactivity, incontinence, and immobility e.g. dermatological, genitourinary, gastrointestinal, respiratory, endocrine, neurological, cardiovascular, pain, psychiatric and nutritional disturbances.

Notes: During each episode of care subjects were prompted to toilet, and were changed if wet. Before or after incontinence care they were encouraged to walk or, if not ambulatory, to wheel their chairs and to repeat sit to stands up to 8 times using minimal level of human assistance necessary. During one trial per day, subject did upper body resistance training (arm curls or arm raises), usually in bed. Subjects offered fluids to drink before and after each trial to increase intake. Individual target goals for exercise adjusted weekly.

Allocation concealment: B

Study: Shaw 2003

Methods: Randomised controlled trial. Block randomisation by computer generated random numbers by researcher independent of recruitment process and blind to baseline interview data. Stratified by MMSE score at study entry: 20-23 (mild impairment), 12-19 (moderate impairment), 4-11 (severe impairment).

Losses: 92 of 308 (30%)

Intention to treat analysis.

Participants: Setting: two inner city A&E departments, Newcastle upon Tyne, UK.

N=274

Sample: older people with cognitive impairment or dementia attending A&E after a fall (community dwelling or in institutions).

Age: mean 84, range 71-97 years.

Inclusion criteria: age 65 years or over; cognitive impairment and dementia (MMSE <24; consent from three people (patient, immediate carer, and next of kin).

Exclusion criteria: if MMSE no longer <24 two weeks after presentation at A&E; 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 > 15 miles from site of recruitment; had no major informant i.e. someone in contact with patient at least 2 x per week.

Interventions: a. Multifactorial, multidisciplinary clinical assessment (medical, physiotherapy, occupational therapy, cardiovascular) and intervention for all identified risk factors for falls.

b. Control: clinical assessment but no intervention.

Outcomes: Length of follow-up 1 year. Falls identified by weekly diary mailed as a postcard, and telephone contact if no card for 2 weeks.

1. Number of participants falling

2. Number of falls

3. Time to first fall

4. Number sustaining major injury

5. Number sustaining a fractured neck of femur

6. Number of fall related A&E attendances

7. Number of fall related hospital admissions

Notes:

Allocation concealment: A

Study: Steinberg 2000

Methods: Randomised controlled trial. Cluster randomisation. 4 groups with approximately equal

numbers formed from 2 or 3 National Seniors Branches. Groups randomly allocated to 1 of 4 interventions.

Method of randomisation not described.

Losses: 9 of 252 (4%)

Intention to treat analysis.

Participants: Setting: community, Australia

N=252

Sample: volunteers from branches of National Seniors Association clubs.

Age: mean age 69 years (range 51 - 87)

Inclusion criteria: National Seniors Club member; aged 50 years or over, with capacity to understand and comply with the project.

Exclusion criteria: none stated.

Interventions: Cumulative intervention

a. Intervention d. plus exercise classes designed to improve strength and balance, 1 hour per month, for 17 months; exercise handouts; gentle exercise video to encourage exercise between classes.

b. Intervention d. plus a. plus home safety assessment and financial and practical assistance to make modifications.

c. Intervention d. plus a. plus b. plus clinical assessment and advice on medical risk factors for falls.

d. Control: oral presentation; video on home safety; pamphlet on fall risk factors and prevention.

Outcomes: Follow-up up to 17 months but varied between groups. Follow-up commenced after start of all components for each intervention.

Fall calendar, marked daily, returned monthly. Telephone follow-up of reported falls and no monthly returns.

1. Time to first fall

2. Fallers per 100 person months

3. Falls per 100 person months.

Notes: Younger, healthier and more active sample than elderly population as a whole.

Allocation concealment: C

Study: Stevens 2001

Methods: Cluster randomised controlled trial. Unit of randomisation individual household. Study population divided into four strata defined by age (<80 years and > 80 years) and sex. Within these strata index recruits allocated in 2:1 ratio to control or intervention. Coinhabitants assigned to same group as index recruit.

Losses: 264 of 1879 (14%)

Intention to treat analysis.

Participants: Setting: community, Perth, Australia.

N=1737 (53% female)

Sample: aged 70 and over, living independently and listed on State Electoral Roll and the White Pages telephone directory. Assigned numbers and recruited by random selection.

Age: mean 76 years.

Inclusion criteria: aged 70 years and over; living independently; able to follow study protocol (cognitively intact and able to speak and write in English); anticipated living at home for at least 10 out of 12 coming months; could make changes to the environment inside the home; had not modified home by fitting of ramps and grab rails.

Exclusion criteria: if living with more than 2 other older people.

Interventions: a. One home visit by nurse to confirm consent, educate about how to recognise a fall, and complete the daily calendar. Sent information on the intervention and fall reduction strategies to be offered. Intervention: home hazard assessment, installation of free safety devices, and an educational strategy to empower seniors to remove and modify home hazards (see Notes).

b. Control: One home visit by nurse to confirm consent, educate about how to recognise a fall, and complete the daily calendar.

Outcomes: Follow-up 1 year. Falls recorded on daily calendar.

No raw data. Results presented as adjusted and unadjusted odds ratios and incident rate ratios

1. Rate of falls (all falls)

2. Rate of falls on environmental hazard inside home

3. Rate of falls inside the home

4. Proportion of fallers (all falls)

5. Proportion of fallers (falls on environmental hazards)

6. Proportion of fallers (falls inside home)

7. Fall related injuries

8. Fall related injuries requiring medical care (rate ratios)

Notes: Hazard list designed with OT input to include factors identified from literature and existing check lists. Eleven hazards included. All identified hazards discussed with subjects but only the three most conspicuous or remediable selected to give specific advice on their removal or modification. Safety devices offered at no cost, and installed by tradesman within 2 weeks of visit.

Allocation concealment: B

Study: Tideiksaar 1993

Methods: Randomised controlled trial.

Losses: none described.

Analysis by intention to treat.

Participants: Setting: hospital, New York, USA.

N=70

Sample: men and women admitted to an acute care facility for older patients during a 9 month period.

Age: mean 84 years (range 67-97).

Inclusion criteria: patients with poor bed mobility (difficulty with transfers).

Interventions: a. Bed alarm system during hospital stay.

b. No bed alarm.

Outcomes: Measured over 9 months. Followed-up for duration of hospital stay.

Hours of exposure to system available for experimental group.

1. Number of participants sustaining fall from bed.

2. Number sustaining other falls.

Notes:

Allocation concealment: B

Study: Tinetti 1994

Methods: Randomised controlled trial. Randomisation of 16 treating physicians, matched in 4 groups of 4, into 2 control and 2 intervention in each group; enrolled subjects assigned to same group as their physician.

Losses: 10 of 301 (3%).

Analysis by intention to treat not possible due to missing data.

Outcome assessors blinded to assignment.

Participants: Setting: community, Southern Connecticut, USA

N=301

Sample: independently ambulant community dwelling individuals (208 women, 93 men)

Age: mean (SD) 78.3 (5.3) years (intervention group) mean (SD) 77.5 (5.3) years (control group)

Inclusion criteria: Aged > 70 years; independently ambulant, at least one targeted risk factor for falling (postural hypotension, sedative/hypnotic use, use of >4 medications, inability to transfer, gait impairment, strength or range of motion loss, domestic environmental hazards.)

Exclusion criteria: Enrolment in another study, MMSE < 20, current (within last month) participation in vigorous activity.

Interventions: a. Interventions targeted to individual risk factors, according to decision rules and priority lists. 3 month programme duration.

b. Control visits by social work students over same period.

Outcomes: Measured at 1 year. Falls ascertained by monthly postal survey, followed by personal or telephone contact.

1. Number falling.

2. Number sustaining medical care fall.

3. Number sustaining serious injury fall.

4. Death during study.

Notes: Yale (New Haven) FICSIT trial [Province 1995]

Risk factors screened for included:

Postural hypotension

Sedative/hypnotic drugs e.g. benzodiazepine

4 or more medications

Impaired transfer skills

Environmental hazards for falls

Impaired gait, leg/arm muscle strength, range of movement

Allocation concealment: B

Study: Vassallo 2001

Methods: Cluster randomised controlled trial. Method of randomisation not described.

Losses: none described.

Inadequate data for intention to treat analysis.

Participants: Setting: geriatric rehabilitation wards, UK.

N=825

Sample: consecutive admissions to three geriatric rehabilitation wards.

Age: not stated

Inclusion criteria: not described.

Exclusion criteria: not described.

Interventions: a. One ward. Multifactorial, multidisciplinary assessment and intervention.

Assessed by consultant, nurse, OT, social worker, physiotherapist who met weekly to discuss patients' fall risk and formulate targeted plan. Patients at risk identified with wrist bands, risk factors corrected or environmental changes instituted (observation beds, alarms, toilet facilities etc) to enhance safety.

b. Control: 2 wards, usual care.

Outcomes: Length of follow-up not stated.

1. Number of fallers

2. Number sustaining injury

3. Number of recurrent fallers

4. Number of falls

5. Number of falls per 100 patient days

Notes: Abstract only

Allocation concealment: B

Study: Vellas 1991

Methods: Randomised controlled trial. Randomised 7 days after a fall.

Losses: 6 out of 95 (6%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, France

N=95

Sample: community dwelling men and women presenting to their general medical practitioner with a history of a fall.

