CLINICAL PRACTICE GUIDELINES

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Clinical practice guideline for the assessment and prevention of falls in older people

Guidelines commissioned by the National Institute for Clinical Excellence (NICE)

November 2004

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NICE guideline on the management of osteoporosis – under development

The NCC-NSC is currently developing a guideline for NICE on osteoporosis. It is suggested that when this guideline is published in 2006, it is used in conjunction with these guidelines on falls prevention.

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Disclaimer

As with any clinical guideline, recommendations may not be appropriate for use in all circumstances. A limitation of a guideline is that it simplifies clinical decision-making (Shiffman 1997). Decisions to adopt any particular recommendations must be made by the practitioners in the light of:

- available resources
- local services, policies and protocols
- the patient's circumstances and wishes
- available personnel and devices
- clinical experience of the practitioner
- knowledge of more recent research findings.

Guideline Development Group membership and acknowledgements

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Terminology

1. *Assessment* refers to the evaluation of risk.
2. Where the term '*carer*' is used, this refers to unpaid carers as opposed to paid carers (for example, care workers).
3. *Cognitive impairment* is defined as mini-mental state examination (MMSE)<24. (Folstein 1975).
4. *Community dwelling* refers to older people living in their own homes.
5. *Extended care* refers to a care facility, such as a nursing home or supported accommodation.
6. *Dementia* – the diagnostic and statistical manual of mental disorders fourth version (DSM-IV, 1994) expresses the internationally prevailing view of the concept of dementia being a form of memory disturbance, with at least one of the following disturbances of aphasia, apraxia, agnosia and disturbance in executive functioning.
7. *A fall* is defined as 'an event whereby an individual comes to rest on the ground or another lower level with or without loss of consciousness' (AGS/BGS 2001).
8. *Home hazard assessment* refers to the assessment of an

older person's home environment and the identification of any hazards that may contribute to that person being at risk of falling.

9. *Injurious fall* refers to a fall resulting in a fracture or soft tissue damage that require treatment.
10. *Multidisciplinary* refers to more than one health care professional from different disciplines.
11. *Multifactorial* is used to describe multiple components or interventions.
12. *An older person* is considered to be someone aged 65 years and above.
13. *Primary prevention* – interventions that are targeted at those at risk or high risk of a fall.
14. *Rehabilitation* – interventions that are targeted at those who have suffered an injurious fall.
15. *Secondary intervention* – interventions that are targeted at those with a history of falls.
16. *Self-efficacy* refers to an older person's perception of their capability. High efficacy relates to increased confidence. This term is referred to in relation to the fear of falling.
17. *Tailored* refers to intervention packages or programmes that are planned to meet the needs of patients.
18. *Targeted* refers to those interventions that are aimed at modifying a particular risk factor.

Abbreviations

Technical terms

ADL	activities of daily living
ARR	absolute relative risk
CAP	client assessed protocol
CI	confidence intervals
FES	falls efficacy scale
GDG	Guideline Development Group
HC	home care
HTA	health technology assessment
NNT	number needed to treat
RAI	residential assessment instrument
RAP	resident assessed protocol
RCT	randomised controlled trial
RR	relative risk

Organisations

DH	Department of Health
MHRA	Medicines and Healthcare Products Regulatory Agency (formerly Medical Devices Agency)
NCC-NSC	National Collaborating Centre for Nursing and Supportive Care
NICE	National Institute for Clinical Excellence
RCN	Royal College of Nursing
SCHARR	School of Health and Related Research

General glossary

Partially based on *Clinical epidemiology glossary* by the Evidence Based Medicine Working Group, www.ed.ualberta.ca/ebm; *Information for national collaborating centres and guideline development groups (NICE 2001).*

Absolute risk reduction: The difference between the observed event rates (proportions of individuals with the outcome of interest) in the two groups.

Benefit: Health or other quality of life gain resulting from an intervention. See 'health benefit'. May also refer to economic benefit.

Bootstrapping: Non-parametric simulation process that involves random re-sampling *with replacement* from the original data to estimate p values, standard error and confidence intervals.

Bias: May result from flaws in the design of a study or in the analysis of results and may result in either an underestimate or an overestimate of the effect.

Capital costs: Major capital assets, generally equipment, buildings and land. They represent investments at a single point in time.

Case-control study: A study in which the effects of an exposure in a group of patients, (cases) who have a particular condition, are compared with the effects of the exposure in a similar group of people who do not have the clinical condition – the latter is called the control group.

Clinical effectiveness: The extent to which an intervention – for example, a device or treatment – produces health benefits, in other words, more good than harm.

Cochrane collaboration: An international organisation in which people retrieve, appraise and review available evidence of the effect of interventions in health care. The Cochrane Database of Systematic Reviews contains regularly updated reviews on a variety of issues. The

Cochrane Library contains the Central Register of Controlled Trials (CENTRAL) and a number of other databases that are regularly updated. It is available as CD-Rom or on the internet (www.cochranelibrary.com).

Cohort study: Follow-up of exposed and non-exposed groups of patients – the 'exposure' is either a treatment or condition – with a comparison of outcomes during the time followed-up.

Co-interventions: Interventions/treatments etc other than the treatment under study that are applied differently to the treatment and control groups.

Co-morbidity: Co-existence of a disease or diseases in a study population in addition to the condition that is the subject of study.

Comparator: The standard intervention against which the intervention under appraisal is compared. The comparator can be no intervention, for example, best supportive care.

Confidence interval (CI): The ranges of numerical values in which we can be confident that the population value being estimated were found. Confidence intervals indicate the strength of evidence; where confidence intervals are wide they indicate less precise estimates of effects.

Cost benefit analysis: An economic analysis that expresses both costs and outcomes in monetary terms. Benefits are valued in monetary terms, using valuations of people's observed or stated preferences, for example, the willingness-to-pay approach.

Cost consequences: The amount of money that will need to be spent as a result of the implementation of the guidance.

Cost effectiveness acceptability curves: Graphs that plot the costs per extra unit of effect of an intervention on the x axis against the probability (chance) of these values being achieved on the y axis. In technology appraisals, cost effectiveness acceptability curves assist in the decision-making process.

Cost effectiveness analysis: An economic study design in which consequences of different interventions may vary but can be measured using the same clinical outcome measure. Alternative interventions are then compared in terms of cost per unit of effectiveness.

Cost effectiveness: The cost per unit of benefit of an intervention. In cost effectiveness analysis, the outcomes of different interventions are converted into health gains for which a cost can be associated.

Cost effectiveness modelling: A synthesis of inputs from various sources in order to calculate an estimate of costs and/or benefits.

Cost effectiveness plane: A graphical illustration of cost effectiveness. The horizontal axis represents the difference in effect between the intervention of interest and the comparator. The vertical axis represents the difference in cost.

Cost impact: The total cost to the person, the NHS or to society.

Cost utility analysis: A form of cost effectiveness analysis in which utility is measured and the units of effectiveness are quality-adjusted life-years (QALYs).

Decision analytic model (decision tree): A systematic way of reaching decisions, based on evidence from research. This evidence is translated into probabilities and then into diagrams or decision trees that direct the clinician through a succession of possible scenarios, actions and outcomes. The main disadvantage is that they are not suited to represent multiple outcome events that recur over time.

Discounting: The process of converting future pounds and future health outcomes to their present value.

Dominance: The dominant intervention is the intervention with the highest effectiveness and lowest costs compared with the alternatives.

Economic evaluation: Comparative analysis of alternative courses of action in terms of both their costs and consequences.

Effectiveness: The extent to which interventions achieve health improvements in real practice settings.

Efficacy: The extent to which medical interventions achieve health improvements under ideal circumstances.

Epidemiological study: A study that looks at how a disease or clinical condition is distributed across geographical areas.

Equity: Fair distribution of resources or benefits.

Extended dominance: The incremental cost effectiveness ratio for a given treatment alternative is higher than that of the next, more effective, alternative.

Extrinsic: Factors that are external to the individual.

Follow-up: Observation over a period of time of an individual, group or population whose relevant characteristics have been assessed in order to observe changes in health status or health-related variables.

Gold standard: A reference standard for evaluation of a diagnostic test. For the purposes of a study, the gold standard test is assumed to have 100 per cent sensitivity and specificity. Choice of the gold standard must therefore be evaluated in appraising a diagnosis study.

Health professional: Includes nurses, allied health professionals and doctors.

Health related quality of life (HRQoL): A combination of an individual's physical, mental and social well-being; not merely the absence of disease. See 'quality of life.'

Health technology assessment: The process by which evidence on the clinical effectiveness and the costs and benefits of using a technology in clinical practice is systematically evaluated.

Healthy years equivalent: A measure of health-related quality of life used in cost-utility analysis. It is the hypothetical number of years spent in perfect health that could be considered equivalent to the actual number of years spent in a defined imperfect health state. It differs from a QALY because not only is it based on the individual's preferences for the duration of life, but also on the individual's preference for the states of health.

Incremental cost effectiveness ratio (ICER): The incremental cost effectiveness ratio is obtained by dividing the cost differences between two treatments by the outcome differences.

Incidence: The number of new cases of illness commencing, or of persons falling ill during a specified time period in a given population.

Incremental cost: The difference between marginal costs of alternative interventions.

Incremental analysis: The analysis of additional costs and additional clinical outcomes with different interventions.

Intrinsic: Factors present within the individual.

Logistic regression model: A data analysis technique to derive an equation to predict the probability of an event given one or more predictor variables. This model assumes that the natural logarithm of the odds for the event (the logit) is a linear sum of weighted values of the predictor variable. The weights are derived from data using the method of maximum likelihood.

Marginal analysis: The additional costs and additional outcome that can be obtained from one additional unit of service (for example, one extra day in hospital or additional tests).

Meta-analysis: A statistical method of summarising the results from a group of similar studies.

Monte Carlo simulation: Monte Carlo simulation randomly generates values for uncertain model input variables over and over to simulate a distribution of outputs for model.

Multivariate model: A mathematical model for analysis of the relationship between two or more predictor (independent) variables and the outcome (dependent) variable.

Number needed to treat: The number of patients who need to be treated to prevent one event.

Odds ratio: Odds in favour of being exposed in subjects with the target disorder divided by the odds in favour of being exposed in control subjects (without the target disorder).

Opportunity costs: The opportunity cost of investing in a health care intervention is best measured by the health benefits (such as life-years saved, or quality-adjusted life years gained) that could have been achieved had the money been spent on the next best alternative intervention or care. It also includes lost opportunity for other health care programmes that may be displaced by the introduction of the new technology.

Predictive validity: A risk assessment tool would have high predictive validity if the predictions it makes of the risk of falling in a sample became true – that is it has both high sensitivity and specificity.

Prevalence: The proportion of persons with a particular disease within a given population at a given time.

Quality adjusted life expectancy: Life expectancy using quality adjusted life years rather than nominal life years.

Quality adjusted life years (QALYs): A measure of health outcome that assigns to each time period a weight. This ranges from 0-1, corresponding to the health-related quality of life during that period, where a weight of 1 corresponds to optimal health, and a weight of 0 corresponds to a health state judged as equivalent to death. These are then aggregated across time periods.

Randomised controlled trial (RCT): A clinical trial in which the treatments are randomly assigned to subjects. The random allocation eliminates bias in the assignment of treatment to patients and establishes the basis for the statistical analysis.

Relative risk: An estimate of the magnitude of an association between exposure and disease, which also indicates the likelihood of developing the disease among persons who are exposed, relative to those who are not. It is defined as the ratio of incidence of disease in the exposed group, divided by the corresponding incidence in the non- exposed group.

Retrospective cohort study: A study in which a defined group of persons with an exposure and an appropriate comparison group who are not exposed are identified retrospectively and followed from the time of exposure to the present. The incidence – or mortality – rates for the exposed and unexposed are assessed.

Sensitivity: Percentage of those who developed a condition who were predicted to be at risk.

Sensitivity analysis: Allows for uncertainty in economic evaluations. Uncertainty may arise from missing data, imprecise estimates, or methodological controversy. Sensitivity analysis also allows for exploring the generalisability of results to other settings. The analysis is repeated using different assumptions to examine the effect on the results.

Specificity: Percentage of those correctly predicted not to be at risk.

Systematic review: A way of finding, assessing and using evidence from studies – usually RCTs – to obtain a reliable overview.

User: Anyone using the guideline.

Validity: The extent to which a variable or intervention measures what it is supposed to measure or accomplish:

- **Internal validity** – of a study refers to the integrity of the design;
- **External validity** – of a study refers to the appropriateness by which its results can be applied to non-study patients or populations.

1 Executive summary

The National Institute for Clinical Excellence (NICE) commissioned the National Collaborating Centre for Nursing and Supportive Care (NCC-NSC) to develop guidelines on the assessment and prevention of falls in older people. This follows referral of the topic by the Department of Health and Welsh Assembly Government. This document describes the methods for developing the guidelines and presents the resulting recommendations. It is the source document for the NICE (abbreviated version for health professionals) and *Information for the public* (patient) versions of the guidelines that are published by NICE. A multidisciplinary Guideline Development Group produced the guidelines and the development process was undertaken by the NCC-NSC.