Age: mean 78 years

Inclusion criteria: no biological cause for the fall; fallen less than 7 days previously.

Exclusion criteria: hospitalised for more than 7 days after the fall; demented; sustaining major trauma e.g. hip fracture or other fracture; unable to mobilise or be evaluated within 7 days of the fall.

Interventions: a. Iskedyl(R) (combination of raubasine and dihydroergocristine) 2 droppers morning and evening for 180 days

b. Placebo for 180 days

Outcomes: Follow-up 180 days.

1. Number of fallers

Notes:

Allocation concealment: B

Study: Vetter 1992

Methods: Randomised controlled trial. Randomisation by household.

Losses: 224 of 674 (33%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, Wales, UK.

N=674

Sample: men and women aged over 70 years on the list of a general practice in a market town.

No exclusion criteria listed.

Interventions: a. Health visitor visits, minimum yearly, for 4 years, with advice on nutrition, environmental modification, concomitant medical conditions, and availability of physiotherapy classes if desired.

b. Control: usual care

Outcomes: Length of follow-up 4 years. Falling status ascertained by interview at end of study period.

1. Number of participants sustaining a fall.

2. Number of participants sustaining fracture fall.

3. Deaths during study.

Notes:

Allocation concealment: A

Study: Wagner 1994

Methods: Randomised controlled but method of randomisation not described.

Losses: 89 of 1559 (6%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, Seattle, USA

N=1559

Sample: 'healthy elderly' men and women, HMO enrollees.

Age: mean 72 years

Inclusion criteria: aged 65 years or over; HMO members; ambulatory and independent.

Exclusion criteria: Too ill to participate as defined by primary care physician.

Interventions: a. 60-90 minute interview with nurse, including review of risk factors, audiometry and blood pressure measurement, development of tailored intervention plan, motivation to increase physical and social activity.

b. Chronic disease prevention nurse visit.

c. Control: usual care

Outcomes: Measured at 1 and 2 years.

1. Number of participants falling.

2. Number sustaining medical care fall.

3. Number sustaining injury fall.

4. Death during the study.

Notes: Risk factors identified: inadequate exercise, high risk alcohol use, environmental hazards if increased fall risk, high risk prescription drug use, impaired vision, impaired hearing.

Allocation concealment: B

Study: Wolf 1996

Methods: Randomised controlled trial. Randomised using computer generated procedure.

Losses: 40 of 200 (20%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, Atlanta, USA.

N=200

Sample: men (N=38) and women (N=162) residing in an independent living facility, recruited by local advertisements and direct contact.

Age: mean (SD) 76.9 (4.8) years for intervention a, 76.3 (5.1) for intervention b, and 75.4 (4.1) for controls.

Inclusion criteria: over 70 years old; ambulatory; living in unsupervised environment; agreeing to

participate on a weekly basis for 15 weeks with 4 month follow-up.

Exclusion criteria: debilitating conditions e.g. cognitive impairment, metastatic cancer, crippling arthritis, Parkinson's disease, major stroke, profound visual defects.

Interventions: a. Tai Chi Quan (balance enhancing exercise). Group sessions twice weekly, for 15 weeks. (Individual contact with instructor approximately 45 minutes per week.)

b. Computerised balance training. Individual sessions once weekly, for 15 weeks. (Individual contact with instructor approximately 45 minutes per week.)

c. Control: group discussions of topics of interest to older people with gerontological nurse, 1 hour once weekly for 15 weeks.

Outcomes: Length of follow-up 7-20 months. Falls ascertained by monthly calendar or by monthly phone call from project staff. Used modified definition of a fall rather than agreed definition for FICSIT trials described in Buchner 1993.

1. Number of falls.

2. Time to 1 or more falls.

3. Time to 1 or more injurious falls.

Notes: Atlanta FICSIT trial [Province 1995]. Published data is not in a useable form.

1997 paper included under this study id reports on a sub-group of the trial, reporting on outcomes other than falls.

Allocation concealment: B

Study: van Haastregt 2000

Methods: Randomised controlled trial. Randomisation by computer generated random numbers.

Losses 81 of 316 (26%).

Inadequate data for intention to treat analysis.

Participants: Setting: community, Hoensbroek, Netherlands.

N=316

Sample: community dwelling men and women registered with 6 general medical practices

Age: mean (SD) 77.2 (5.1) years

Inclusion criteria: aged 70 years and over; living in the community; 2 or more falls in previous 6 months or score 3 or more on mobility scale of Sickness Impact Profile.

Exclusion criteria: bed ridden; fully wheelchair dependent; terminally ill; awaiting nursing home placement; receiving regular care from community nurse

Interventions: a. 5 home visits from community nurse over 1 year. Screened for medical, environmental and behavioural risk factors for falls and mobility impairment; advice, referrals and "other actions".

b. Control: usual care

Outcomes: Follow-up 12 months and 18 months.

Falls recorded in weekly diary.

1. Number falling

2. Number sustaining medical care fall.

3. Number sustaining injury fall

4. Number sustaining 2 or more falls

5. Number complying with recommendations

6. Death during study

Notes:

Allocation concealment: B

Study: van Rossum 1993

Methods: Randomised controlled trial. Stratified on sex, self rated health, composition of household and social class prior to randomisation. People living together allocated to same group.

Intervention group randomised to nurses.

Losses 102 of 580 (18%).

Intention to treat analysis.

Participants: Setting: community, Netherlands

N=580

Sample: general population sampled, not volunteers

Inclusion criteria: aged 75 to 84 living at home.

Exclusion criteria: subject or partner already receiving regular home nursing care.

Interventions: a. Preventive home visits by public health nurse x 4 per year for 3 years. Extra visits/ telephone contact as required.

Check list of health topics to discuss. Gave advice and referrals to other services.

b. Control received no home visits

Outcomes: Follow-up at 11/2 years and 3 years by postal survey and interview. Falls in previous 6 months recorded.

1. Number of falls.

Also measured, but not considered in this review were self rated health; functional state; wellbeing and mental state; use of services.

Notes:

Allocation concealment: A

ABBREVIATIONS AND ACRONYMS:

A&E: accident and emergency department

ADL: activities of daily living

AMT: abbreviated mental test

BMD: bone mineral density

BMI: body mass index

CHF: congestive heart failure

CSH: carotid sinus hypersensitivity

CSM: carotid sinus massage

FICSIT: frailty and injuries: cooperative studies of intervention techniques

GP: general practitioner

HMO: health maintainance organisation

HRT: hormone replacement therapy

IADL: instrumental activities of daily living. More complex than ADL e.g. handling personal finances, preparing meals, shopping, housekeeping, traveling, using the telephone

IQR: Interquartile range

m: meters

MMSE: mini mental state examination

OT: occupational therapist

SD: standard deviation

SF36: medical outcomes study 36-item short form questionnaire, a standard measure of health related quality of life

x: times

Characteristics of excluded studies

Study: Abreu 1998

Reason for exclusion: Not RCT. Divided into groups by convenience sampling. Intervention: group versus home fall prevention education. Falls outcomes.

Study: Ades 1996

Reason for exclusion: RCT. Intervention: weight training exercise. No falls outcome. Outcome gait velocity and strength.

Study: Allen 1986

Reason for exclusion: RCT. Intervention: geriatric consultation team. No falls outcome. Outcome compliance of hospital doctors.

Study: Bean 2002

Reason for exclusion: RCT. Intervention: 12 week exercise programme of stair climbing using weighted vests versus walking. Outcomes: strength, power and physical performance in mobility-limited older people. No falls outcome.

Study: Binder 1995

Reason for exclusion: RCT. Intervention: exercise programme, randomised to vitamin D or not. Outcome balance. All participants demented. No falls outcome.

Study: Bowling 1992

Reason for exclusion: RCT. Intervention: randomised to nursing home or long stay hospital ward. No falls outcome. Outcomes accidents, quality of life.

Study: Buchner 1997b

Reason for exclusion: RCT. Intervention: endurance training. MoveIT study. Same control group as included FICSIT study. No falls outcome.

Study: Caplan 1999

Reason for exclusion: RCT. Intervention: Hospital in the Home instead of acute admission. Not just elderly (age range 17-111 years). Not fall prevention trial; falls monitored as possible complications.

Study: Charette 1991

Reason for exclusion: RCT. Intervention: resistance exercise. No falls outcome. Outcome - cross section of muscle fibre.

Study: Cheng 2001

Reason for exclusion: RCT. Intervention: symmetrical standing training and repetitive sit-to-stand

training using a standing biofeedback trainer. Falls outcome but all subjects had hemiplegic stroke and not just elderly.

Study: Chin A Paw 2001

Reason for exclusion: RCT. Intervention: exercise and enriched food regimen. Outcome: functional performance. No falls outcome

Study: Clark 1975

Reason for exclusion: RCT. Exercise intervention. No falls outcome.

Study: Crilly 1989

Reason for exclusion: RCT. Intervention: exercise programme. Outcome postural sway. No falls outcome.

Study: Crotty 2002

Reason for exclusion: RCT. Intervention: accelerated discharge and home based rehabilitation after hip fracture. Not intervention to prevent falls; falls recorded but as adverse events.

Study: Deery 2000

Reason for exclusion: Not RCT. Controlled trial. Pre-post intervention analysis. Intervention: fall prevention programme consisting of peer presented education sessions. Falls outcomes.

Study: Earles 2001

Reason for exclusion: RCT. High-velocity resistance training versus self-paced walking program in high functioning older adults. No falls outcomes.

Study: Fiatarone 1994

Reason for exclusion: RCT. Exercise/nutritional intervention. No falls outcome. Outcomes muscle strength and mobility, gait, stair climbing and others. FICSIT trial.

Study: Galindo-Ciocon 1995

Reason for exclusion: Not RCT. Pre-post intervention design. Intervention: fall prevention counseling and gait and balance training. Falls outcomes.

Study: Geiger 2001

Reason for exclusion: RCT. Stroke patients with hemiplegia. Physical therapy alone vs physical therapy plus visual biofeedback/forceplate training. Outcome: balance and Get up & Go.

Study: Gerson 2001

Reason for exclusion: RCT. Intervention in Emergency Department: giving fallers fall prevention brochures vs home hazard checklist vs home hazard checklist plus counseling on making home safety changes. No falls outcome. Outcome: reduction in hazards.

Study: Graafmans 1996

Reason for exclusion: Sub-group of RCT testing daily Vitamin D versus placebo. 2578 persons randomised. This paper reports an epidemiological study of risk factors for falls in a sub-group of 368 subjects. The source population for this paper were subjects from 13 homes or apartment houses and randomisation had taken place within these units in blocks of 10, however of 458 eligible subjects only 368 agreed to enrol in this study (80.1%). Although the percentage who fell in intervention and control groups are reported, it was felt that this paper should be excluded as the sample was a self-selected subgroup and the number in intervention and control groups were not provided. There was no statistically significant difference in percentage of fallers with or without Vitamin D (OR 1.0; 95% CI 0.6 to 1.5).

Study: Green 2002

Reason for exclusion: RCT. Intervention: physiotherapy for patients with mobility problems more than 1 year after a stroke. Falls outcomes but all stroke patients aged 50 years and over. 95% had left or right hemiparesis.

Study: Greendale 2000

Reason for exclusion: RCT. Intervention: use of a weighted vest (no vest, 3% of body weight or 5% of body weight) to be worn 2 hours per day, 4 days per week, for 27 weeks. No falls outcome. Outcome knee extensor and flexor strength, selected measures of physical performance, serum and urine markers of bone turnover, and quality of life indices.

Study: Hagberg 1989

Reason for exclusion: RCT. Intervention: exercise. No falls outcome. Outcome new cardiovascular event.

Study: Hall 1992

Reason for exclusion: RCT. Intervention nurse visit, individualised interventions. No falls outcome. Outcomes psychological tests, care status.

Study: Hansen 1992

Reason for exclusion: RCT. Intervention: geriatric follow up after hospital discharge. Outcome admission to nursing homes. No falls outcome.

Study: Hebert 2001

Reason for exclusion: RCT. Intervention: multifactorial assessment of community dwelling people aged 75 and over. Primary outcome: functional decline (defined as death, admission to an institution or increase of > or = 5 points on the Functional Autonomy Measurement System (SMAF) scale disability score during one year follow-up). Secondary outcomes: functional autonomy, well-being, perceived social support, and use of health care services. No falls outcome.

Study: Hendrich 1988

Reason for exclusion: Not RCT. Hospital prevention plan. Falls outcomes.

Study: Hendriksen 1984

Reason for exclusion: RCT. Intervention: home visits and provision of aids.

Outcome GP visits, hospitalisation. No falls outcome.

Study: Hendriksen 1989

Reason for exclusion: RCT. Intervention: preventive home visits.

Outcome: hospitalisation. No falls outcome.

Study: Hofmeyer 2002

Reason for exclusion: RCT. Intervention: training to improve the ability of disabled older adults to rise from the floor. Not fall prevention. No falls outcome.

Study: Holmqvist 1998

Reason for exclusion: RCT. Intervention: early supported discharge after stroke.

Not fall prevention. Falls reported as a possible adverse effect.

Study: Hopman-Rock 1999

Reason for exclusion: RCT. Intervention: psychomotor activation programme for cognitively impaired elderly in institutional care. Not fall prevention. Falls monitored as a possible adverse effect.

Study: Hu 1994

Reason for exclusion: RCT. Not fall prevention. Falls artificially induced. Balance parameters measured.

Study: Judge 1993

Reason for exclusion: RCT. Outcome static balance, muscle strength. No falls outcome.

Study: Kelly 2002

Reason for exclusion: Not RCT. Pre-post test design in skilled nursing care facility (USA) of adhesive credit card sized alarm activated by weight bearing.

Study: Kempton 2000

Reason for exclusion: Not RCT. Evaluation of non randomised community fall prevention programme targeting eight risk factors. Geographical control.

Study: Kerschan-Schindl2000

Reason for exclusion: Not RCT. Sample selected from controlled trial of home exercise programme. Falls outcomes.

Study: Kilpack 1991

Reason for exclusion: Not RCT. Pre-post intervention design. Nursing intervention. Outcome falling.

Study: Krishna 1983

Reason for exclusion: Not RCT. Pre-post intervention design. Hospital based, staff education programme. Outcome falling.

Study: Kuipers 1993

Reason for exclusion: Controlled study. Pre-post intervention. Hospital based risk assessment and intervention. Falls outcome.

Study: Kustaborder 1983

Reason for exclusion: Not RCT. Pre-post intervention design. Hospital based. Outcome accidents (not just falls).

Study: Lamoureux 2003

Reason for exclusion: RCT. Intervention: progressive resistance. Outcome: strength assessed using an obstacle course. No falls outcome.

Study: Latham 2001

Reason for exclusion: RCT. Hospital based. Intervention: progressive resistance strength training. No falls outcome. Outcome: strength, gait speed, timed "up-and-go", balance (Berg).

Study: Lauritzen 1993

Reason for exclusion: RCT. Intervention hip protectors. Hip fracture outcome.

Study: Lawrence 1992

Reason for exclusion: Not RCT. Case series. Nursing intervention. Outcome falling.

Study: Li 2001

Reason for exclusion: RCT. Exercise intervention (Tai Chi). No falls outcome. Outcome self-efficacy and self-reported physical functioning.

Study: Lichtenstein 1989

Reason for exclusion: RCT. Exercise intervention. No falls outcome. Outcome balance and sway

Study: Lord 1996a

Reason for exclusion: RCT. Exercise intervention. No falls outcome. Outcome gait related.

Study: Lord 1996b

Reason for exclusion: RCT. Exercise intervention. No falls outcome. Outcome balance related.

Study: MacRae 1996

Reason for exclusion: Not RCT. Pre-post intervention. Walking programme for nursing home residents. Falls monitored as possible adverse events.

Study: McCabe 1985

Reason for exclusion: Not RCT. Nursing intervention. Falls outcomes.

Study: McEwan 1990

Reason for exclusion: RCT. Intervention: screening programme by nurses with general assessment. Outcome - health indices, ADL, morale. No falls outcome.

Study: McMurdo 1993

Reason for exclusion: RCT. Intervention: exercise. Outcome sway, depression, ADLs, chair to stand time. No falls outcome.

Study: Mills 1994

Reason for exclusion: RCT. Low intensity aerobic exercise. No falls outcome.

Study: Mohide 1988

Reason for exclusion: RCT. Intervention: quality assurance programme in nursing homes. No falls outcome. Outcome: hazardous mobility and constipation.

Study: Morganti 1995

Reason for exclusion: RCT. Intervention; resistance training. Outcome not falling. Outcome strength.

Study: Morton 1989

Reason for exclusion: Not RCT. Falls prevention programme. Hospital.

Study: Naso 1990

Reason for exclusion: RCT. Exercise intervention. No falls outcome. Outcome 'training effect'.

Study: Nichols 1993

Reason for exclusion: RCT. Intervention: resistance training. No falls outcome. Outcome: strength

Study: Obonyo 1983

Reason for exclusion: Not RCT. No untreated group. Falls outcomes.

Study: Pathy 1992

Reason for exclusion: RCT. Intervention: postal health screening by questionnaire. Outcome: mortality, quality of life, health service use. No falls outcome.

Study: Plautz 1996

Reason for exclusion: Not RCT. Pre-post intervention design. Falling outcome.

Study: Ploeg 1994

Reason for exclusion: RCT. Intervention: safety assessment. No falls outcome. Outcome: safety behaviour changes

Study: Pomeroy 1999

Reason for exclusion: RCT. Intervention: physiotherapy to improve mobility in demented elderly people. No falls outcome.

Study: Posner 1990

Reason for exclusion: RCT. Intervention: aerobic exercise intervention. No falls outcome. Outcome new cardiovascular diagnoses.

Study: Poulstrup 2000

Reason for exclusion: Not RCT. Community based intervention programme. Quasi experimental, with non-randomised control communities. Intervention: information and home visits with follow-up, removing physical hazards, treating somatic and psychiatric illnesses and dealing with improper drug consumption, diet insufficiencies and physical and mental inactivity. Outcome: fall related fractures.

Study: Pujiula 2001

Reason for exclusion: Not RCT. Community-based intervention programme (methods). Quasi experimental, with non-randomised control communities. Intervention: multifactorial community intervention.

Study: Rainville 1984

Reason for exclusion: Not RCT. Pre-post intervention. Hospital fall prevention programme.