The main areas examined by the guideline were:

- The evidence for factors that increase the risk of falling.
- The most effective methods of assessment and identification of older people at risk of falling.
- The most clinically and cost effective interventions and preventative strategies for the prevention of falls.
- The clinical effectiveness of hip protectors for the prevention of hip fracture.
- The most clinically and cost effective interventions and rehabilitation programmes for the prevention of further falls.
- Older peoples' views and experiences of falls prevention strategies and programmes.

Recommendations for good practice based on the best available evidence of clinical and cost effectiveness are presented.

Evidence published after October 2003 was not considered.

Health care professionals should use their clinical judgement and consult with patients when applying the recommendations, which aim to reduce the negative physical, social and financial impact of falling.

A version for health professionals (NICE version) and a version for patients and carers (*Information for the public*) are also available.

Guidelines on osteoporosis are currently being developed by NICE and should be referred to in conjunction with this guideline when published (2006). In addition, guidelines on the management of dementia are being developed by NICE and will be published in 2006.

2 Principles of practice and summary of guideline recommendations

2.1 Principles of practice

The principles outlined below describe the ideal context in which to implement the recommendations in this guideline. These have been adapted from the NICE clinical practice guideline: *Pressure ulcer prevention* (2003). These principles were submitted to a consensus process and were refined, following Guideline Development Group feedback.

Person-centred care

- Patients and their carers should be made aware of the guideline and its recommendations and be referred to NICE's version, *Information for the public*.
- Patients and their carers should be involved in shared decision-making about individualised falls prevention strategies.
- Health care professionals are advised to respect and incorporate the knowledge and experience of people who have been at long-term risk of falling and have been self-managing this risk.
- Patients and their carers should be informed about their risk of falling, especially when they are transferred between care settings or discharged home from hospital settings.

A collaborative multidisciplinary approach to care

- All members of the multidisciplinary team should be aware of the guideline and all care should be documented in the patient's health care records.

Organisational issues

- An integrated approach to falls prevention with a clear strategy and policy should be implemented. It should be operationally linked to bone health (osteoporosis) and cardiac pacing services in such a way as to avoid duplication.
- Care should be delivered in a context of continuous quality improvement, where improvements to care following guideline implementation are the subject of regular feedback and audit.
- Commitment to and availability of education and training are needed to ensure that all staff, regardless of profession, are given the opportunity to update their knowledge base and are able to implement the guideline recommendations.
- Patients should be cared for by personnel who have undergone appropriate training and who know how to initiate and maintain correct and suitable preventative measures. Staffing levels and skill mix should reflect the needs of patients.

2.2 Summary of guideline recommendations

(please refer to Sections 5.13 and 5.14 for system used to grade recommendations)

1.1 Case/risk identification

1.1.1 Older people in contact with health care professionals should be asked routinely whether they have fallen in the past year and asked about the frequency, context and characteristics of the fall/s. [C]

1.1.2 Older people reporting a fall or considered at risk of falling should be observed for balance and gait deficits and considered for their ability to benefit from interventions to improve strength and balance. (Tests of balance and gait commonly used in the UK are detailed in the full guideline, see Section 5.) [C]

1.2 Multifactorial falls risk assessment

1.2.1 Older people who present for medical attention because of a fall, or report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should be offered a multifactorial falls risk assessment. This assessment should be performed by a health care professional with appropriate skills and experience, normally in the setting of a specialist falls service. This assessment should be part of an individualised, multifactorial intervention. [C]

1.2.2 Multifactorial assessment may include the following: [C]

- identification of falls history
- assessment of gait, balance and mobility, and muscle weakness
- assessment of osteoporosis risk
- assessment of the older person's perceived functional ability and fear relating to falling
- assessment of visual impairment
- assessment of cognitive impairment and neurological examination
- assessment of urinary incontinence
- assessment of home hazards

- cardiovascular examination and medication review.

1.3 Multifactorial interventions

1.3.1 All older people with recurrent falls or assessed as being at increased risk of falling should be considered for an individualised multifactorial intervention. [A]

In successful multifactorial intervention programmes the following specific components are common – against a background of the general diagnosis and management of causes and recognised risk factors: [A]

- strength and balance training
- home hazard assessment and intervention
- vision assessment and referral
- medication review with modification/withdrawal.

1.3.2 Following treatment for an injurious fall, older people should be offered a multidisciplinary assessment to identify and address future risk and individualised intervention aimed at promoting independence and improving physical and psychological function. [A]

1.4 Strength and balance training

1.4.1 Strength and balance training is recommended. Those most likely to benefit are older community-dwelling people with a history of recurrent falls and/or balance and gait deficit. A muscle-strengthening and balance programme should be offered. This should be individually prescribed and monitored by an appropriately trained professional. [A]

1.5 Exercise in extended care settings

1.5.1 Multifactorial interventions with an exercise component are recommended for older people in extended care settings who are at risk of falling. [A]

1.6 Home hazard and safety intervention

1.6.1 Older people who have received treatment in hospital following a fall should be offered a home hazard assessment and safety intervention/modifications by a suitably trained health care professional. Normally this should be part of discharge planning and be carried out within a timescale agreed by the patient or carer, and appropriate members of the health care team. [A]

1.6.2 Home hazard assessment is shown to be effective only in conjunction with follow-up and intervention, not in isolation. [A]

1.7 Psychotropic medications

1.7.1 Older people on psychotropic medications should have their medication reviewed, with specialist input if appropriate, and discontinued if possible to reduce their risk of falling. [B]

1.8 Cardiac pacing

1.8.1 Cardiac pacing should be considered for older people with cardioinhibitory carotid sinus hypersensitivity, who have experienced unexplained falls. [B]

1.9 Encouraging the participation of older people in falls prevention programmes

1.9.1 To promote the participation of older people in falls prevention programmes the following should be considered. [D]

- Health care professionals involved in the assessment and prevention of falls should discuss what changes a person is willing to make to prevent falls.
- Information should be relevant and available in languages other than English.
- Falls prevention programmes should also address potential barriers, such as low self-efficacy and fear of falling, and encourage activity change as negotiated with the participant.

1.9.2 Practitioners who are involved in developing falls prevention programmes should ensure that such programmes are flexible enough to accommodate participants' different needs and preferences and should promote the social value of such programmes. [D]

1.10 Education and information-giving

1.10.1 All health care professionals dealing with patients known to be at risk of falling should develop and maintain basic professional competence in falls assessment and prevention. [D]

1.10.2 Individuals at risk of falling, and their carers, should be offered information, both orally and in writing about: [D]

- what measures they can take to prevent further falls
- how to stay motivated if referred for falls prevention strategies that include exercise or strength and balancing components
- the preventable nature of some falls
- the physical and psychological benefits of modifying falls risk
- where they can seek further advice and assistance

- how to cope if they have a fall, including how to summon help and how to avoid a long lie.

1.11 Interventions that cannot be recommended

1.11.1 Brisk walking

There is no evidence that brisk walking reduces the risk of falling. One trial showed that an unsupervised brisk walking programme increased the risk of falling in postmenopausal women with an upper limb fracture in the previous year. However, there may be other health benefits of brisk walking by older people. (Level I)

1.12 Interventions that cannot be recommended because of insufficient evidence

We do not recommend implementation of the following interventions at present. This is not because there is strong evidence against them, but because there is insufficient or conflicting evidence supporting them.

1.12.1 **Low intensity exercise combined with incontinence programmes.** There is no evidence that low intensity exercise interventions, combined with continence promotion programmes, reduce the incidence of falls in older people in extended care settings.

1.12.2 **Group exercise (untargeted).** Exercise in groups should not be discouraged as a means of health promotion, but there is little evidence that exercise interventions that were not individually prescribed for community-dwelling older people are effective in falls prevention.

1.12.3 **Cognitive/behavioural interventions.** There is no evidence that cognitive/behavioural interventions alone reduce the incidence of falls in community-dwelling older people of unknown risk status. Such interventions include risk assessment with feedback and counselling and individual education discussions. There is no evidence that complex interventions – in which group activities including education, a behaviour modification programme aimed at moderating risk, advice and exercise interventions – are effective in falls prevention with community-dwelling older people.

1.12.4 **Referral for correction of visual impairment.** There is no evidence that referral for correction of vision as a single intervention for community-dwelling older people is effective in reducing the number of people falling. However, vision assessment and referral has been a component of successful multifactorial falls prevention programmes.

1.12.5 **Vitamin D.** There is evidence that vitamin D deficiency and insufficiency are common among older people and that, when present, they impair muscle strength and possibly neuromuscular function, via CNS-mediated pathways. In addition, the use of combined calcium and vitamin D3 supplementation has been found to reduce fracture rates in older people in residential/nursing homes and sheltered accommodation. Although there is emerging evidence that correction of vitamin D deficiency or insufficiency may reduce the propensity for falling, there is uncertainty about the relative contribution to fracture reduction via this mechanism (as opposed to bone mass) and about the dose and route of administration required. Therefore currently no firm recommendation can be made on its use for this indication. Guidance on the use of vitamin D for fracture prevention will be contained in the forthcoming NICE clinical practice guideline on osteoporosis, which is currently under development.

1.12.6 **Hip protectors.** Reported trials that have used individual patient randomisation have provided no evidence for the effectiveness of hip protectors to prevent fractures when offered to older people living in extended care settings or in their own homes. Data from cluster randomised trials provide some evidence that hip protectors are effective in the prevention of hip fractures in older people living in extended care settings, who are considered at high risk.

3 Background to the current guideline

In March 2002, the National Collaborating Centre for Nursing and Supportive Care (NCC-NSC) was commissioned by NICE to develop clinical guideline on the assessment and prevention of falls in older people for use in the NHS in England and Wales. The remit from the DH and Welsh Assembly Government was as follows:

> *To prepare clinical guidelines for the NHS in England and Wales for the assessment and prevention of falls, including recurrent falls in older people; with an associated clinical audit system.*

Clinical need

Falls are a major cause of disability and the leading cause of mortality resulting from injury in people aged above 75 in the UK (Scuffham & Chaplin 2002). Furthermore, more than 400,000 older people in England attend accident and emergency departments following an accident, while up to 14,000 people die annually in the UK as a result of an osteoporotic hip fracture (National Service Framework for Older People 2001). It's clear that falling has an impact on quality of life, health and health care costs.

Falls are not an inevitable result of ageing, but they do pose a serious concern to many older people and to the health system. Older people have a higher risk of accidental injury that results in hospitalisation or death than any other age group (Cryer 2001). The Royal Society for the Prevention of Accidents (ROSPA) estimates that one in three people aged 65 years and over experience a fall at least once a year – rising to one in two among 80 year-olds and older. Although most falls result in no serious injury, approximately 5 per cent of older people in community-dwelling settings who fall in a given year experience a fracture or require hospitalisation (Rubenstein et al. 2001).

Incidence rates for falls in nursing homes and hospitals are two to three times greater than in the community and complication rates are also considerably higher. Ten to 25 per cent of institutional falls result in fracture, laceration or need for hospital care (Rubenstein 2001).

The key issue of concern is not simply the high incidence of falls in older people – since children and athletes have a very high incidence of falls – but rather the combination of a high incidence and a high susceptibility to injury (Rubenstein 2001). In 1999, there were 647,721 A&E attendances and 204,424 admissions to hospital for fall-related injuries in the UK population aged 60 years or over (Scuffham and Chaplin 2002). The associated cost of these falls to the NHS and PSS was £908.9 million and 63 per cent of these costs were incurred from falls in those aged 75 years and over (Scuffham and Chaplin 2002). In addition, 86, 000 hip fractures occur annually in the UK (Torgerson 2001) and 95 per cent of hip fractures are the result of a fall (Youm 1999). Although only 5 per cent of falls result in fracture (Tinetti 1988), the total annual cost of these fractures to the NHS has been calculated as £1.7 billion (Torgerson 2001) with many individuals losing independence and quality of life (Cooper 1993). Some older people have stated that they would rather die than fracture their hip and have to live in a nursing home (Salkeld 2000).

Although most falls do not result in serious injury, the consequences for an individual of falling or of not being able to get up after a fall can include:

- psychological problems, for example, a fear of falling and loss of confidence in being able to move about safely
- loss of mobility, leading to social isolation and depression
- increase in dependency and disability
- hypothermia
- pressure-related injury
- infection.

Falls have a multifactorial aetiology, with more than 400 separate risk factors described (Oliver 2000). The major risk factors for falling are diverse, and many of them – such as balance impairment, muscle weakness, polypharmacy and environmental hazards – are potentially modifiable. Since the risk of falling appears to increase with the number of risk factors, multifactorial interventions have been suggested as the most effective strategy to reduce declines in function and independence and also to prevent the associated costs of complications (Gillespie et al. 2001).

Preventive programmes based on risk factors for falling include exercise programmes, education programmes, medication review, environmental modification in homes or institutions and nutritional or hormonal supplementation (Cummings et al. 2001).

Interventions need to target extrinsic factors such as hazards within the home environment and intrinsic risk factors, such as mobility, strength, gait, medicine use and sensory impairment (HDA 2002). Numerous interventions have been studied in the prevention of falls. Few trials have been carried out in the UK.