Study: Rantz 2001

Reason for exclusion: RCT (cluster randomised nursing homes). Intervention: staff workshops and feedback about 23 quality indicators versus workshops and feedback and clinical consultation versus control. Outcomes: reporting of 23 quality indicators. Subgroup analysis of nursing homes that made use of clinical consultation v those that did not. Falls one of 23 quality indicators but no useable data.

Study: Reuben 1995

Reason for exclusion: RCT. Intervention: geriatric assessment of hospital patients. No falls outcome. Outcome functional and health status, mortality.

Study: Robbins 1992

Reason for exclusion: RCT. Balance outcomes. No falls outcome.

Study: Robertson 2001c

Reason for exclusion: Not RCT. Controlled trial in multiple centres. Intervention: home based exercise in over 80 year olds. Same programme as in Campbell 1997, Campbell 1999, and Robertson 2001. Outcome: falls, injuries resulting from falls, and cost effectiveness.

Study: Robinson 2002

Reason for exclusion: Not RCT. Controlled study of physiotherapy in community dwelling elderly people, but subjects self selected to participate in intervention.

Study: Sauvage 1992

Reason for exclusion: RCT. Intervention: aerobic exercise programme. No falls outcome. Outcome: strength, gait, balance.

Study: Schlicht 2001

Reason for exclusion: RCT. Intervention: intense strength training to improve functional ability related to the risk of falling. No falls outcomes. Outcome strength, walking speed, balance, sit-to-stand performance.

Study: Schmid 1990

Reason for exclusion: Not RCT (pre-post intervention design). Development of injury risk assessment tool in nursing home patients. Outcome falling.

Study: Schnelle 1996

Reason for exclusion: RCT. Intervention: exercise to improve mobility in physically restrained nursing home residents. No falls outcomes.

Study: Sherrington 1997

Reason for exclusion: RCT. Intervention: home exercise programme. No falls outcome. Outcome: improved mobility and strength, post hip fracture.

Study: Shigematsu 2002

Reason for exclusion: RCT (cluster). Intervention: dance based aerobic exercise. No falls outcome. Outcome: balance, strength and locomotion/agility.

Study: Shumway-Cook 1997

Reason for exclusion: Not RCT. Quasi-experimental design. Exercise intervention. Non-equivalent control group. Logistic regression model of fall risk was an outcome, but not actual falls.

Study: Simmons 1996

Reason for exclusion: RCT. Intervention: exercise in water. No falls outcome. Outcome: functional reach as a measure of fall risk.

Study: Sinaki 2002

Reason for exclusion: RCT. Intervention: proprioceptive dynamic posture training in osteoporotic women with kyphotic posture. Outcome: spinal X-rays, back extensor, hip extensor, knee extensor and grip strength, balance tested by computerised dynamic posturography. No falls outcomes.

Study: Skelton 1999

Reason for exclusion: Not RCT. Pre-post test design. Describes Falls Management Exercise (FaME) Programme and ongoing evaluation study which is not randomised.

Study: Speltz 1987

Reason for exclusion: Not RCT. Pre-post intervention. Hospital. Falls outcomes.

Study: Svanstrom 1996

Reason for exclusion: Not RCT. Quasi experimental, with non-randomised controls. Intervention - environmental risk control. Pre-post intervention design. Outcomes hip fracture (discharge data)

Study: Sweeting 1994

Reason for exclusion: Not RCT. Pre-post intervention. Hospital. Falls outcomes.

Study: Tennstedt 1998

Reason for exclusion: RCT. Intervention: to reduce fear of falling and increase activity levels. Not fall prevention. Falls reported as possible adverse effect.

Study: Thompson 1988

Reason for exclusion: RCT. Exercise intervention. No falls outcome.

Study: Thompson 1996

Reason for exclusion: Not RCT. Pre-post intervention. Environmental risk factor modification. Falls outcomes.

Study: Tideiksaar 1990

Reason for exclusion: Not RCT. Pre-post intervention. Falls outcomes.

Study: Tideiksaar 1992

Reason for exclusion: Not RCT. Community based survey and falls prevention programme. Qualitative evaluation only. Falls outcomes.

Study: Tinetti 1992

Reason for exclusion: Not RCT. Prospective cohort study. Outcome injurious falls.

Study: Tinetti 1999

Reason for exclusion: RCT. Intervention: home based multicomponent rehabilitation after hip fracture. Not intervention to prevent falls; falls recorded but as adverse events.

Study: Topp 1993

Reason for exclusion: RCT. Intervention: resistance training classes. Outcome: change in gait and balance. No falls outcome.

Study: Topp 1996

Reason for exclusion: RCT. Intervention: home based resistance training. Outcome: change in ankle strength, training intensity, postural control, and gait. No falls outcome.

Study: Tynan 1987

Reason for exclusion: Not RCT. Description of fall and fracture prevention programme

Study: Urton 1991

Reason for exclusion: Not RCT. Description of falls prevention programme

Study: White 1991

Reason for exclusion: Not RCT. Description of intervention in rehabilitation unit

Study: Wolf-Klein 1988

Reason for exclusion: Not RCT. Pre-post intervention (multidisciplinary falls clinic). Falls outcomes.

Study: Wolfson 1996

Reason for exclusion: RCT. Intervention: exercise. Outcome: balance, strength and gait velocity. No falls outcome. FICSIT trial.

Study: Yates 2001

Reason for exclusion: RCT. Intervention: multifactorial intervention to reduce fall risk (fall risk education, 10 week exercise programme, nutritional counseling and/or referral, environmental hazard education). Outcome: decrease in selected fall risk factors (physiological outcome measures, locus of control for nutrition, nutritious food behaviour, falls efficacy score, depression, environmental hazards). No falls outcomes.

Study: Ytterstad 1996

Reason for exclusion: Not RCT. Quasi experimental, with non-randomised controls. Pre-post intervention design. Outcomes include falling.

Study: von Koch 2000

Reason for exclusion: RCT. Intervention: early supported discharge and rehabilitation at home after a stroke. Falls outcome but stroke patients and not a fall prevention strategy; falls monitored as adverse

event.

RCT: randomised controlled trial

Characteristics of ongoing studies

Study: Allegrante

Trial name or title: Self efficacy and strength training to improve postoperative rehabilitation of hip fracture patients

Participants: 200 patients with a hip fracture

Interventions: In hospital instruction of patient and care giver post operatively, 8 weeks high intensity strength training, home based walking programme, supportive phone calls vs standard care

Outcomes: Follow-up 1 year.

Primary: within patient change in physical, social, and role function subscales of SF-36. Secondary: recurrent falls, ADL, muscle strength, balance, institutionalisation

Starting date: July 1993

Completed June 2000

Contact information: Dr JP Allegrante,

Hospital for Special Surgery,

535 East 70 th St,

New York,

NY,

10021,

USA.

Notes: Includes economic analysis

Study: Allen

Trial name or title: A primary care based fall prevention programme: evaluation of the Canterbury fall prevention programme

Participants: One General Practice, Canterbury, UK. Fallers referred by GP staff and identified in A&E. Inclusion criteria: falling in previous 2 weeks; aged at least 65 years; living independently in the community; registered with target general practice; able to communicate well enough to participate. Exclusion criteria: unable to speak English; too mentally confused; medical reason for falling; terminally ill; sudden onset of paralysis; moved out of area

Interventions: Home interview and assessment including medication review and referral to other agencies; group intervention 2 x per week for 6 months for seated exercise, practice getting up from floor, group discussion re health and emotional needs

versus usual care.

Intervention carried out by East Kent Health Promotion Service and nurses employed by the general practice

Outcomes: Follow-up at 6, 12 and 18 months.

Falls

Starting date: Enrolling from August 1996 to Sept 1998

Contact information: Alison Allen,

East Kent Health Promotion Service,

East Kent Community NHS Trust,

43 Old Dover Road, Canterbury,

Kent,

CT1 3HR

UK.

Notes: Completion date March 2000?

Methods reported in Allen A, Simpson JM, Physiotherapy Theory and Practice (1999);15:121-133.

Study: Behrman

Trial name or title: Prediction and prevention of falls in the elderly

Participants: 500 individuals aged over 75 years at high risk of developing disabilities, from each general practice in Maidenhead

Interventions: Full geriatric assessment at day hospital and course of group exercises vs usual care

Outcomes: Changes in Barthel score, mental depression score, change in residential status, mortality.

Falls not mentioned in list of outcomes, but title and research question describe prevention of falls and disability

Starting date: April 1997

Contact information: Dr R Behrman,

Geriatric Dept,

St Mark's Hospital, Maidenhead,

SL6 6DU

Berks,

UK.

Notes:? falls outcomes

Study: Brown

Trial name or title: Functional adaptation to exercise in elderly subjects

Participants: 108 community dwelling people

Interventions: 16 week exercise and functional retraining programme including balance, strength, gait components

Outcomes: Falls, and balance and functional abilities

Starting date: Completed. Data analysis in progress

Contact information: A Piotrowski Brown,

School of Physiotherapy,

Curtin University, Selby Street, Shenton Park 6008,

Western Australia.

Tel +61 8 9266 3650,

Fax +62 8 9266 3636

email a.brown@info.curtin.edu.au

Notes:

Study: Clemson

Trial name or title: The effectiveness of a community-based program for reducing the incidence of falls among the elderly: a randomised trial

Participants: 310 community residing people aged 70 years or over

Interventions: Falls prevention and confidence building program (Stepping Out) employing a multi-faceted small group approach. It combines a range of strategies: balance and strength exercises, environmental adaptation (home and community), managing medications, coping with low vision, behavioural change, education, and risk management skills

Outcomes: Falls (daily calendar, posted monthly for up to 14 months).

Secondary measures: SF-36; Modified Falls-Efficacy Scale (MFES); Mobility Efficacy Scale (MES); Physical Activity Scale for the Elderly (PASE); Worry Scale; Falls Behavioural Scale for older people (FaB).

Starting date: August 1999

Complete

Paper submited for publication

Contact information: Dr L Clemson

School of Occupation & Leisure Sciences

The University of Sydney

PO Box 170

Lidcombe

NSW 1825

Australia

Email: l.clemson@fhs.usyd.edu.au

Notes:

Study: Cumming

Trial name or title: Randomised trial of vision improvement for prevention of falls

Participants: 800 males and females aged 70 years and over, mainly recruited from aged care service clients

Interventions: Vision testing, with appropriate interventions if required (mainly new glasses or cataract surgery)

Outcomes: Falls

Vision-related quality of life

Starting date: August 2002

Contact information: R.G Cumming

Centre for Education and Research on Ageing,

University of Sydney

Email: bobc@health.usyd.edu.au

Notes:

Study: Dyer

Trial name or title: Preventing falls in residential homes: a multi-agency pilot study

Participants: 300 residents of residential homes

Interventions: Not described

Outcomes: Number of falls per resident, number of sedative medications, Tinetti gait assessment

Starting date: 01/09/2000

Contact information: Dr Chris Dyer,

St Martin's Hospital,

Midford Road,

Bath BA2 5RP

Tel: 01225 831749

Notes:

Study: Edwards

Trial name or title: Randomised controlled trial of falls clinic and follow-up home

intervention

Participants: Volunteer community living seniors residing in apartments

Interventions: On site "falls clinic" assessment to identify those at high risk of falls, followed by intensive in-home comprehensive assessment and tailored intervention programme vs low intensity educational session

Outcomes: Incidence and risk of falls

Starting date:? completed

Contact information: N. Edwards,

Career Scientist,

School of Nursing,

University of Ottawa,

Canada.

Notes: Ongoing trial described in Edwards N, Cere M, Leblond D. A community-based intervention to prevent falls among seniors. Family and Community Health 1993; 15(4):57-65.

Study: Gordon

Trial name or title: The Winchester Falls Project: a randomised controlled trial of multidisciplinary assessment in the secondary prevention of falls

Participants: People aged over 65 living in the community who have had a least 1 previous fall in the preceding month

Interventions: Multidisciplinary assessment.

The study also aims to determine whether such an intervention, if effective, is best carried out in a primary or secondary care setting

Outcomes: Mean rate of falls per subject per year

Starting date: 01/02/2000

Contact information: Dr Chris Gordon,

Consultant Physician,

Winchester and Eastleigh Health Care NHS Trust,

Royal Hampshire County Hospital,

Romsey Road,

Winchester,

SO22 5DG

UK.

Telephone: 01962 825572

Notes:

Study: Grove

Trial name or title: Effects of T'ai Chi training on general wellbeing and motor performance in patients with Parkinson's disease

Participants: 20 patients with Parkinson's disease recruited form the Parkinson's disease clinic

Interventions: T'ai Chi training

Outcomes: Get up and go test, log book of falls

Starting date: 31/03/200

Contact information: Dr M. Grove

Royal Cornwall Hospitals NHS Trust

Treliske

Truro

TR1 3LJ

UK

Notes:

Study: Haines

Trial name or title: Effectiveness of a targeted falls prevention program in the sub-acute hospital setting. A randomised controlled trial

Participants: 626 sub-acute inpatients

Interventions: Targeted multiple intervention program. Includes falls risk alert cards, exercise program, education program and hip protectors delivered on top of "regular care".

Control group received "regular care" alone

Outcomes: Falls (primary), fallers, falls with injuries

Intervention sub-group analyses

Starting date: March 2002

Completed April 2003

Now in data analysis phase and preparation for publication

Contact information: T Haines

B.Physio.Hons

(PhD student at the University of Melbourne and National Ageing Research Institute)

Telephone: +61398812431

Email: terrence.haines@peterjames.org.au

Notes:

Study: Harwood

Trial name or title: Does expedited cataract extraction reduce the risk of falls in elderly people? - a randomised controlled trial

Participants: 400 women aged 75 -85 years with bilateral cataract suitable for surgery, who have not had previous ocular surgery

Interventions: Two trials.

1. Expedited vs routine surgery for first eye

2. Expedited surgery vs routine surgery for second eye

Outcomes: Time to first fall, mean fall frequency over 12 months, visual acuity, visual disability (VF-14), Barthel Index, London Handicap Scale, Euroqol, formal and informal care costs

Starting date: 01/09/98

Completed

Contact information: Dr R. Harwood or

Mr AJE Foss,

Health Care of the Elderly,

A Floor,

East Block, University Hospital, Nottingham,

NG7 2UH

UK.

Telephone:

0115 924 9924 ext 42809

Notes: Collecting data for cost-effectiveness analysis

Study: Healey

Trial name or title: Using targeted risk factor reduction to prevent falls in older in-patients

Participants: Eight Care of the Elderly wards or units of a district general hospital cluster randomised in matched pairs.

Interventions: Use of pre-printed care plan for patients identified as at risk of falling, plus appropriate remedial measures versus usual care.

Outcomes: Number of falls.

Starting date: 12 month duration

Complete

Contact information: F. Healey,

Dept of Elderly Medicine,

York District Hospital,

Wigginton Road,

York YO31 8HE

United Kingdom

email: Frances.Healey@york.nhs.uk

Notes:

Study: Lamb

Trial name or title: Prevention of fall injury trial: PRE-FIT

Participants: Setting: Primary care

Interventions: Targeted multi-factorial fall prevention versus usual care

Outcomes: Injurious falls, quality of life, costs

Starting date: 01/06/2002

Contact information: Prof S Lamb,

Inter-disciplinary Research Centre in Health (HSS),

Coventry University,

Priory Street,

Coventry,

CV1 5FB

United Kingdom

Telephone: 024 76887451

Fax: 024 76888020

email: s.lamb@coventry.ac.uk

Notes:

Study: Lesser

Trial name or title: Vestibular rehabilitation in prevention of falls due to vestibular disorders in adults

Participants: Adults with vestibular disorders

Interventions: Vestibular rehabilitation

Outcomes: Falls and quality of life

Starting date: 01/08/2000

Contact information: Mr THJ Lesser,

Otolaryngology,

University Hospital Aintree,

Longmoor Lane,

Liverpool,

L9 7AL

United Kingdom

Telephone: 0151 529 4035

Fax: 0151 529 5263

Notes:

Study: Lord

Trial name or title: The effect of tailored falls prevention program on fall risk and falls in older people: a randomized controlled trial

Participants: Six hundred and twenty people aged 75 years and older (mean age 80.4, SD = 4.5) who

were randomly recruited from a membership database of a private health insurance company

Interventions: A tailored falls prevention program that targets deficits identified from a physiological profile assessment (PPA). The interventions comprised tailored exercise, visual and counseling interventions based on the PPA results

Outcomes: Falls, injurious falls, postural sway, coordinated stability, reaction time, lower limb muscle strength and health status

Starting date: June 1999

Contact information: Assoc. Prof. Stephen Lord,

Prince of Wales Medical Research Institute,

Barker Street, Randwick, Sydney,

NSW, 2031

Australia

Telephone: +61-2-9382-2721

Fax: +61-2-9382-2722

Email: s.lord@unsw.edu.au

Notes: The PPA uses a web-based computer software program to assess an individual's performance in relation to a normative database compiled from large population studies. A falls risk assessment report is produced for each individual that includes a graph indicating an individual's overall falls risk score, and a profile of the individual's test performances in tests of vision, sensation, strength, reaction time and balance.

Study: Michie

Trial name or title: A randomised trial of vitamin D supplementation in preventing hip fracture

Participants: Elderly residents of nursing and residential homes

Interventions: Vitamin D supplements for 2 years using a dose 20 times lower than the minimum toxic dose

Outcomes: Research question is to determine whether vitamin D supplementation reduces the high

incidences of falls and hip fractures in elderly people living in nursing and residential care homes but no mention of falls outcomes.

Outcome number of hip fractures.

Starting date: 01/03/2001

Contact information: Dr C Michie,

Ealing Hospital NHS Trust,

Uxbridge Road,

Southall,

Middlesex,

UB1 3HW

England.

Telephone: 0181 967 5569

Fax: 0181 967 5339

E-mail: colinm@easynet.co.uk

Notes: Cluster randomisation by care home

Study: Moxon

Trial name or title: Promoting mental health in elderly care homes

Participants: Cluster randomised trial.

24 elderly care homes (12 matched pairs). Each home with average of 35 residents, and 11 care staff.

Exclusion criteria for residents: too confused (MMSE assessment).

Interventions: 1. York Programme for reducing prevalence and incidence of depression in elderly care homes: training course for staff; mentoring and reinforcing training; managing depression using psychosocial and medical insights.