The prevention and management of falls in older people is a key Government target in reducing morbidity and mortality. This is outlined in the National Service Framework (NSF) for England, standard six for older people, which covers falls and specifically aims to:

> *'reduce the number of falls which result in serious injury and ensure effective treatment and rehabilitation for those who have fallen' (NSF 2001).*

The NSF also outlines key changes needed to reduce the number of falls and their impact by:

a) prevention – including the prevention and treatment of osteoporosis

b) improving the diagnosis, care and treatment of those who have fallen

c) rehabilitation and long-term support

d) ensuring that older people who have fallen receive effective treatment and rehabilitation

e) ensuring that patients and their carers receive advice on prevention, through a specialised falls service.

In the light of the serious and costly impact of falls in the community and long-term care setting among older people, plus the potential of interventions to positively influence this problem, risk assessment and preventative interventions were selected as the focus for this NICE guideline.

These guidelines will support the implementation of standards two and six of the National Service Framework for Older People in England (2001).

4 Aims of the guideline

- To evaluate and summarise the evidence for assessing and preventing falls in older people.
- To highlight gaps in the research evidence.
- To formulate evidence-based and, where possible, clinical practice recommendations on the assessment of older people and prevention of falls in older people based on the best evidence available to the GDG.
- To provide audit criteria to assist with the implementation of the recommendations.

4.1 Who the guideline is for

As detailed in the guideline scope, the guideline is of relevance to:

- those older people – aged 65 and above – who are vulnerable to or at risk of falling
- families and carers
- health care professionals who share in caring for those who are vulnerable or at risk of falling
- those responsible for service delivery.

4.2 Groups covered by the guideline

The recommendations made in the guideline cover the care of older people:

a) in the community or extended care, who are at risk of falling or who have fallen

b) who attend primary or secondary care settings, following a fall.

4.3 Groups not covered

The following groups are not covered by this guideline:

a) hospitalised patients who sustain a fall while in hospital or who may be at risk of falling during hospitalisation

b) people who are confined to bed for the long-term.

4.4 Health care setting

This guideline makes recommendations on the care given by health care professionals who have direct contact with and make decisions concerning the care of older people who have fallen or are at risk of falling.

It also makes recommendations on the care given by health care professionals or carers where applicable, involved in the care of older people who have been taken to hospital following a fall.

This is an NHS guideline, but also addresses the interface with other services, such as those provided by social services, secure settings, care homes and the voluntary sector. It does not include services exclusive to these sectors.

4.5 Interventions covered

The following interventions are covered:

- exercise, including balance training
- multifactorial interventions – packages of care, for example, exercise, education and home modifications
- vision assessment and correction of impaired vision
- home hazard assessment and modification
- patient and staff education
- medication review
- hip protectors
- rehabilitation strategies.

Podiatric interventions were in the scope of the guideline, however no controlled trials were identified with falls as an outcome.

Recommendations also take account of the psychosocial aspects of falling, including fear of falling and loss of confidence resulting from a fall.

4.6 Interventions not covered

- The prevention and treatment of osteoporosis (currently guidelines on this area are being developed by NICE).
- The management of hip and other fractures.
- The prevention of falls in acute settings.

4.7 Audit support within guideline

The guideline provides audit criteria and advice (see page 80).

4.8 Guideline Development Group

The guideline recommendations were developed by a multidisciplinary and lay GDG convened by the NICE-funded NCC-NSC, with membership approved by NICE. Members include representatives from:

- nursing
- general practice
- allied health
- NSF working party
- falls researchers
- falls clinicians
- patient groups.

A list of GDG members is attached (Appendix A). The GDG met eight times between September 2002 and December 2003.

All members of the GDG were required to make formal declarations of interest at the outset, which were recorded. GDG members were also asked to declare interests at the beginning of each GDG meeting. This information is recorded in the meeting minutes and kept on file at the NCC-NSC.

5 Methods used to develop the guideline

This section describes the systematic review methods used to inform the clinical questions. Results are presented that provided the basis for the evidence statements and recommendations, which are reported in Section 6.

5.1 Summary of development process

The methods used to develop this guideline are based on those outlined by Eccles and Mason (2001) and in the draft NICE technical manual. The structure of the recommendations section (Section 6) – that is recommendations; evidence statements, evidence narrative and GDG commentary – came from McIntosh et al. (2001).

The following sources of evidence were used to inform the guideline:

The Cochrane reviews: a) *Interventions for the prevention of falls in older people* (Gillespie et al. 2003) and b) *Hip protectors for the prevention of hip fractures* (Parker et al. 2003).

American Geriatric Society/British Geriatric Society (2001) clinical guidelines that were based on the systematic review *Falls prevention interventions in the Medicare population* (Shekelle et al. 2002).

Analysis of epidemiological data relating to risk factors (NCC-NSC).

Reviews of assessment processes, tools, tests and instruments for identifying those at risk (NCC-NSC).

Review of studies examining patients' views and experiences of falls prevention programmes and methods to maximise participation (NCC-NSC).

Reviews of studies on fear of falling and interventions to reduce the psychosocial consequences of falling (NCC-NSC).

Reviews of the evidence on costs and economic evaluations (SCHARR).

Reviews of rehabilitation strategies (NCC-NSC).

The stages used to develop this guideline were as follows:

- develop scope of guideline
- convene multidisciplinary GDG
- review questions set
- identify sources of evidence
- retrieve potential evidence
- evaluate potential evidence
- utilise the updated Cochrane reviews – Interventions for preventing falls in older people (2003) and Hip protectors (2003)
- utilise the AGS/BGS clinical guidelines and Shekelle systematic review (2002)
- undertake systematic review on guideline areas not covered by either the Cochrane review, AGS/BGS guidelines and Shekelle review
- extract relevant data from studies meeting methodological and clinical criteria
- interpret each paper, taking into account the results including, where reported, the beneficial and adverse effects of the interventions; cost; acceptability to patients; level of evidence; quality of studies; size and precision of effect; and relevance and generalisability of included studies to the scope of the guideline
- prepare evidence reviews and tables that summarise and grade the body of evidence
- formulate conclusions about the body of available evidence, based on the evidence reviews, by taking into account the factors above
- agree final recommendations and apply recommendation gradings
- submit first drafts – short and full versions – of guidelines for feedback from NICE registered stakeholders
- GDC to consider stakeholders' comments, following first stage consultation
- submit final drafts of all guideline versions – including *Information for the public* version and algorithm – to NICE for second stage of consultation
- GDG to consider stakeholders' comments
- final copy submitted to NICE.

Questions addressed by the evidence reviews included:

– What is the best method of identifying those at highest risk of a first or subsequent fall? *(Source of evidence: risk factor evidence review)*

– What assessment tool or process should be used to identify modifiable risk factors for falling? *(Source of evidence: assessment evidence review)*

– What are the most clinically effective and cost effective methods for falls prevention? *(Source of evidence: clinical and cost effectiveness reviews)*

- What interventions are there to reduce the psychosocial consequences of falling? (*Source of evidence: Cochrane review*)
- What is the evidence for the effectiveness of hip protectors? (*Cochrane review*)
- What is the best method for maximising participation and compliance in falls prevention programmes and modification of specific risk factors, for example, medication withdrawal/review? (*Source of evidence: patients' views and experiences*)
- Are falls prevention programmes acceptable to patients? (*Source of evidence: patients' views and experiences review*)
- What is the best method of rehabilitation/intervention/process of care following a fall requiring treatment? (*Source of evidence: rehabilitation review, hip protector review and Cochrane falls prevention review*)

The methods and the main results for each review are reported in Sections 5.2 to 5.11. The detailed evidence summaries – including economic evidence, where relevant – evidence statements, GDG considerations and recommendations are in Section 6.

5.2 Risk factors for falling: review methods and results

5.2.1 Background

To identify those at risk of falling, it is necessary to review the evidence base for risk factors, looking at older people in both community dwelling and residential/extended care settings. Although some risk factors are intuitive, an examination of the empirical evidence provides a comprehensive and thorough overview, with information on the risk factors that should be considered for inclusion in screening/assessment tools and protocols.

Because the literature in this area is vast, the evidence statements and recommendations presented in the American and British Geriatric Society (AGS/BGS) 2001 guidelines, and an analytic review by Perell et al. (2001) formed the foundation for the current review. The Perell review provided information on the assessment of older people at risk and a summary of the risk factors predictive of falling.

This section reports the findings of these key documents and the review of evidence undertaken to update these documents.

Although risk factors for subsequent falls have 'face validity' (Colon-Emeric & Laing 2002), interpretation of the evidence base is often problematic. A variety of study designs have been employed to study this topic, with resulting issues of bias and confounding. This means that summarising such studies is challenging. Furthermore, there is no formal guidance on how best to review the risk factor evidence base.

The gold standard approach for researching risk factors is to carry out a prospective cohort study, in which predictors or risk factors are recorded at baseline, and participants are followed-up, with falls outcomes measured. Often study designs, such as case-control and cross-sectional, are used but these are more susceptible to confounding and other biases (Eggar et al. 2001).

Therefore, to build on the existing evidence base (provided by the AGS/BGS guidelines and the Perell review), we restricted the review to evidence from prospective cohort studies. This decision was made following initial screening of search results, which indicated that many different study designs have been used to attempt to identify risk factors, and after consultation with methodological experts. The time and resources available to undertake an evidence review on this complex topic (and assessment tools – see Section 2) also provided further justification for restricting the study design criteria.

5.2.2 Objectives

The review sought to answer the following question:

What are the key risk factors that should be used to identify those at highest risk of a first or subsequent fall?

5.2.3 Selection criteria

Types of studies

Reviews of risk factors with preference given to systematic reviews.

Prospective cohort studies of risk factors of falls in older people who are either community-dwelling or living in extended care settings.

Types of participants

Older people aged 65 and over.

Types of outcome

Those studies that report falls as an outcome.

Risk factors that were conceptually relevant.

Explicit details of how risk factors were measured.

5.2.4 Search strategy

Twelve electronic databases were searched between 1998 and December 2002, using a sensitive search strategy – used for both the risk factor and risk assessment review questions. The bibliographies of all retrieved and relevant publications were searched for further studies.

Following guidance from NICE, we searched from the present, looking back over a five-year period, to assess the likely volume of papers that would require eligibility assessment and critical appraisal. The volume of papers requiring screening and appraisal was considerable. As we were contributing to existing evidence bases (Perell 2001; AGS/BGS 2001), which would have captured the key studies prior to 1998, no further searching was carried out.

Hand searching was not undertaken following NICE advice that exhaustive searching on every guideline review topic is not practical and efficient (Mason et al. 2002). (Note: this applies to all reviews reported here, except for the Cochrane reviews summarised here).

Reference lists of articles were checked for articles of potential relevance (Note: this was done for all reviews reported in this guideline and will not be repeated in other methods sections).

The search strategies and the databases searched are presented in Appendix B. All searches were comprehensive and included a large number of databases.

5.2.5 Sifting process

Once articles were retrieved the following sifting process took place:

- First sift: for material that potentially meets eligibility criteria on basis of title/abstract by one reviewer.
- Second sift: full papers ordered that appear relevant and eligible and where relevance/eligibility not clear from the abstract.
- Third sift: one reviewer appraised full articles that met eligibility criteria. Time did not allow for an independent reviewer to identify and appraise studies.

(Note: this sifting process applies to all of the non-Cochrane reviews reported in this document and will not be repeated).

5.2.6 Data abstraction

Papers were screened for relevance and prospective cohort studies identified. Methodological quality was assessed using pre-defined principles as outlined in 5.2.7 and epidemiological appraisal criteria, which were adapted for this review. Data were extracted by a single reviewer and evidence tables compiled.

The following information was extracted:

Author, setting, number of participants at baseline and follow-up, methods and details of baseline and outcome measurement, results including summary statistics and 95 per cent confidence intervals, and comments made on the methodological quality.

Masked assessment – whereby data extractors are blind to the details of journal, authors etc – was not undertaken because there is no evidence to support the claim that this minimises bias.

5.2.7 Appraisal of methodological quality

Each study was assessed against the following quality criteria:

Selection

Cohort of eligible older people with well defined demographic information.

High recruitment rate of participants equal to or greater than 80 per cent of those approached.

Identification of risk factors

Risk factors conceptually relevant.

Explicit details of how risk factor information is measured.

Confounding

Statistical adjustment carried out/ sensitivity analysis.

Analytic methods described.

Follow-up/outcomes

Method of measurement of outcome given.

Where quality was low, this is indicated in the evidence tables (Evidence table 1).

5.2.8 Data synthesis

No quantitative analysis was carried out for this review. Summary statistics and vote counting of statistical significance for each risk factor were reported in the evidence tables.

5.2.9 Details of studies included in the review

Results of the search and sift are shown in Table 1 below.

Table 1: Sifting results for risk factor review

Initial search results	1396
N screened for relevance following sift	223
N identified as relevant	37
N included	28
N excluded	9

Participants and settings

Most studies reported findings from community-dwelling participants with varying sample sizes, method of recruitment, participation and follow-up rates. Three studies were conducted in an extended care setting. Baseline data collected ranged from detailed socio-demographic characteristics and full examination of health and functioning.

Methodological quality of studies

The quality of the identified studies that met the inclusion criteria was variable. Shortcomings included: self-reported data, low participation and follow-up rates; no details of how outcomes were ascertained; small sample sizes; no information on reliability and validity of outcome ascertainment. Often no justification was given for the selection of risk factors to study.

Outcome measurement

Methods of data collection included self-completed questionnaires, face-to-face interview and full medical examination. Measurement of baseline data included self-report of falls history as a predictor, relying on the participants' recall of events. Other measurements, such as participants' perception of health status and functioning, were often recorded using self-reported rating scales, which are subjective and prone to bias. Outcome measurement also differed between studies and included: a final interview with a self-reported fall record during the follow-up period; falls diaries completed weekly by participants and posted monthly to researchers; and examination of medical and hospital admission records of fall events of the participants.

Statistical adjustment for confounding and/or sensitivity analysis was carried out in most of the studies and analytical methods described.

Characteristics of excluded studies are shown in Appendix G.

Table 2: Statistical summaries of risk factors for falls from Perell (2001)

Risk factor	Mean RR/OR (Range)
Muscle weakness	4.4 (1.5-10.3)
History of falls	3.0 (1.7-7.0)
Gait deficit	2.9 (1.3-5.6)
Balance deficit	2.9 (1.6-5.4)
Use of assist devices	2.6 (1.2-4.6)
Visual deficit	2.5 (1.6-3.5)
Arthritis	2.4 (1.9-2.9)
Impaired activities of daily living	2.3 (1.5-3.1)
Depression	2.2 (1.7-2.5)
Cog impairment	1.8 (1.0-2.3)
Age⋯›80=	1.7 (1.1-2.5)

5.2.11 Summary of research evidence

A review of the empirical evidence relating to risk factors is provided by Perell et al. (2001). This review reported the mean relative risk (RR) or odds ratio (OR) and rank for each factor. However, no details were given of the study design of the included studies. These statistical summaries are reproduced in Table 2.

The included studies from the evidence update are presented in Evidence table 1 (Appendix E). Results of the studies are presented as either relative risk or odds ratios. The risk factors reported in the evidence table of included studies are those that were reported as statistically significant.

Individual risk factors from the evidence update are summarised below. Table 3, column 3 reports the frequency that the risk factor was reported in the included studies. Heterogeneity between studies prohibited aggregation of results.

Table 3: Frequency of reporting of risk factor in included studies

Risk factor	RR/OR Range	Mean RR/OR (Range)
Falls history	OR= 2.4-4.6 RR= 1.9-2.4	11
Mobility impairment	OR= 2.0-3.0	8
Visual impairment	OR= 2.6-5.8 RR= 1.6	5
Balance deficit	OR= 1.8-3.9 RR=1.7	5
Gait deficit	OR= 1.8-2.2 RR= 2.2	4
Mental status	OR= 2.2-6.7 RR= 6.2	4
Functional dependence	OR= 1.7 RR= 5-6	4
Fear	OR=1.7-2.8	3
Low body mass	OR= 1.8-4.1	3
Depression	OR= 1.5-2.2 RR= 2.8	3
Diabetes	OR=3.8-4.1	2
Environmental hazards	OR= 2.3-2.5	2
Incontinence	OR=1.8-2.3	2
Multiple medications	OR= 2.02-3.16	Meta-analysis: n=14 studies
Anti-arrhythmic	OR 1.59	Meta-analysis: n=10 studies
Psychotropic drugs	OR= 1.66 (1.40-1.97)	Meta-analysis: n=11 studies

In addition to those risk factors shown in Table 3, other risk factors were reported as significant in single studies – that is those studies reporting on one risk factor – as follows:

- generalised pain
- reduced activity
- high alcohol consumption
- parkinson's disease
- arthritis
- diabetes
- stroke
- low body mass.

Whilst identification of single risk factors is informative, especially when planning interventions for prevention, it is also the interaction between multiple risk factors that needs to be considered (AGS/BGS 2001). Furthermore, within study analysis demonstrates association of different factors. Further details are reported in Evidence table 1 but a brief summary of such studies is presented below.

Covinsky et al. (2001) carried out regression analysis with significant risk factors and a final model (model 3) suggested that abnormal mobility, balance deficit and previous falls history were predictive of further falls. Stalenhoef et al. (2002) developed a risk model with postural sway, falls history, reduced grip strength and depression as significant predictors. Cwikel et al. (1998) developed a risk model (elderly falls screening test), which included: fall in last year, injurious fall in last year, frequent falls, slow walking speed, and unsteady gait. It is clear from the evidence that a previous fall and/or gait and balance disorders may be predictive of those at highest risk, but the presence of other less obvious factors should be considered in combination.

The results described above were obtained mainly from community-dwelling participants. The results from studies conducted with extended care participants were similar, in that a previous fall was predictive of a further fall. Medications also featured as important risk factors for both those in community and extended care settings – for example, benzodiazepines, antidepressants, neuroleptics and cardiotonic glycosides as single predictors, but also the use of multiple medications (Leipzig et al. 1999).

Analysis of multivariate studies of risk factors for falling

- of the included studies displayed in Evidence table 1, some reported adjusted summary statistics in which multivariate analysis had been carried out. Others had conducted bivariate analysis, with the reporting of unadjusted significant factors. Therefore, to assist with clarification of the risk factor evidence, the multivariate studies were analysed in depth. This section reports on:
- a detailed examination of studies in which multivariate analysis had been carried out
- further detailed examination of the quality of each multivariate study
- the results for each risk factor.

Methods

Multivariate analysis allows for the efficient estimate of measures of association, while controlling for a number of confounding factors simultaneously. Mathematical multivariate regression models include:

- linear regression when the dependant outcome variable is continuous data
- logistical regression for binary data.

While this information can be obtained from the studies included in our evidence review, there were several associated methodological issues that made data extraction and synthesis of the multivariate studies difficult. These included:

a) different methods of analysis are employed within each study

b) methods of conducting systematic reviews of prognostic studies are unclear.

The clinical interpretability of information from each study and risk factors is both complex and challenging due to the heterogeneity of the studies.

Methodological advice was sought on how to best appraise the studies and how to illustrate the results in a rigorous, but clinically relevant and meaningful way. We were advised to extract adjusted summary statistics and report details of both the statistical methods and adjusted variables within each study. To aid interpretation, these results were presented in an evidence table (Evidence table 2, Appendix E) and a narrative summary was produced.

Study design inclusion criteria

Prospective cohort studies with multivariate statistical analysis, including those studies reporting statistical significance for the specified risk factor. Also included are studies reporting statistically non-significant results. This avoids introducing reporting bias.

Detailed quality assessment of risk factor studies

Studies were quality assessed using the following criteria. All studies had to fulfil the following criteria for inclusion:

- eligible cohort of participants
- high participation at baseline and follow-up > 70 per cent

- risk factors conceptually relevant
- baseline measurement of risk factors
- reporting of methods, explicit inclusion criteria and demographic information
- adequate length of follow-up > six months
- measurement of falls as outcome
- statistical methods detailed. Adequate reporting for data extraction. For methods of adjustment for confounding reported, see below.

Quality was then classified as follows:

High quality

- large sample >200
- high participation at baseline and follow-up > 80 per cent
- baseline measurement of risk factors: clear methods of measurement given. Balance between clinical tests and subjective measurement
- methods of outcome measurement clear. Falls diaries with frequent researcher follow-up. Minimal reliance on recall of fall events
- methods of adjustment: all factors adjusted and reported.

Medium quality

- large sample >200
- participation at baseline and follow-up 70-80 per cent
- baseline measurement of risk factors: unclear methods of measurement given. Subjective methods of measurement.

  or

- methods of outcome measurement clear. Inadequate measurement of outcome – that is relying on memory at follow-up alone
- methods of adjustment: Some adjustment and reporting.

Low quality

- small sample < 200
- low participation at baseline and follow-up < 70 per cent
- baseline measurement of risk factors: unclear methods of measurement given. Subjective methods of measurement.

  or

- methods of outcome measurement clear. Inadequate measurement of outcome – that is relying on memory at follow-up alone
- methods of adjustment: adjusted variables not reported.

Data abstraction

Evidence table 1 (Appendix E) from the previous review formed the basis of data extraction, but further details of statistical methods were extracted from the original paper. Studies were quality assessed using the criteria above.

For each risk factor, the following were extracted:

Study reference, risk factor, summary statistic and 95 per cent confidence intervals, adjustment variables and method of multivariate analysis, quality of study.

Results

Twenty-four of the 31 risk factor studies had conducted multivariate analysis. The studies were characterised by heterogeneity, for example:

- different summary statistics were reported
- different methods of measurement of baseline characteristic were used
- different aspects of particular risk factors were measured. While this is useful to describe factors within domains, it was more difficult to combine for graphical representation
- falls outcome measurement included single fallers, two or more falls and recurrent fallers.

Quality gradings of each study are shown in Evidence table 2 (Appendix E).

Heterogeneity between studies prohibited aggregation of results and, where stated, crude estimate of the range of both RR and OR is provided.

Evidence summary

Evidence table 2 (Appendix E) describes the included prospective cohort studies in which multivariate analysis had been conducted. The results are reported for each risk factor and include both the statistically significant and non-significant summary statistics following multivariate analysis. Non-significant results were reported to avoid introducing reporting bias. Each factor is also reported by setting. The following (Table 4) summarises Evidence table 2 and provides a frequency count of significant and non-significant results, based on the multivariate.

Table 4: Frequency count of significant and non-significant results for multivariate risk factor studies

Risk factor	N= reporting statistical significance in multivariate analysis	N= reporting non statistically significant results in multivariate analysis
Falls history	10	7
Mobility impairment	2	4
Visual impairment	3	8
Balance deficit	4	8
Gait deficit	3	6
Cognitive impairment	3	9
Fear	3	1
Environmental hazards	2	
Muscle weakness		2
Incontinence	2	5

This further analysis indicated that the following factors were most predictive of falling and should be considered by clinicians responsible for assessing those at risk of falling:

Community-dwelling older people

Falls history
Gait deficit
Balance deficit
Mobility impairment
Fear
Visual impairment
Cognitive impairment
Urinary incontinence
Home hazards.

People cared for in extended care settings

Falls history
Gait deficit
Balance deficit
Visual impairment
Cognitive impairment.

5.3 Assessment of those at high risk of falling: review methods and results

5.3.1 Background

The purpose of assessment is to identify those at risk of falling in order to target effective intervention(s). There are many falls assessment instruments that have been developed for specific purposes and settings. Many have been developed for use by specific health care professionals for community-dwelling individuals and those receiving care in residential/extended care settings. Other assessment instruments, functional observations and clinical tests have been developed and tested with older people in different settings and vary in their detail and administration.

Perell (2001) categorises such tools as follows:

- detailed medical examination and assessment of generic problems.
- nursing assessment by means of a scale with a scoring method. Low or high scores will trigger further investigation or planning of interventions.
- functional assessment or gait and balance limitation assessment to predict those likely to fall.

The aim of the current review was to provide information on the most well developed and pragmatic tools available for use in community and extended care settings.

Following methodological advice, key narrative reviews summarising assessment tools was used as a starting point for determining the scope of the review. These reviews suggested which tools were most advanced in their development and might be most useful for consideration in clinical practice. These tools were then profiled (see Evidence table 3, Appendix E), drawing on key primary studies with details provided of their development and properties.

A systematic review was not undertaken because of the size of the literature associated with each tool. However, a range of key tools was identified, reviewed and presented. GDG input then assessed the value and utility of particular assessment strategies for clinical practice.

5.3.2 Objectives

The review sought to answer the following question:

What assessment tool (or process) should be used to identify modifiable risk factors for falling and those at high risk of falling?

5.3.3 Selection criteria

Types of studies

Narrative reviews were used as the principal source of

evidence and further evidence was obtained from primary studies that described a particular tool.

- Narrative reviews were sought that provided information about currently available risk assessment instruments utilised in community dwelling and extended care settings.
- Primary studies describing the development of the most frequently cited risk assessment tools, the measurement properties and clinical utility of such tools were sought.

Exclusion criteria

- Individual, newly developed and less pragmatic tools were excluded but referred to in the table of excluded studies (Appendix G). Such tools include detailed analysis of gait requiring intensive training or specialist skills, and complex equipment for analysis. They are not useful as a generic tool for assessing and identifying risk.
- Inpatient assessment tools are excluded as this is beyond the scope of the review.

5.3.4 Search strategy and sifting process

The search strategy, databases searched, dates and the sifting process are as for 'risk'. See Sections 5.2.4 to 5.2.5.

5.3.5 Data abstraction

Data were extracted by a single reviewer and evidence tables compiled. The following information was extracted:

author, setting, population, objectives of tool, procedure, length of time to administer, training required, burden/acceptability to patients, measurement type, derivation of cut-off points for level of risk, further testing of the tool.