2. Control: York Programme not introduced

Outcomes: Depression

Falls

Starting date: 01/11/1998 to 31/10/2002

Contact information: Mrs Sallie Moxon

Senior Researcher

c/o Dept of Mental Health for the Elderly

Bootham Park

York

YO30 7BY

United Kingdom

Telephone: 01904 454839

Fax: 01904 454810

email: YHSRU@yorkhealth.demon.co.uk

Notes:

Study: RECORD

Trial name or title: Randomised placebo-controlled trial of daily oral vitamin D and calcium for the secondary prevention of osteoporosis related fractures in the elderly (MRC RECORD study)

Participants: 6500 people aged at least 70 years with a recent proximal femur or other appendicular fracture or clinical vertebral fracture, and able to comply with protocol e.g. MMSE >7.

Those with multiple or high transfer injury; inability to walk prior to presenting fracture without support, suffering from malignant disease, contraindication to calcium or vitamin D, current or recent (<1 year) treatment with >200 IU daily of vitamin D, any vitamin D metabolite, vitamin D by injection, calcium, fluoride, diphosphonates or calcitonin will be excluded.

Interventions: Vitamin D3 800 IU plus calcium 1 g vs vitamin D3 alone vs calcium alone vs placebo

Outcomes: 4 monthly postal questionnaire (plus notification by participant, contact person or GP) about: new fractures, death, hospital admission, change of residence type, falls, EuroQol and SF12.

Starting date: 01/11/98

Contact information: Prof Adrian Maxwell Grant,

MRC/RECORD Study Office,

Health Services Research Unit,

Drew Kay Wing,

Polwarth Building,

Foresterhill,

Aberdeen,

AB25 2ZD

Scotland,

UK.

Telephone: 01224 553908

Fax: 01224 663087

E-mail: a.grant@abdn.ac.uk

Notes:

Study: SAFE PACE 2

Trial name or title: SAFE PACE 2. Syncope and falls in the elderly - pacing and carotid sinus evaluation: a randomised controlled trial of cardiac pacing in older patients with falls and carotid sinus hypersensitivity.

Participants: Patients with carotid sinus hypersensitivity.

Patients screened in A&E, geriatric medicine, general medicine, and orthopaedic facilities.

Inclusion criteria: >50 years old, 2 or more unexplained falls in previous 12 months, cardioinhibitory response (>3 seconds asystole) to carotid sinus massage.

Exclusion criteria: cognitive impairment (MMSE <20), atrial fibrillation.

Interventions: 1. Medtronic Kappa 700 (Europe) or Kappa 400 (North America) pacemaker

2. Control group:

implantable loop recorder (Medtronic Reveal)

Outcomes: Weekly fall diaries.

Number of fallers in 24 months after intervention.

Secondary outcome: number of falls, frequency of dizzy symptoms, injury rates, the use of primary, secondary, and tertiary care facilities, cognitive function.

Resource use and cost data collected

Starting date: May 1999

Contact information: Dr RA Kenny

Cardiovascular Investigation Unit

Victoria Wing

Royal Victoria Infirmary

Newcastle upon Tyne

NE1 4LP

United Kingdom

Notes: International multicentre trial

Study: SAFER 2

Trial name or title: SAFER 2 - Syncope and falls in the emergency room - an explanatory randomised controlled trial of a multidisciplinary post-fall assessment and intervention strategy in elderly recurrent fallers attending casualty

Participants: 625 patients from 2 centres.

Inclusion criteria: over 65 years old with recurrent falls (2 or more falls in preceding 12 months) presenting to the casualty department.

Exclusion criteria:

MMSE score <23

Interventions: Global specialised post fall multi-disciplinary assessment and individualised intervention strategy. Duration tailored to each individual patient.

Controls receive usual care

Outcomes: Follow-up for 12 months. Interviewed at home at 3, 6 and 12 months Primary outcome: number of patients who fall within 1 year of assessment.

Number of falls recorded by fall diary.

Secondary outcome: mortality, injury rates and hospitalisation, assessment of mental health, SF-36, EuroQol, and use of health services

Starting date: 01/12/98

Complete

Contact information: Dr M Davis,

Gateshead Health NHS Trust,

Queen Elizabeth Hospital,

Sheriff Hill,

Gateshead,

NE9 6SX

UK.

Telephone: 0191 482 0000

Fax: 0191 4824711

Notes: Assessment includes patient history (including medication), full physical examination including visual acuity, laboratory blood tests, 12 lead ECG and a cardiovascular assessment.

Physiotherapy assessment of gait, balance, muscle strength and footwear.

Occupational therapy home hazard assessment.

Study: Safe-Grip

Trial name or title: Safe-Grip fall injuries intervention: a randomised trial

Participants: 210 men and women aged 60 and over, recently released from an inpatient visit or already inactive at home.

Interventions: Physical restoration programme (SAFE-GRIP)

Outcomes: Falls, physical functional capacity (ADL/IADL, health related quality of life), fall related injuries.

Starting date: October 1995

Complete

Contact information: Dr C.A. DeVito

VA Medical Centre

Miami

Florida

33125

USA

Tel: 305-324-3179

or

Dr R.O. Morgan

Houston VA Medical Centre

Houston

Texas

77030

USA

Notes:

Study: Smith

Trial name or title: Primary prevention of fractures in the elderly: RCT of an annual injection of vitamin D in the prevention of hip and other non-vertebral fractures

Participants: 10,000 men and women aged 75 years and over from a general practice population (96 practices)

Interventions: 300,000 IU (1 ml) vitamin D (ergocalciferol) intra-muscularly given annually in the autumn over 3 years vs placebo

Outcomes: Hip fractures, non vertebral fractures and falls. Outcome data collected at 6 months intervals from the trial participants in a short self -administered questionnaire

Starting date: 01/09/2000

Complete

Undertaking data analysis

Contact information: Dr Helen Smith,

Aldermoor Health Centre,

Aldermoor Close,

Southampton,

SO16 5ST

UK.

Telephone: 023 8024 1055

Fax: 023 8070 1125

E-mail: h.e.smith@bsms.ac.uk

Notes:

Study: Spice

Trial name or title: Secondary prevention of falls

Participants: 450 community dwelling elderly aged over 64 years who have fallen at least twice.

Interventions: 3 arms:

1. Health visitor/practice nurse falls risk assessment/referral

2. Multidisciplinary day hospital assessment by physician, OT and physiotherapist

3. Usual care

Outcomes: Falls. Follow-up monthly using postcards +/- phone call for 1 year

Starting date: Sept 2000

Contact information: Dr C Spice,

Registrar in Elderly Medicine,

Dept of Elderly Medicine,

Royal Hampshire County Hospital,

Romsey Road, Winchester,

Hants,

SO22 5DG

UK.

Notes: Cluster randomisation

Study: Swift

Trial name or title: A controlled intervention study of Vitamin D supplementation on neuromuscular and psychomotor function in elderly people who fall

Participants: 160 patients over 65 years who have had a fall (identified through A&E records) and are Vitamin D deficient

Interventions: 1. Vitamin D supplementation with IM ergocalciferol

2. Matched placebo

Outcomes: Fall rates (secondary outcome).

Primary outcome: choice reaction time and aggregate functional performance

Starting date: 01/04/1999

Complete

Contact information: Prof C. Swift

Division of Health of the Elderly

King's College Hospital (Dulwich)

East Dulwich Grove

London

SE22 8PT

Notes:

Study: Torgerson

Trial name or title: Randomised trial of fall and fracture prevention advice by practice nurses

Participants: 6200 women aged 70 and over, recruited from GP patient lists, or hospital fracture clinics, UK.

Inclusion criteria: body weight <58 kg; history of fracture; current smoker; mother or sibling who has had a hip fracture; poor/fair health; needs to use arms to get up from a chair.

Exclusion criteria: bed or chair bound patients; unable to give informed consent

Interventions: 1. Invitation to attend for assessment by practice nurse or osteoporosis nurse specialist depending on where recruited: fracture risk, medication, vision and foot assessment. Individualised advice and referrals depending on age and risk factors identified. Patients with history of vertebral fracture or height loss will be advised to consider using calcium and vitamin D supplements and to see GP for referral for bone mass measurement. GPs of patients who are frequent fallers will be asked to consider referral to specialist falls clinic and/or medication review. Eyesight and feet will be checked and recommendations to attend optician and podiatrist. Summary of assessment and recommendations sent to subject's GP, copied to subject with lay summary. Subjects considered high fracture risk recalled after 3 months to discuss action taken by GP, interventions adopted and alternative treatment options if none adopted. Further written contact with GP if communication problem.

Control: usual care

Outcomes: Follow-up at 6, 12, 18 and 24 months by postal questionnaire. Primary outcome: fracture reduction. Secondary outcomes: falls, use of medications and hip protectors, number of referrals to specialists for BMD assessment, dietary and life-style changes, quality of life (SF12, EuroQol, fear of falling scale), costs, satisfaction with treatment

Starting date: 01/10/2001

Contact information: Dr David Torgerson

Reader

Director of York Trials Unit

Area 4

Seebohm Rowntree Building

Dept of Health Sciences

University of York

York YO10 5DD

Phone 01904 321340

Fax 01904 321383

(email: djt6@york.ac.uk)

Notes:

Study: VIP trial

Trial name or title: VIP falls prevention trial

Participants: 400 men and women aged 75 years and over with impaired vision (visual acuity 6/24 or less) living in the community, recruited through NZ Foundation for the Blind, hospital and university low vision clinics

Interventions: 1. Otago Exercise Programme (home based balance and strength retraining programme, previously tested in 4 controlled trials in normally sighted older people) delivered by physiotherapists.