5.3.6 Appraisal of methodological quality

Narrative reviews and primary studies were included if they met the inclusion criteria. Where data were provided, this information was extracted. No clear quality criteria exist to appraise studies validating tools and tests for assessment. Whilst quality principles are defined for diagnostic studies (see Sackett 2000), these are not appropriate for assessing the quality of assessment tools or processes.

5.3.7 Data synthesis

No quantitative statistical analysis was conducted for this review.

5.3.8 Results of assessment evidence retrieval and appraisal

Table 5 details the sifting results and number of papers included.

Table 5: Sifting results

Initial search results	1396
N screened for relevance following sift	223
N relevant	46
N included	17

Most of the evidence was extracted from identified narrative reviews (Evidence table 3, Appendix E). Supplementary evidence was obtained from included primary studies with large populations (greater than 50). Details are given of excluded studies (Appendix G). It was unrealistic to profile existing tools utilising all the original primary studies available on each tool. This was beyond the search scope and time limits of this review and there reached a point where no further studies could be included.

Participants and settings

Studies were conducted with older people in both community-dwelling settings and extended care.

Assessment tools

The categories of tools identified included:

1. Tests of balance and gait used in both community dwelling and extended care settings.
2. Multifactorial assessment instruments/processes administered by health care professionals for all settings, including:
   a) home hazard assessment instruments administered by health care professionals for community-dwelling people
   b) multifactorial falls risk assessment processes.
3. Minimum data set (MDS) for home care and residential settings for comprehensive assessment.

1. Tests of balance and gait used in both community-dwelling and extended care settings

Table 6 illustrates the most frequently reported tools administered in community dwelling and extended care settings as identified by the review. For a full profile of each tool, readers should refer to the Evidence table 3, Appendix E.

Table 6: Most frequently used tests of balance and gait

Timed up and go test
Turn 180°
Performance-oriented assessment of mobility problems (Tinetti scale)
Functional reach
Dynamic gait index
Berg balance scale

Methodological quality and type of studies

Many studies reporting the development of new tools were identified, in addition to studies that tested existing tools tested on small populations. Other tests/tools exist but have limited information regarding further testing with large populations and are considered to be less useful in a clinical context. Such tools include detailed balance and gait analysis, examination of footwear and in-depth assessment of visual factors. These processes are more useful for diagnostic purposes, rather than identifying those at risk in community and extended care settings. The quality of reviews identified was variable and most were narrative with brief methods reported.

Not all tests and instruments have undergone rigorous testing with large populations. Some studies use previous falls history as a reference frame and then examine whether the tool identifies the fallers from the non-fallers.

Comments on the quality of information is given in the evidence table. However, it was not possible to quality assess individual references relating to each tool cited in the narrative reviews.

Conclusion

It is unclear which tool or assessment instrument is the most predictive and therefore useful. Many tools have undergone testing and exploration of measurement properties and predictive ability. The clinical utility, feasibility for clinicians and acceptability to patients often guides the choice of tools, but some appear more useful than others. For example, the 'timed up and go' test (TUGT) – as referred to in the AGS/BGS guidelines – is both pragmatic and frequently cited, can be used in any setting, and its administration requires no special equipment. The 'turn 180°' test is of similar value and can be administered in any setting. However, both these tests rely on clinical judgement and the value of timed cut-off values for the TUGT and number of steps for the turn 180° test need to be considered, if recommending their use.

Other tests – such as the Berg balance test, Tinetti scale, functional reach and dynamic gait test – may offer more detailed assessment and be of diagnostic value, but take longer to administer and need both equipment and clinical expertise. These tests cannot be recommended for use in all settings and may be more useful during a comprehensive assessment by a multidisciplinary team.

2 & 3. Multifactorial instruments and minimum dataset instruments administered by health care professionals (all settings)

There are many tools/instruments that can be administered by health care professionals. These can be categorised as follows:

a) Home hazard assessment instruments, administered by health care professionals for community-dwelling population.

b) Multifactorial falls risk assessment processes.

c) Minimum data set (MDS) home care and residential assessment instrument for comprehensive assessment.

a) Home hazard assessment instruments administered by health care professionals for community-dwelling population

Home hazard assessment instruments have been developed for use by community nursing personnel, occupational therapists, and physiotherapists to identify hazards in the home that may contribute to or increase the risk of falling. The content validity of these tools has been established.

Environmental hazards have been described as significant risk factors for selected individuals, but generalisability of the single most important risk factors for falling associated with home environment has not yet been established. The Perell (2001) review describes and details many nurse administered tools, but most are developed for use only in hospital settings.

The benefit of home hazard assessment for community-dwelling people is difficult to extrapolate from available studies, as most include some kind of intervention such as either referral or home modification. It appears that benefit is only achieved if followed by such referral.

The AGS/BGS (2001) guidelines recommended the following:

> *When older people at increased risk of falling are discharged from hospital, a facilitated home hazard assessment should be considered (B).*

This is supported by level I evidence from a study by Cumming et al. (1999), which showed that a facilitated home/environmental hazard assessment and supervised modification programme after hospital discharge was effective in reducing falls: RR= 0.64(0.49-0.84). Sub-group analysis demonstrated a significant reduction in the number of participants falling in the group with a history

of falling in the previous year: RR= 0.64(0.49-0.84), but not in those without a history of a previous fall RR=1.03(0.75-1.41). Five randomised controlled trials, reported in the AGS/BGS guidelines, demonstrated no benefit of home environment modification without other components of multifactorial interventions.

Many 'off the shelf' home hazard assessment tools are available and are being developed at local level. Those administering the instrument should decide the choice of tool (Evidence table 4, Appendix E for further details).

b) Multifactorial falls risk assessment processes

Whilst the term 'multifactorial' is frequently referred to in relation to falls assessment, there is disparity between studies of what factors are included within this process. The AGS/BGS (2001) guidelines describe different levels of assessment determined by an older person's falls risk status. Consequently, a brief assessment for those at low risk of falling is suggested, with a more comprehensive and detailed assessment for high-risk groups. Referral to a geriatrician may be needed for such comprehensive assessment.

The Cochrane review (2001) on falls prevention reports that different details and levels of assessment are contained in the included studies. Components include:

- environmental, including home hazards
- medical
- functional
- psychosocial
- activities of daily living
- medication review.

The review by Shekelle (2002) reports similar differences between studies. The most common domains included in relation to risk assessment were:

- medication review
- vision
- environmental hazards
- orthostatic BP.

The results from Shekelle (2002) suggest that: "Although not proven, it makes clinical sense that comprehensive post fall and falls risk assessment should be targeted to persons at high risk as they have most to gain."

The benefit of multifactorial assessment for older people is difficult to extract from available sources, as it appears that benefit is only achieved if followed by referral and therefore specific intervention.

The Shekelle review refers to randomised controlled trials in which multifactorial falls risk assessment and individually tailored follow-up and management programmes were most effective in preventing falls for community-dwelling older people. The pooled risk ratio of n=10 studies that included a multifactorial falls risk assessment and management programme was relative risk (RR) = 0.84 (0.73-0.97) for risk of falling and pooled incident ratio was 0.65 (0.49-0.85) for the number of falls (n=7 studies).

The Cochrane review on falls prevention reported that multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes were effective for both unselected community-dwelling people: three trials pooled RR= 0.73 (0.63-0.86) and those with a history of falling / or known risk factors two trials= RR 0.79 (0.67-0.94) (Gillespie et al. 2003).

Nurse assessment, followed by physician referral for older people in extended care settings, was of no benefit in one study included in the Cochrane falls prevention review, RR= 0.97 (0.84-1.11) (Gillespie et al. 2003).

c) The minimum data set home care and residential assessment instrument for comprehensive assessment

Glossary
MDS: Minimum data set.
HC: Home care (community dwelling).
CAP: Client assessed protocol for home care.
RAI: Residential assessment instrument (extended care).
RAP: Residential assessed protocol for extended care.

While multifactorial assessment processes as described above are specific to falls, the implementation of the single assessment process (SAP) is driven by a holistic and individualistic approach to management and care of older people across a number of domains. MDS tools are referred to in the SAP and have been suggested as useful (DH 2001). Other tools are referred to in the DH single assessment process guidance (2002) and current existing tools are subject to accreditation. Details of such instruments are soon to be published on the SAP website (www.dh.gov.uk/scg/sap/).

The MDS assessment instruments have undergone testing for reliability and validity in community-dwelling and extended care settings but details are not reported here. There are currently two principal instruments with others being developed. The first instrument – MDS-RAI – is aimed at older people in residential settings, while the second – MDS-HC – is for community-dwelling older people receiving home care. There is an assessment data collection form and software is available, which is used in

conjunction with the appropriate MDS assessment manual. The RAI and HC both have a standardised form that provides an initial assessment of minimum data taken at various stages along the service user's care pathway. The comprehensive design of the form will 'trigger' 1-30 care protocols. These protocols provide a more focused assessment leading to suggested care plans. The RAI is associated with the RAP – residential assessed protocol for extended care. The MDS-HC is associated with CAP – a client-assessed protocol for home care.

The MDS is a standardised multidisciplinary assessment system for assessing care needs for older people within residential care. This instrument was originally developed in the USA to enable an accurate assessment of the older people leading to planned quality care. However, it is now being used in many other countries such as the UK, China, Japan, Italy and Norway.

The primary purpose of this tool is to provide a comprehensive assessment that is integrated with care planning. This includes identification and evaluation of potential problems; identification of requirements for rehabilitation; maintenance of client strengths and prevention of decline; and promotion of comprehensive well-being. It follows a pathway from identification and evaluation, to guidance on service provision and care planning. The instrument encompasses the following assessment domains: cognition, communication, activities of daily living, continence, social functioning, disease diagnosis, vision, physical functioning, health conditions and preventative health measures, informal supportive services, mood and behaviour, nutrition/hydration status, dental status, skin condition, environmental assessment, and service utilisation in the last seven days. The falls-related data are within different domains. Since 1997, it is compulsory for facilities in the US to complete this assessment instrument. This tool is suggested within *Single assessment process: assessment tools and scales* (DH 2002).

Detailed examination of the MDS

The content validity of the risk assessment of falls section of the MDS instrument was examined and information on the utility of the instrument in practice in relation to falls was also sought.

This was done to see if the MDS HC and RAI instruments provide adequate information to identify those at risk of falling, and whether all the important risk factors for falls are included.

Of particular interest was what factors within the associated protocols trigger either further assessment of falls or lead to targeted falls interventions.

As indicated by the risk factor review prospective cohort studies, in which multivariate analysis with adjustment for confounding was undertaken, the risk factors below were shown to be most significant by setting. These were compared with those risk factors listed in the CAP and RAP protocols.

Community-dwelling older people

Falls history, gait deficit, balance deficit, mobility impairment, fear, visual impairment, cognitive impairment, urinary incontinence and home hazards.

People cared for in extended care settings

Falls history, gait deficit, balance deficit, visual impairment and cognitive impairment.

The instruments (HC and RAI) contain falls-related data in various sections/domains and clear pathways exist for the trigger to the falls protocols.

Triggers for falls CAP: home care instrument

Within HC, the potential for repeated falls or risk of initial fall is suggested if one or more of the following factors below are present. This will lead to further detailed assessment and CAPs.

Trigger factors for falls CAP

- Falls in the last 90 days
- Sudden change of mental functioning
- Being treated for dementia
- Being treated for Parkinsonism
- Has unsteady (abnormal) gait.

Triggers for Falls RAP: Residential care instrument

The potential for additional falls or risk of initial fall is suggested if one or more of the following factors outlined below are present. This will lead to further detailed assessment and the application of RAP (2000).

Triggers for falls RAP

- Fall in the past month
- Fall in past one to six months
- Wandering
- Dizziness/vertigo
- Use of trunk restraint
- Anxiolytic drugs
- Antidepressants.

These tools provide relevant information about potential intrinsic and extrinsic risk factors, for which there are beneficial interventions. Of particular interest is the information relating to the assessment of balance and gait, which provides detailed aspects of balance and gait abnormalities, with possible diagnoses and rehabilitative

or environmental interventions. There are also suggested care pathways relating to home hazard assessment.

However, although the instruments contain important risk factors for falling, no clear pathway exists to specifically identify patients at risk. In addition, the risk factors listed differ from those that emerged as significant in the risk factor evidence review. Each factor is within different domains and will lead to the falls care pathway. What is not clear is at what point an older person enters this process.

Evaluation of performance of MDS instrument

To see whether the MDS instrument improved the quality of care for older people at risk of falling, studies were sought evaluating its performance. Although as stated, this instrument is a comprehensive assessment tool that can provide information for the single assessment process, 'falls' represents one protocol within this document with an associated range of items to act as a trigger for further assessment. For the purpose of this review and scope of the guideline, only studies focusing on falls-related information were reviewed.

English language studies of the following designs: prospective cohort, quasi experimental/controlled before and after designs or pre and post were sought. In addition, these must have report fall-related information such as incidence rates, reduction in falls and the trigger of falls protocols.

Appraisal of methodological quality

The methodological quality of the studies was assessed using the following criteria:

- eligibility criteria stated
- appropriateness of design
- sampling method
- validation of measurements relevant to falls outcomes or the instrument's ability to perform in relation to falls
- response rate
- statistical techniques used
- bias and confounding addressed.

An overall subjective rating of quality was applied to each study as follows:

High: all of above criteria met

Medium: most of the criteria met

Low: insufficient information given.

Search strategy

Eight electronic databases were searched between 1995 and April 2003 using a sensitive search strategy. The bibliographies of all retrieved and relevant publications were searched for further studies. The lower limit was selected because this instrument is relatively new.

The major databases searched were MEDLINE, EMBASE, CINAHL, PSYCINFO, HMIC, AMED (Allied & Complementary Medicine Database), and BNI (British Nursing Index). The platform was Silver Platter Windows-based WINSPIRS. The Web of Science and Cochrane Library databases were also searched, using just the first part of the search strategy found in Appendix B.

Data abstraction

The papers were screened for relevance and those papers that met the inclusion criteria were identified and quality appraised. Data were extracted by one reviewer and evidence tables compiled.

The following information was extracted:

Author and country of origin; aim and objective; population and setting; number of participants; study design and method; outcome measurements and summary statistics; and comments on methodological quality.

Results

An initial search strategy identifying UK only papers resulted in five papers, but they were not related to falls assessment or outcomes. The search was then broadened to include international papers. The following is the result of the search and sift for papers to meet the inclusion criteria. Table 7 provides information on the process of selecting papers for critical appraisal.

Table 7: Sifting results for studies evaluating MD

Initial search results	399
N screened for relevance	129
N relevant	3
N Included	3

Methodological quality of studies

Three studies met the inclusion criteria. Two studies were conducted in the US and the third was a multi-centre, cross-cultural study of five countries.

The quality of the three included studies was medium. Two were prospective cohort and one a before/after study. Two were conducted with community-dwelling older people (HC) and one in extended care setting (RAI).

Evidence summary

The first study conducted by Fries et al. (1997) evaluated the effect of the implementation of the MDS:RAI system

on selected conditions representing outcomes for nursing home residents. This was a simple before and after study design of medium quality. Measurements of the prevalence of falls 30 days prior to admission were taken at baseline and then at six months post intervention. The results were non-significant for prevalence of falls between pre and post administration of the RAI, although there was a slight increase in the percentage of residents who fell post-RAI (pre=10.5%, post=10.6%). The overall prevalence of falls was pre-RAI 6,597 and post-RAI 6,178.

The second study included was conducted by Ritchie et al. (2002). The aim of this study was to evaluate the establishment of a co-ordinated care programme for community-dwelling older people to receive assessments that lead to effective treatments, referral or care-plans. The sample was 99.6 per cent male of which 83.65 per cent were married, mean age=78. A thorough screening process was undertaken to locate those elders deemed as at risk. Follow-up measurements were taken at first and subsequent assessments using the MDS-HC instrument. A total of 158 protocols were triggered out of a possible 226. There were four typical response activities to falls triggered protocols that patients received. 38.4 per cent received falls prevention education, 5 per cent received prosthetics, 3.8 per cent received rehabilitation referral and 1.3 per cent received adult protective services. It is unclear as to whether there was overlap between these services. The most fundamental problem with this study is that the sample was 99.6 per cent male.

Finally, the third study (Morris et al. 1997) involved five volunteer countries: Australia, Canada, the Czech Republic, Japan and the US. The sample was randomly selected within facilities of community-dwelling people but did not represent a random sample within the population of the country. The study had two objectives, of which the one relevant to this review is reported. This examined the interaction between different client profiles measured by their cognitive performance – measured on the Folstein mini-mental examination – and the effect of these measurements on triggering the protocols. For a sample size of 780, the average number of protocols triggered was nearly 12 of which the falls protocol represents 79 per cent. Those mentally intact triggered 82.5 per cent of the falls protocols, whereas 65 per cent at the lower of the cognitive scale triggered falls protocols. Those with severe cognitive impairment more frequently triggered bowel management, incontinence, and pressure ulcer protocols.

Further work needs to be done evaluating the impact of these instruments on patient care and outcomes. At this stage there is insufficient information to make recommendations regarding the use of these tools and protocols specifically for falls. This is a subject that should be reconsidered when the guidelines are updated.

5.4 Fear of falling as a risk factor and tools to measure fear of falling: methods and results

5.4.1 Background

Fear of falling is considered multifaceted in aetiology. While fear may result as a consequence of falling, anticipatory anxiety may also occur in those who have not fallen. Murphy et al. (1982) refers to the 'post fall syndrome' that recognises fear as a consequence of falling. Ptophobia – the phobic reaction to standing or walking – is a term introduced by Bhala et al. (1982).

Fear of falling has been further conceptualised as:

- encompassing activity limitation due to the residing fear
- fear resulting in loss of confidence in balance ability and
- low fall-related efficacy, which translates to low confidence at avoiding falls.

Fear of falling is not necessarily limited to those with a history of falling nor is fear predictive of a future fall. Fear may also compromise quality of life by limiting mobility and social interaction.

We conducted two evidence reviews on the area of fear of falling. Firstly, we reviewed the empirical evidence investigating associations of fear of falling with future falling. Secondly, we reviewed methods available to measure fear and their usefulness for patients and clinicians.

5.4.2 Aim of review

The aim of this review was to:

1) identify studies in which fear has been examined as a predictor of falling and/or a consequence of falling
2) ascertain whether fear of falling should be included in risk assessment
3) assess methods and tools available to measure fear of falling and to ascertain their clinical utility.

5.4.3 Selection criteria

Types of studies

Prospective cohort studies, with fear and fall related data measured at baseline and follow-up, were preferred because we were interested in fear as a predictor of future or further falls.

Systematic/narrative reviews describing methods for measuring fear of falling.

Types of participants

Older people aged 65 and above.

Types of outcome

Those studies which report falls as an outcome.

Exclusion criteria

Individual studies examining the psychometric properties of instruments used to measure fear of falling and related constructs – this work was outside the resources available.

5.4.4 Search strategy

The searches for both fear of falling as a risk factor and tools to measure fear of falling were combined, as this was the most efficient way of searching. Please refer to Appendix B for details of the search strategy and databases searched.

Searches were confined to the period 1980 and December 2002/January 2003.The bibliographies of all retrieved and relevant publications were searched for further studies.

The databases searched were MEDLINE, EMBASE, CINAHL, PSYCINFO, HMIC, AMED (Allied & Complementary Medicine Database), ZETOC and BNI using the Silver Platter Windows-based WINSPIRS platform.

5.4.5 Data abstraction

The following data were extracted and evidence tables compiled:

Author, setting, number of participants at baseline and follow-up, methods and details of baseline and outcome measurement, results including summary statistics and 95 per cent confidence intervals, and comments on the quality of studies.

Once individual papers were retrieved, the articles were checked for methodological rigour – using quality checklists appropriate for each study design – applicability to the UK and clinical significance. Assessment of study quality concentrated on dimensions of internal validity and external validity. Information from each study that met the quality criteria was summarised and entered into evidence tables.

5.4.6 Appraisal of methodological quality

The methodological quality of each trial was assessed by one reviewer, using the principles of quality referred to in the risk factor review (Section 5.2.7).

5.4.7 Data synthesis

No quantitative analysis was carried out for this review. Summary statistics and reporting of statistical significance for each study are included in the evidence tables.

5.4.8 Details of studies included in the review

Sifting results

The number of studies included is shown in Table 8.

Table 8: Sifting results for studies on fear of falling

Initial Search results	634
N considered for inclusion	50
N Included	7 (inc. 2 reviews)

5.4.9 Methodological quality of the included studies

Generally, the quality of the prospective cohort studies on examining fear as a risk factor for falling and association of fear of falling with quality of life and health status was high. These studies were conducted on large samples of community-dwelling older people. No studies were identified that were specific to older people in extended care settings. Studies were excluded mainly because of small sample sizes.

The studies identified within the reviews on measurement of fear of falling and related constructs were categorised as follows:

- examination of the psychometric properties of available instruments
- development of new tools for the measurement of fear
- modification and testing of internationally developed instruments for use in the UK – for example, falls efficacy scale (FES).

Generally, the two identified reviews (Nakamara 1998 and Legters 2002) were of limited value. Both were narrative with no details of methods used to identify and appraise studies.

Characteristics of excluded studies are shown in Appendix G.

5.4.10 Evidence summary

Fear of falling

Three prospective cohort studies reported fear as a significant predictor of future falling (Arfken 1994; Cumming 2000; Friedman 2002). While it is clear that fear can be a predictor for falling and a consequence of falls, shared risk factors increase the likelihood of falling. Many studies examined specific factors that correlate with the fear of falling. Although such studies are not reviewed here, the literature refers to many correlates. For example: psychological indicators of balance confidence, (Powell 1995; Myers et al. 1996; Manning et al. 1997; and Parry 2000); lack of confidence leading to reduced activity and loss of independence, (Maki et al. 1991). Other correlates

include chronic dizziness (Burker et al. 1995); fewer social contacts (Howland et al. 1998); lower quality of life (Lachman 1998), (see Evidence table 4, Appendix E for further details of included studies).

The findings from this review provided sufficient evidence that fear of falling is a significant predictor of future falling and should be considered in falls assessment of older people.

Measurement of fear of falling

Fear related to falling is an important consideration when assessing older people and planning interventions. How to elicit such information from older people has been the focus of much research.

In the discussion paper by Legters (2002), details are given of existing methods of measuring fear. Early research focused on simple questions to establish if fear was present. Examples given were responses to questions of 'are you afraid of falling?' in 'yes/no' or 'fear/no fear' format. Whilst this is a simple measure, it does not provide information of the degree of fear. Further development of such measures resulted in more sophisticated methods, such as verbal rating scales that provide ordinal levels of measurement of degrees of fear. Examples of verbal rating scales include responses such as: not afraid; slightly afraid; somewhat afraid; very afraid.

Details of the study on the FES (Tinetti et al. 1990 USA), which appears to be the most widely used tool, are given in Evidence table 3, Appendix E. This tool was designed for the purpose of measuring fear in a research context. The conceptual framework underpinning the development of this instrument is related to asking individuals about their feelings, within a variety of specific situations or activity. Perceptions of capability are referred to as 'self-efficacy'. High efficacy relates to increased confidence. The FES measures the individual's degree of efficacy within a specific activity (Tinetti et al. 1991). Confidence in accomplishing each activity without falling is assessed on a 10-point scale, with a higher score equivalent to lower confidence or efficacy. The FES score is the sum of scores and possible scores range from 10-100. Other tools have been developed but none to the extent of FES.

In terms of clinical utility, it is suggested that the FES could be an effective screening tool to determine if further evaluation is needed, particularly concerning balance (Legters 2002; Nakamura 1998).

It is clear that fear of falling is related to future falling and this needs to be discussed with older people who are at risk of falling. However, whilst the FES does provide detailed information, this tool may, at this stage, only be useful for research purposes. What may be more important is that older people are asked if they are fearful of falling. If so, then the reason for this fear and the degree of fear should be assessed by an appropriate health care professional.

5.5 Interventions for the prevention of falls: review methods and results

5.5.1 Background

Many preventive intervention programmes aimed at recognised 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. However, in the majority 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 are population-based approached programmes.

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.

In July 2003, a Cochrane systematic review on Interventions for the prevention of falls in older people was updated (Gillespie et al. 2003). This was itself an update of a previous review (2001); has undergone peer review and is published in the Cochrane Library. This review has formed the basis for the evidence on effective interventions to prevent falls for this guideline.

The review methods and results are summarised below from the updated systematic review (full details are available on www.cochrane.co.uk).

5.5.2 Objectives

The review sought to present the best evidence for effectiveness of programmes designed to reduce the incidence of falls in both community-dwelling older people and those in extended care settings among those at risk of falling and known fallers. This review has also provided evidence for rehabilitation interventions for the secondary prevention of falls (see Section 5.9).

5.5.3 Selection criteria

Types of studies

RCTs, including those in which the method of allocation to treatment or control group was inadequately concealed – for example, trials in which patients were allocated using an open random number list or coin toss.

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 participants

Older people of either sex, living in the community or extended care. Participant characteristics of interest included falling status at entry (for example, non-faller, single faller, multiple faller), residential status (for example,. community, extended care), and where appropriate, associated co-morbidity. While the review also included trials of interventions in hospital settings if the patients were elderly, those results are not reported here, as this is outside the scope of the guideline.

Types of intervention

Studies which evaluated the following interventions for falls prevention were included in the clinical effectiveness evidence review:

1. Exercise/physical therapy
2. Home hazard modification
3. Cognitive/behavioural interventions
4. Medication withdrawal/adjustment
5. Nutritional/vitamin supplementation
6. Hormonal and other pharmacological therapies
7. Referral for correction of visual deficiency
8. Cardiac pacemaker insertion for syncope associated falls
9. Exercise, visual correction and home safety
10. Multidisciplinary, multifactorial health/environmental risk factor screening and intervention (community-dwelling)
11. Multifactorial intervention in residential settings
12. Multidisciplinary, multifactorial health/environmental risk factor screening and intervention (community-dwelling)
13. Multifactorial intervention in residential settings.