2. Home safety programme

Outcomes: All falls and injuries resulting from falls during one year of follow-up

Starting date: October 2002

Contact information: Dr MC Robertson

Senior Research Fellow

Dept of Medical and Surgical Sciences

University of Otago Medical School

PO Box 913

Dunedin

New Zealand

Tel: +64 3 474 7007 ext 8508

Fax: +64 3 474 7641

email: clare.robertson@stonebow.otago.ac.nz

Notes:

Study: Voukelatos

Trial name or title: Central Sydney Tai Chi trial - A randomised control trial investigating the effectiveness of Tai Chi to reduce the risk of falling

Participants: 700 community dwelling elderly people recruited through community newspapers. Inclusion criteria: community dwelling; aged 60 and over. Exclusion criteria: dementia, Parkinson's, Alzheimer's, or other cognitively degenerative disease; blind; crippling arthritis or are unable to walk across a room unaided or with, at most, a walking stick; participated in Tai Chi within the last 12 months.

Interventions: Intervention: 16 week modified beginners Tai Chi programme; one class of 1 hour per week.Controls: waiting list controls received Tai Chi after 6 months.

Outcomes: Number of falls in the study period of 6 months (intervention 4 months plus 2 months follow-up).Secondary outcome measures: balance, leg strength, ankle flexibility, fear of falling (using the falls efficacy scale), and functionality (using the IADL questionnaire)

Starting date: May 2000

Contact information: Alexander Voukelatos,

Health Promotion Unit,

Level 4, Queen Mary Building,

Grose Street, Camperdown,

NSW 2050

Australia

Telephone: +61 2 9515 3358 or +61 2 9515 3350

Fax: +61 2 9515 3351

Email: avouk@email.cs.nsw.gov.au

Notes: Trial funded through the NSW Health, Health Promotion Research Demonstration Grants scheme

Study: Wark

Trial name or title: A vitamin D study in older women in residential care

Participants: 601 residents of nursing homes and assisted living facilities. Exclusion criteria: 25-hydroxyvitamin D levels less than 25 nmol/l or greater than 90 nmol/l

Interventions: Intervention: ergocalciferol (initially 10,000 IU per week, then 1000 IU per day) plus 600 mg of calcium carbonate Control: matching placebo plus 600 mg of calcium carbonate

Outcomes: Falls and fractures recorded in diaries for duration of intervention (2 years).

Compliance monitored by pill counts.

Starting date: January 1996

(complete)

Contact information: Prof John D Wark,

Dept of Medicine, The University of Melbourne,

C/- The Royal Melbourne Hospital

Victoria, 3050

Australia.

Telephone: +61 3 9342 7109

Fax: +61 3 9348 2254

Email: jdwark@unimelb.edu.au

Notes:

ABBREVIATIONS AND ACRONYMS:

A&E: accident and emergency department

ADL: activities of daily living

IADL: instrumental activities of daily living - e.g. use of telephone, shopping, housework, managing finances

MMSE: mini-mental state examination (cognitive assessment)

wk: week

Table 01 Search strategies for CINAHL and EMBASE

CINAHL (OVID ONLINE): 1. exp Clinical Trials/

2. exp Evaluation Research/

3. exp Comparative Studies/

4. exp Crossover Design/

5. clinical trial.pt.

6. or/1-5

7. ((clinical or controlled or comparative or placebo or prospective or randomi#ed) adj3 (trial or study)).tw.

8. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw.

9. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw.

10. (cross?over$ or (cross adj1 over$)).tw.

11. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment $ or therap$ or control$ or group$)).tw.

12. or/7-11

13. or/6,12

14. Accidental Falls/

15. (falls or faller$1).tw.

16. or/14-15

17. exp Aged/

18. (senior$1 or elderly or older).tw.

19. or/17-18

20. and/16,19

21. and/13,20

EMBASE (OVID ONLINE): 1. exp Randomized Controlled trial/

2. exp Double Blind Procedure/

3. exp Single Blind Procedure/

4. exp Crossover Procedure/

5. or/1-4

6. ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed) adj3 (trial or study)).tw.

7. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw.

8. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw.

9. (cross?over$ or (cross adj1 over$)).tw.

10. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment $ or therap$ or control$ or group$)).tw.

11. or/6-10

12. or/10-11

13. Animal/ not Human/

14. 12 not 13

15. Falling/

16. (falls or fallers).tw.

17. or/15-16

18. exp Aged/

19. (elderly or senior$ or older).tw.

20. or/18-19

21. and/17,20

22. and/14,21

Table 02 Quality assessment items and possible scores

Items and scores: Item A: Was the assigned treatment adequately concealed prior to allocation?

3= Method did not allow disclosure of assignment

2= Small but possible chance of disclosure of assignment

1= States random, but no description or quasi-randomised

Items and scores: Item B: Were the outcomes of patients who withdrew described and included in the analysis (intention to treat)?

3= Intention to treat analysis based on all cases randomised possible or carried out

2= States number and reasons for withdrawal but intention to treat analysis not possible

1= Inadequate detail

Items and scores: Item C: Were the outcome assessors blinded to treatment status?

3= Effective action taken to blind assessors

2= Small or moderate chance of unblinding of assessors

1= Not mentioned or not possible

Items and scores: Item D: Were the treatment and control group comparable at entry?

3= Good comparability of groups, or confounding adjusted for in analysis

2= Confounding small; mentioned but not adjusted for

1= Large potential for confounding, or not discussed

Items and scores: Item E: Were the subjects blind to assignment status after allocation?

3= Effective action taken to blind subjects

2= Small or moderate chance of unblinding of subjects

1= Not possible, or not mentioned (unless double-blind), or possible, but not done

Items and scores: Item F: Were the treatment providers blind to assignment status?

3= Effective action taken to blind treatment providers

2= Small or moderate chance of unblinding of treatment providers

1= Not possible, or not mentioned, or possible, but not done

Items and scores: Item G: Were care programmes, other than the trial options, identical?

3= Care programmes clearly identical

2= Clear but trivial differences

1= Not mentioned, or clear and important differences in care programmes

Items and scores: Item H: Were the inclusion and exclusion criteria clearly defined?

3= Clearly defined

2= Poorly defined

1= Not defined

Items and scores: Item J: Were the outcome measures used clearly defined?

3= Clearly defined

2= Poorly defined

1= Not defined

Items and scores: Item K: Was ascertainment of fall and other outcomes reliable?

3= Diary or active registration

2= Interval recall

1= Participant recall at end of study period

Items and scores: Item L: Was the duration of surveillance clinically appropriate?

3= 1 year or more (duration of stay for hospital studies)