Types of outcome

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 that 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.

5.5.4 Search strategy

The following databases were searched:

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

PsycLIT and Social Sciences Citation Index to May 1997

No language restrictions were applied and further trials were identified by contact with researchers in the field.

The search strategies and the databases searched are presented in Appendix B. All searches were comprehensive and included a large number of databases. A combination of subject heading and free text searches was used for all areas. Free text terms were checked on the major databases to ensure that they captured descriptor terms and their exploded terms.

Further trials were identified by contact with researchers in the field.

5.5.5 Sifting process

From the title, abstract, or descriptors, two reviewers 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 that met the selection criteria were quality assessed.

Once articles were retrieved the following sifting process took place:

- First sift: for material that potentially meets eligibility criteria on basis of title/abstract by two reviewers.
- Second sift: full papers ordered that appear relevant and eligible and where relevance/eligibility not clear from the abstract by two reviewers.
- Third sift: full articles are appraised that met eligibility criteria by two reviewers.

5.5.7. Appraisal of methodological quality and data extraction

The methodological quality of each trial was assessed by two researchers independently. The following quality criteria were used (Appendix C):

- description of inclusion and exclusion criteria used to derive the sample from the target population
- description of a priori sample size calculation
- evidence of allocation concealment at randomisation
- description of baseline comparability of treatment groups
- outcome assessment stated to be blinded
- outcome measurement
- clear description of main interventions.

The 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 (see Appendix C for further details).

Data were independently extracted by pairs of reviewers using a data extraction form, which had been designed and tested prior to use. Consensus, or third party adjudication resolved disagreement.

5.5.8 Data synthesis

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 $P < 0.1$.

5.5.9 Details of studies included in the review

Included in the updated review were 62 trials reporting a variety of settings, participants, and interventions. Four studies reported results of prevention interventions in hospital settings and are excluded from this report, as this is not within the scope of the guideline. Details are therefore given of the remaining 58 studies.

Settings

Of the 58 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.

A further three studies included participants with specific conditions from a range of residential settings.

Participants

In 16 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.

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 14 studies.

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 13 studies and was less than 70 years in four studies.

In 10 studies, the participants were all women, and in one the participants were all men. The remaining studies recruited men and women in varying proportions. In most, the proportion of women was more than 70 per cent.

Interventions

Exercise/physical therapy interventions (22 studies)

Fourteen studies compared a physical exercise or physical therapy intervention alone with a social meeting or visit, education only, or no intervention. In one study, self-paced brisk walking was compared with upper limb exercises. Another study compared an enhanced exercise programme that was offered to all other participants. The remaining six studies in this category examined complex interventions as follows:

- an exercise programme and a programme of medication withdrawal
- progressive resistance quadriceps exercises and the administration of oral vitamin D
- progressive strength training and conditioning with a Tai Chi programme, with a cognitive/behavioural component

- exercise programme and a cognitive intervention in a factorial design
- programme of exercise associated with management of urinary continence
- a cognitive/behavioural intervention either alone, or combined with: exercise, exercise and home safety screening, or exercise and home safety screening and medical assessment.

Home hazard modification (nine studies)

The following interventions were included in the studies:

- assessment of environmental hazards and supervision of home modifications by an experienced occupational therapist
- home safety assessment and facilitation of elimination of hazards
- comprehensive home visit that included assessment and modification of home hazards
- nurse-led home hazard assessment, free installation of safety devices, and an education programme
- exercise, correction of visual deficiency, and home hazard modification, each alone, and in combination.
- home hazard assessment as a component of two of four other intervention packages.

Three other studies evaluated home hazard modification in combination with other interventions, using a cognitive/behaviour modification approach.

Cognitive/behavioural interventions (seven studies)

The following interventions were included within this category:

- comparison of two risk assessment interviews and a feedback/counselling interview, with a single baseline assessment interview only
- comparison of 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.

Medication withdrawal/adjustment (two studies)

- exercise programme and a placebo-controlled psychotropic medication withdrawal programme
- optimisation of medication along with home hazard modification
- medication withdrawal/adjustment was also included in the majority of the multifactorial intervention listed below.

Nutritional/vitamin supplementation (six studies)

Five studies 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.

One other 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.

Hormonal and other pharmacological therapies (two studies)

One reported incidence of falls as a secondary outcome after administration of hormone replacement therapy to calcium replete, post-menopausal women.

Another 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.

Referral for correction of visual deficiency (one study)

This study compared a control group with groups receiving exercise, correction of visual deficiency, and home hazard modification, each alone, and in combination.

Cardiac pacemaker insertion for syncope-associated falls (one study)

One trial 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.

Exercise, visual correction and a home safety intervention (one study)

This study reported the effects of exercise, vision improvement, home hazard modification or no intervention in a factorial design.

Multidisciplinary, multifactorial, health / environmental risk factor screening and intervention (20 studies)

These were complex interventions that differed in the details of the assessment, referral, and treatment protocols. In most studies, a health professional – usually a nurse – or other trained person made the initial assessment, assessing the participants, providing advice and arranged referrals.

Multifactorial intervention in nursing home residents (one study)

One cluster randomised trial 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 for any length of time.

5.5.10 Methodological quality of studies

A summary of the methodological quality of each study of the trials is shown in Appendix F.

The quality of studies was variable. In 19 studies, it appeared that the assigned treatment was adequately concealed prior to allocation. In three the assigned treatment was not concealed prior to allocation. In the remaining 36, there was inadequate information to judge concealment.

Losses from groups resulted from, for example, withdrawal from the study or death.

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 in four trials, by using placebos or identical tablets, when the intervention involved the administration of drugs.

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'.

Active registration of falling outcomes, or use of a diary, was clearly indicated in 31 studies. 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.

Table 9: Length of follow-up

Follow-up	n=trials
3 months	5
4 months	3
5 months	1
6 months	6
8 months	1
44 weeks	1
49 weeks	1
2 years	4
3 years	2
4 years	1
10 years	1

Duration of follow-up varied both between and within studies. It was for a minimum of one year in 38 studies. Table 9 reports the length of follow-up for other trials.

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.

The characteristics of excluded studies table (Appendix G) lists 97 studies, which fall into two categories. Thirty-five non-randomised studies reporting falls – or fall-related injuries – as an outcome were excluded on the basis of non-randomisation. Sixty-two randomised trials originally identified by the search strategy either reported intermediate outcomes of preventive strategies – for example, balance or muscle strength measures – or did not describe an intervention designed to reduce the risk of falling.

At the time of writing there were 14 trials waiting assessment and 29 ongoing trials identified.

5.5.11 Comparisons

Trials were included in which participants were 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.

5.5.12 Summary of results

For full details of included studies see Evidence table 5, Appendix E.

The Cochrane review reports the following:

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

Interventions likely to be beneficial:

- A programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional (three trials, 566 participants, pooled relative risk (RR) 0.80, 95 per cent confidence interval (95%CI) 0.66 to 0.98).
- A 15-week Tai Chi group exercise intervention (one trial, 200 participants, risk ratio 0.51, 95%CI 0.36 to 0.73).

- Home hazard assessment and modification that is professionally prescribed for older people with a history of falling (three trials, 374 participants, RR 0.66, 95% CI 0.54 to 0.81).
- Withdrawal of psychotropic medication (one trial, 93 participants, relative hazard 0.34, 95%CI 0.16 to 0.74).
- Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity (one trial, 175 participants, WMD -5.20, 95%CI -9.40 to -1.00).
- Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention programmes in the community, both for unselected population of older people (four 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 (five trials, 1176 participants, pooled RR 0.86, 95%CI 0.76 to 0.98).
- Multidisciplinary assessment and intervention programme in residential care facilities (one trial, 439 participants, cluster-adjusted incidence rate ratio 0.60, 95%CI 0.50 to 0.73).

Interventions of unknown effectiveness:

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

Interventions unlikely to be beneficial:

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

The Cochrane review concluded the following:

- Prevention programmes that 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 that target known fallers.
- Even amongst known fallers, the risk reduction where significant is small, and the clinical significance remains less clear.
- Interventions that target multiple risk factors are marginally effective, as are targeted exercise interventions, home hazard modification and reducing psychotropic medications.
- Where important individual risk factors can be corrected, focused interventions may be more clearly effective.
- It appears that interventions with a focused intention may in fact be multifactorial.
- There is a lack of clarity about the optimum duration and intensity of interventions.
- Some interventions – for example, brisk walking – may increase the risk of falling.
- The outcome of interest – falling – was not always clearly defined in the studies and therefore the definition of falling used could alter the significance of the results. In addition, methods used for recording falls also varied widely between studies.

The full summaries are included in Section 6. From these were derived evidence statements and recommendations.

5.6 Analysis of compliance with interventions for the prevention of falls

5.6.1 Background

Ideally, all participants in a trial should complete the study and follow the protocol in order to provide data on every outcome of interest at all time-points. However, in reality most trials have missing data. This may be because some of the participants drop out before the end of the trial; participants do not follow the protocol, either deliberately or accidentally; or some outcomes are not measured correctly, or cannot be measured at all, at one or more time-points. Regardless of the cause, inappropriate

handling of the missing information can lead to bias. However, on occasions it is impossible to know the status of participants at the times when the missing information should have been collected. This could happen, for example, if participants move to different areas during the study or fail to contact the investigators for an unknown reason. Other reasons may include: inability to comply with the intervention, perhaps due to lack of motivation; the intervention being too difficult; or not acceptable to participants. Excluding these participants or specific outcome measurements from the final analysis can also lead to bias.

The only strategy that can be confidently assumed to eliminate bias in these circumstances is called 'intention to treat' analysis. This means that all the study participants are included in the analyses, as part of the groups to which they were randomised, regardless of whether they completed the study or not. This relies on the researcher having measurement of outcome, regardless of compliance to the intervention.

The purpose of this analysis was to examine the drop out rates and/or losses to follow-up for each trial included in the Cochrane review, where reported. This was done to shed light on the acceptability and sustainability of clinically effective interventions and prevention programmes.

5.6.2 Aim

The aim was to assess patient compliance with clinically effective interventions, as measured by drop-out rates/losses to follow-up.

Methods

Losses to follow-up rates and drop-out rates were extracted from those RCTs that reported clinically effective interventions and were included in the updated Cochrane review *Interventions for the prevention of falls in elderly people* (Gillespie et al. 2003). Reasons for drop-out/loss to follow-up were recorded where reported.

Results

The total number of studies reporting drop out rates/losses to follow-up was 19 out of 58 studies.

For each clinically effective intervention, where reported, details and reasons for drop out and losses to follow-up are presented in the table below. (Refer to Evidence table 6, for full details of the studies from which this information was extracted).

Table 10: Losses-to follow-up and drop-out rates in those studies reporting positive results

Muscle strengthening and balance retraining		
Study	Drop out rates/losses to follow-up	Comments
Campbell (1997, 1999). Community-dwelling women aged 80 years and older, individually tailored intervention.	N=622 invited to participate, n=359 chose not to participate, n=30 not eligible. N=233 at randomisation Intervention (I)=116 Control (C)=117). At one year follow-up n=213(91%) I=103 (88%), C=110(94%) n=153 (71%) agreed to continue for a further year: I=71 C=81 At two year follow-up n=103 (67%): I=41(57%), C=62 (76%) Total losses/drop out rates at two years Intervention= 75 (64%) Control=55 (47%)	Falls were self-recorded using a calendar, which was posted monthly to researcher, for both groups. The intervention group also recorded if they had completed the prescribed exercises. Intention to treat analysis.
Robertson (2001). Community-dwelling aged 75 years and older, individually prescribed exercise programme.	N=590 invited to participate n=284 chose not to participate n=6 not eligible n=240 at randomisation Intervention (I)=121 Control(C)=119 n=13 (10%) withdrew from exercise intervention Withdrew from trial: N=8 (I) n=21(C) At one year follow-up, falls monitored n=211 (87%), I=113(93%), C=98(82%) For the intervention group, 43% (49 of 113) carried out their exercise programme three or more times per week, 72% (n=81) carried it out at least twice a week, 71% (n=80) walked at least twice a week during the year's follow-up. Total losses/drop out rates: 10%	Self-reported postcards sent to researchers monthly. Intention to treat analysis.

Tai Chi		
Study	Drop out rates/losses to follow-up	Comments
Wolf (1996). Community-dwelling untargeted people, mean age 76 years.	Total losses/drop out rates: 40 of 200 (20%) 20 months	Intention to treat analysis not possible.