2= Less than 1 year

1= Not defined

Table 03 Quality assessment scores

Study id: Armstrong 1996

Item A: 3

Item B: 3

Item C: 2

Item D: 2

Item E: 1

Item F: 1

Study id: Becker 2003

Item A: 3

Item B: 3

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Buchner 1997

Item A: 1

Item B: 3

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Bischoff 2003

Item A: 2

Item B: 3

Item C: 3

Item D: 3

Item E: 3

Item F: 3

Study id: Campbell 1997

Item A: 3

Item B: 3

Item C: 3

Item D: 3

Item E: 1

Item F: 1

Study id: Campbell 1999

Item A: 3

Item B: 3

Item C: 3

Item D: 3

Item E: 2

Item F: 2

Study id: Carpenter 1990

Item A: 1

Item B: 2

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Carter 1997

Item A: 3

Item B: 2

Item C: 2

Item D: 2

Item E: 1

Item F: 1

Study id: Carter 2002

Item A: 2

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Cerny 1998

Item A: 2

Item B: 3

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Close 1999

Item A: 2

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Coleman 1999

Item A: 1

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Cornillon 2002

Item A: 2

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Cumming 1999

Item A: 3

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Dawson-Hughes 1997

Item A: 2

Item B: 3

Item C: 3

Item D: 1

Item E: 3

Item F: 3

Study id: Day 2002

Item A: 3

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Donald 2000

Item A: 2

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Ebrahim 1997

Item A: 3

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Fabacher 1994

Item A: 3

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Fiatarone 1997

Item A: 1

Item B: 2

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Gallagher 1996

Item A: 1

Item B: 1

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Gray-Donald 1995

Item A: 1

Item B: 3

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Hogan 2001

Item A: 3

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Hornbrook 1994

Item A: 1

Item B: 1

Item C: 2

Item D: 3

Item E: 1

Item F: 1

Study id: Jensen 2002

Item A: 3

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Jitapunkul 1998

Item A: 1

Item B: 1

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Kenny 2001

Item A: 1

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Kingston 2001

Item A: 1

Item B: 1

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Latham 2003

Item A: 3

Item B: 3

Item C: 3

Item D: 3

Item E: 3

Item F: 2

Study id: Lightbody 2002

Item A: 2

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Lord 1995

Item A: 2

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Mayo 1994

Item A: 1

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: McMurdo 1997

Item A: 1

Item B: 2

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: McMurdo 2000

Item A: 1

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Means 1996

Item A: 1

Item B: 2

Item C: 3

Item D: 1

Item E: 1

Item F: 1

Study id: Mulrow 1994

Item A: 3

Item B: 2

Item C: 3

Item D: 2

Item E: 2

Item F: 1

Study id: Newbury 2001

Item A: 3

Item B: 1

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Nikolaus 2003

Item A: 2

Item B: 3

Item C: 3

Item D: 2

Item E: 1

Item F: 1

Study id: Nowalk 2001

Item A: 1

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Pardessus 2002

Item A: 2

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Pereira 1998

Item A: 1

Item B: 2

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Pfeifer 2000

Item A: 2

Item B: 2

Item C: 1

Item D: 3

Item E: 3

Item F: 2

Study id: Ray 1997

Item A: 2

Item B: 3

Item C: 3

Item D: 3

Item E: 1

Item F: 1

Study id: Reinsch 1992

Item A: 2

Item B: 2

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Robertson 2001

Item A: 3

Item B: 3

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Rubenstein 1990

Item A: 3

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Rubenstein 2000

Item A: 2

Item B: 3

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Ryan 1996

Item A: 1

Item B: 1

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Sato 1999

Item A: 2

Item B: 2

Item C: 3

Item D: 3

Item E: 3

Item F: 3

Study id: Schnelle 2003

Item A: 2

Item B: 1

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: Shaw 2003

Item A: 3

Item B: 3

Item C: 3

Item D: 3

Item E: 1

Item F: 1

Study id: Steinberg 2000

Item A: 1

Item B: 3

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Stevens 2001

Item A: 2

Item B: 3

Item C: 3

Item D: 3

Item E: 3

Item F: 1

Study id: Tideiksaar 1993

Item A: 1

Item B: 1

Item C: 1

Item D: 1

Item E: 1

Item F: 1

Study id: Tinetti 1994

Item A: 2

Item B: 2

Item C: 2

Item D: 3

Item E: 1

Item F: 1

Study id: van Hastregt 2000

Item A: 1

Item B: 2

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Study id: van Rossum 1993

Item A: 3

Item B: 3

Item C: 2

Item D: 2

Item E: 1

Item F: 1

Study id: Vassallo 2002

Item A: 1

Item B: 1

Item C: 2

Item D: 1

Item E: 1

Item F: 1

Study id: Vellas 1991

Item A: 1

Item B: 1

Item C: 1

Item D: 2

Item E: 3

Item F: 1

Study id: Vetter 1992

Item A: 3

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Wagner 1994

Item A: 2

Item B: 2

Item C: 1

Item D: 2

Item E: 1

Item F: 1

Study id: Wolf 1996

Item A: 2

Item B: 1

Item C: 1

Item D: 3

Item E: 1

Item F: 1

Table 04 Quality assessment scores (continued)

Study id: Armstrong 1996

Item G: 3

Item H: 3

Item J: 2

Item K: 1

Item L: 2

Study id: Becker 2003

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Bischoff 2003

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Study id: Buchner 1997

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Campbell 1997

Item G: 1

Item H: 2

Item J: 3

Item K: 3

Item L: 3

Study id: Campbell 1999

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Carpenter 1990

Item G: 1

Item H: 1

Item J: 1

Item K: 2

Item L: 1

Study id: Carter 1997

Item G: 1

Item H: 3

Item J: 3

Item K: 2

Item L: 3

Study id: Carter 2002

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Study id: Cerny 1998

Item G: 1

Item H: 1

Item J: 1

Item K: 1

Item L: 2

Study id: Close 1999

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Coleman 1999

Item G: 1

Item H: 2

Item J: 1

Item K: 1

Item L: 3

Study id: Cornillon 2002

Item G: 1

Item H: 3

Item J: 1

Item K: 3

Item L: 3

Study id: Cumming 1999

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Dawson-Hughes 1997

Item G: 2

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Day 2002

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Donald 2000

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Ebrahim 1997

Item G: 2

Item H: 3

Item J: 2

Item K: 2

Item L: 3

Study id: Fabacher 1994

Item G: 1

Item H: 3

Item J: 2

Item K: 1

Item L: 3

Study id: Fiatarone 1997

Item G: 3

Item H: 2

Item J: 1

Item K: 2

Item L: 2

Study id: Gallagher 1996

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Study id: Gray-Donald 1995

Item G: 1

Item H: 3

Item J: 3

Item K: 2

Item L: 2

Study id: Hogan 2001

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Hornbrook 1994

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Jensen 2002

Item G: 1

Item H: 1

Item J: 3

Item K: 3

Item L: 3

Study id: Jitapunkul 1998

Item G: 1

Item H: 1

Item J: 1

Item K: 2

Item L: 3

Study id: Kenny 2001

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Kingston 2001

Item G: 1

Item H: 3

Item J: 1

Item K: 1

Item L: 2

Study id: Latham 2003

Item G: 1

Item H: 3

Item J: 2

Item K: 3

Item L: 2

Study id: Lightbody 2002

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Study id: Lord 1995

Item G: 1

Item H: 2

Item J: 3

Item K: 2

Item L: 3

Study id: Mayo 1994

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: McMurdo 1997

Item G: 3

Item H: 1

Item J: 1

Item K: 2

Item L: 3

Study id: McMurdo 2000

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Means 1996

Item G: 1

Item H: 2

Item J: 1

Item K: 2

Item L: 2

Study id: Mulrow 1994

Item G: 2

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Study id: Newbury 2001

Item G: 1

Item H: 1

Item J: 1

Item K: 1

Item L: 3

Study id: Nikolaus 2003

Item G: 1

Item H: 2

Item J: 3

Item K: 3

Item L: 3

Study id: Nowalk 2001

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Pardessus 2002

Item G: 1

Item H: 3

Item J: 1

Item K: 2

Item L: 3

Study id: Pereira 1998

Item G: 2

Item H: 3

Item J: 2

Item K: 1

Item L: 3

Study id: Pfeifer 2000

Item G: 2

Item H: 3

Item J: 3

Item K: 2

Item L: 3

Study id: Ray 1997

Item G: 1

Item H: 3

Item J: 3

Item K: 2

Item L: 3

Study id: Reinsch 1992

Item G: 1

Item H: 1

Item J: 3

Item K: 2

Item L: 3

Study id: Robertson 2001

Item G: 2

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Rubenstein 1990

Item G: 1

Item H: 2

Item J: 2

Item K: 3

Item L: 3

Study id: Rubenstein 2000

Item G: 3

Item H: 3

Item J: 1

Item K: 2

Item L: 2

Study id: Ryan 1996

Item G: 2

Item H: 2

Item J: 2

Item K: 2

Item L: 2

Study id: Sato 1999

Item G: 1

Item H: 3

Item J: 3

Item K: 2

Item L: 3

Study id: Schnelle 2003

Item G: 1

Item H: 3

Item J: 1

Item K: 3

Item L: 2

Study id: Shaw 2003

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Steinberg 2000

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Stevens 2001

Item G: 3

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: Tideiksaar 1993

Item G: 2

Item H: 2

Item J: 2

Item K: 3

Item L: 3

Study id: Tinetti 1994

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 3

Study id: van Haastregt 2000

Item G: 3

Item H: 3

Item J: 1

Item K: 3

Item L: 3

Study id: van Rossum 1993

Item G: 2

Item H: 2

Item J: 2

Item K: 2

Item L: 2

Study id: Vassallo 2002

Item G: 1

Item H: 1

Item J: 2

Item K: 3

Item L: 3

Study id: Vellas 1991

Item G: 1

Item H: 2

Item J: 2

Item K: 1

Item L: 2

Study id: Vetter 1992

Item G: 1

Item H: 2

Item J: 1

Item K: 1

Item L: 3

Study id: Wagner 1994

Item G: 1

Item H: 2

Item J: 3

Item K: 1

Item L: 3

Study id: Wolf 1996

Item G: 1

Item H: 3

Item J: 3

Item K: 3

Item L: 2

Finding Issue 1, 2001 version of the review

There is a reference to a Cochrane Review by the same authors cited in the Journal of the American Geriatrics Society, Vol 51, issue 3, p. 312, titled: Interventions to reduce the incidence of falling in the elderly. IN: The Cochrane Library, Issue 3, Oxford: Update Software, 2001.

We cannot find this article in the Cochrane Reviews. Does this article from Issue 1, 2004 replace the 2001 article?

Yes, the review in Issue 1, 2004 "Interventions for preventing falls in elderly people" is the current version of the review cited in the JAGS paper. The title of this review was changed in Issue 3, 2001. Cochrane reviews are regularly updated to include the latest evidence and therefore the version that appears in The Cochrane Library, will always be the most up to date.

The changes that have been made in the updates are explained in the notes section of the review.

Comment: Penny Logan
Response: Kate Rowntree and Lesley Gillespie

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Dr MC Robertson Senior Research Fellow Dept of Medical and Surgical Sciences University of Otago Medical School PO Box 913 Dunedin New Zealand Tel: +64 3 474 7007 ext 8508 Fax: +64 3 474 7641 email: clare.robertson@stonebow.otago.ac.nz. VIP falls prevention trial. Ongoing study October 2002. [Context Link]

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Medical Subject Headings (MeSH): Human; *Accidental Falls/pc (prevention & control); Accidents, Home/pc (prevention & control); Aged; Environment Design; Exercise; Health Education; Patient Education; Randomized Controlled Trials

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Accession Number: 00075320-100000000-00635