Home hazard assessment and modification for those with a history of falling

Study	Drop out rates/losses to follow-up	Comments
Nikolaus (2003). Older people (mean age 81) recruited from geriatric hospital and assigned to comprehensive assessment, followed by a diagnostic home visit and home intervention vs. recommendations and usual care.	N=391 eligible N=31 chose not to participate N=360 at randomisation Intervention (I)=181 Control C=179 At follow-up= I=140 (77%) C=139 (77%) Total losses/drop out rates 23% Compliance with intervention recommendations: Recommendation — Compliance rate N(/%) Shower seat — 23 (82) Emergency call — 14 (78) Grab bars — 27 (77) Night light(bed/bathroom) — 20 (70) Anti slip mat bath — 12 (66) Elevation of bed — 19 (63) Rollator — 37 (56) Elevation of toilet seat — 43 (54) Removal of rugs — 12 (41) Removal of obstructions in walkways — 15 (33) 12 months	Falls were recorded using a calendar and telephoned monthly by researchers. Intention to treat analysis.
Day (2002). Untargeted community-dwelling aged 70 and over. Multi-faceted study including home hazard, exercise and vision referral interventions.	Total losses/drop out rates: 1.5 % 18 months	Intention to treat analysis.
Pardessus (2002). Home visit and modification following hospital admission following a fall. Mean age 83 years.	Total losses/drop out rates: 9 of 60 (15%) One year	Intention to treat analysis.

Withdrawal of psychotropic medications

Study	Drop out rates/losses to follow-up	Comments
Campbell (1999). Community-dwelling people aged 65 years and over. Gradual withdrawal of psychotropic medications vs. continuing to take medications.	N=547 invited to participate N=400 chose not to participate N=54 not eligible N=93 at randomisation Intervention= 48 Control= 45 Falls monitored for 24 months I= 33 (68%) C=39 (86%) Total losses/drop out rates: I=32%. C=14% Authors report that one month after completion of the study, 47 % (8 of 17) of the participants from the medication withdrawal group who had taken capsules containing placebo only for the final 30 weeks had restarted taking psychotropic medication.	This study also included a group receiving exercise. Data here is combined to illustrate compliance with the psychotropic programme.

Cardiac pacing		
Study	Drop out rates/losses to follow-up	Comment
Kenny (2001). Older people presenting at A&E following a non-accidental fall, mean age 73. Pacemaker vs. no pacemaker.	Total losses/drop out rates: N=16 of 175 (9%) One year	71,299 A&E attendees screened, n=1624 received carotid sinus massage, n=175 agreed to be randomised. Intention to treat analysis not possible.
Fabacher (1994). Community-dwelling people aged 70 years and over.	Total losses/drop out rates: 59 of 254 (23%) One year	Intention to treat analysis not possible.
Jitapunkel (1998). Community-dwelling people, mean age 76.	Total losses/drop out rates: 44 of 160 (28%) Three years	Not stated.
Newbury (2001). Community-dwelling, age range 75-91.	Total losses/drop out rates: 11 of 100 (11%) 12 months	Intention to treat analysis.
Wagner (1994). Community-dwelling, mean age 72 years.	Total losses/drop out rates: 89 of 1559 (6%) Two years	Intention to treat analysis not possible.

Targeted multidisciplinary interventions		
Study	Drop out rates/losses to follow-up	Comment
Tinetti (1994). Community-dwelling, mean age 77 years, with at least one risk factor present.	Total losses/drop out rates: 10 of 301 (3%) One year	Intention to treat analysis not possible.
Close (1999). Community-dwelling older people, mean age 78, presenting at A&E following a fall.	Total losses/drop out rates:: 93 of 397 (23%) One year	Intention to treat not possible.
Hogan (2001). Community-dwelling, aged 65 years and over, with a falls history in the previous three months.	N=163 at randomisation Intervention=79 Control=84 Completed trial I=66 (83%) C=73 (86%) Total losses/drop out rates: I=17%, C=14% One year	Intention to treat analysis.
Kingston (2001). Community-dwelling, mean age 71 years, attending A&E following a fall.	Total losses/drop out rates: 17 of 109 (16%) 12 weeks	Intention to treat not possible.
Lightbody (2002). Community-dwelling, median age 75, attending A&E following a fall.	Total losses/drop out rates: 34 of 348 (10%) Six months	Intention to treat analysis not possible.
Van Haastregt(2000). Community-dwelling, mean age 77 years with a falls history.	N=392 met inclusion criteria N=316 at randomisation: Intervention=159 Control=157 N completed trial I=120 (75%) C=115 (73%) Total losses/drop out rates: 81 of 316 (26%) 18 months	Intention to treat analysis not possible.

Multidisciplinary: extended care		
Study	Drop out rates/losses to follow-up	Comment
Jensen (2002). Extended care residents aged 65 and over.	N=439 residents (9 facilities) N=402 assessed Intervention=194 (4 facilities) Control= 208 (5 facilities) Follow up and evaluation completed I= 157 (80%) C=167 (80%) Total losses/drop out rates: 20% 8.5 months	Intention to treat analysis not possible.

Summary of results

Muscle strengthening and balance training: appears to be high participation with intervention at one-year follow-up. In one study, 57 per cent were carrying out the intervention at two years follow-up.

Tai Chi: 20 per cent dropout at seven to 20 month follow-up

Home hazard intervention: 2-28 per cent were not available at follow-up (one year-18 months).

Psychotropic medication withdrawal: 68 per cent at follow-up (24 months).

Cardiac pacing: 9 per cent were not available at follow-up (one year).

Untargeted, multidisciplinary interventions: 6-28 per cent drop-out (one to three years).

Targeted, multidisciplinary interventions: 3-26% drop-out (three to 18 months).

Extended care, multidisciplinary intervention: 80 per cent participation at follow-up (34 weeks).

Implications

The intention of this analysis was to shed light on the factors affecting likely patient compliance and adherence to intervention packages and on sustainability. However, insufficient information on reasons for patient drop-out was given in the studies. Drop-out/losses-to follow-up rates give a crude indication of possible participation rates. However, in everyday practice these could either be lower or higher. Factors influencing participation from the patient's perspective is given in Section.5.8.

5.7 Interventions to reduce the psychosocial consequences of falling: review methods and results

5.7.1 Methods

Aim of the review

To present findings on the effect of falls prevention interventions on psychosocial factors, such as confidence and fear of falling. No additional searching was conducted for this review as the source of results was extracted from those trials that reported effective falls prevention interventions and strategies in the Cochrane review (Gillespie et al. 2003).

The review sought to answer the following question:

Do effective falls prevention programmes also improve psychosocial factors related to fear of falling and the psychosocial consequences of falling?

5.7.2 Selection criteria

Study designs

RCTs from the Cochrane interventions for the prevention of falls systematic review that reported clinically effective interventions and that also investigated outcome in terms of psychosocial measures.

Patients

Older people, mainly more than 65 years of age but 60 acceptable.

Settings

All, including A&E; not relating to prevention of falls while a patient in hospital.

Interventions

Clinically effective prevention programmes/ interventions

to reduce the incidence of falls that report psychosocial outcomes.

Outcomes

- Number of falls.
- Measurement of fear, confidence, quality of life and other aspects of psychosocial consequences of falling.
- Mean change or summary statistics were extracted, with significance levels where reported.

5.7.3 Data synthesis

Synthesis of results was not appropriate.

5.7.4 Evidence tables and summary

The number of studies providing information on psychosocial outcomes was two out of the 19 studies reporting clinical effectiveness.

The table below gives details of the psychosocial outcomes from the two studies.

Table 11

Unselected, multidisciplinary interventions: please refer to Evidence table 1 for details of interventions			
Study	Drop out rates/losses to follow-up	Mean change or relative risk (RR)	Comment
Newbury (2001). Community-dwelling, aged 75 and over.	Self-rated health (n(%)) 'Very good' or 'good' for intervention group. Geriatric depression score (GDS).	Baseline= 22(50%) Follow up= 30 (68%) p=0.032 Mean change from baseline to follow-up = -0.5 (-3.95 to 2.95) p=0.05	 Participants were less depressed as measured by the (GDS) following the intervention.
Muscle strengthening and balance training			
Study	Drop out rates/losses to follow-up	Mean change or relative risk (RR)	Comment
Campbell (1997, 1999). Community-dwelling women aged 80 years and older, individually tailored intervention.	Results reported for the intervention group, for those that continue with the study at one year and those who did not. Mean falls efficacy score. Results for those still exercising at two years and those not.	Mean (SD) falls efficacy score: Continued= 89.4(12.8) Withdrew= 83.8(16.4) p=0.009 Exercising= 93.3(9.4) Not exercising= 86.8(15.1) p=0.03	Participants reported increased confidence and reduced fear of falling in the intervention group.

As can be seen above, secondary outcomes relating to psychosocial variables are not routinely measured in all of the included trials. It is therefore difficult to extrapolate from the available limited published evidence. While it is important to determine if falls prevention programmes are effective in reducing the incidence of falls, other outcomes – such as the reduction in fear of falling – that are important for patients should also be measured. It is not clear from the available evidence which component of a prevention programme acts on reducing the incidence of falling and increasing confidence and other quality of life measures.

These two trials, focused on those > 75 and 80 years of age, did show an improvement on psychosocial measures such as depression, confidence and fear of falling. However, in the absence of patient interviews it is difficult to know if it is the social benefits of participating in group programmes that exert a benefit, in addition to the benefit from reduction in falls.

5.8 Patient views and experiences: review methods and results

5.8.1 Background

Information on patients' views, compliance with and acceptability of falls prevention programmes is lacking within trials and systematic reviews. Accordingly, studies that investigated these factors were reviewed. Both this evidence and the evidence from the systematic review (Gillespie et al. 2003) are needed to enable the development of pragmatic recommendations on falls prevention.

Frequently within trials the only indicator of compliance is the drop-out/losses to follow-up rate, which includes reasons relating to morbidity and mortality (see Section 5.6 above). While these are useful measures, it is likely that compliance rates in trials of falls interventions may be lower than in actual clinical practice. This is because of the advantage within trials of dedicated resources – such as follow-up telephone calls etc – to maximise participation. Information of patients' views of the falls prevention trials in which they participated is similarly lacking.

Therefore, it was thought useful to review and summarise evidence that captures the patient perspective on the likely barriers to and facilitators of participation in falls prevention programmes. This may indicate successful methods to promote compliance/adherence and participation in falls prevention programmes.

Much of this evidence comes from studies conducted independently of trials of falls prevention, which therefore reflect a variety of designs, settings and participants. However, appraisal of this material enables a fuller consideration of some of the issues associated with falls prevention programmes from the perspective of the intended target group.

All studies were quality assessed and the relevant data extracted and reported in evidence tables. The summarised results and conclusions were then condensed in a table on 'summary of barriers/facilitators relating to falls prevention programmes' to give the GDG a breakdown of the key points arising from these studies.

Methods

Objective

To review qualitative and quantitative studies published in the last 10 years, which examine older people's views of falls prevention strategies.

Inclusion criteria

Study designs: All (systematic review – qualitative). May include studies conducted concurrently with RCTs, or independently

Publication status: Not theses, letters, editorials

Dates: 1990-May 2003

Language: English

Patients: Older people (mainly more than 65 years of age)

Settings: All, including A&E, except relating to preventing falls in hospital settings

Outcomes: Measures and/or self-report/clinician report of:

- barriers to and benefits of participation in falls prevention programmes
- participant views and experiences of falls prevention strategies
- compliance/adherence with falls prevention strategies or components of falls prevention strategies, such as exercise.

Exclusion criteria

Theses, letters, editorials, case studies.

Studies with a focus on hospital-based falls prevention programmes for patients who have fallen whilst a hospital inpatient.

5.8.4 Search strategy

The search strategy was devised to be very broad in order to pick up qualitative studies for this review. The search strategies and the databases searched are presented in Appendix B. All searches were comprehensive and included a large number of databases. All search strategies were adapted for smaller or simpler databases or for web-based sources, which did not allow complex strategies or multi-term searching. A combination of subject heading and free text searches was used for all areas. Free text terms were checked on the major databases to ensure that they captured descriptor terms and their exploded terms.

5.8.5 Data abstraction

Data from included trials were extracted by one reviewer into pre-prepared data extraction tables. The following data were extracted from each study:

Qualitative

Study, aim of study, methods, sample characteristics, setting, results, conclusions.

Quantitative

Study, objective, setting, population characteristics, methods, interventions, outcomes, results.

All data were extracted into evidence tables (Evidence table 6, Appendix E).

5.8.6 Appraisal of methodological quality

All studies were quality assessed by one person, using study design specific quality assessment checklists developed by the Centre for Statistics in Medicine. The qualitative checklist was developed in-house, based on others, and then circulated to qualitative researchers for comment and refinement. See Appendix C for further details of quality for specific study designs.

5.8.7 Data synthesis

No quantitative analysis was undertaken. The data were presented in evidence tables and the main findings were qualitatively summarised. A table of barriers and facilitators was generated based on the findings of the studies.

5.8.8 Details of studies included in the review

Sifting results

The numbers of studies obtained are detailed in Table 12.

Table 12: Results of search/sift for studies of patients' views and experiences

Total number of hits	14576
Full articles ordered	31
Final number articles included	24

Type of studies included

- Qualitative (two were unpublished) – 10
- Systematic review – one
- Narrative review – three
- Randomised controlled – three
- Before/after – three
- Cross-sectional – four.

Participants and settings

Qualitative

One study (Resnick 1999) investigated the views of nursing home residents. Three studies were conducted on hospital wards; one on people admitted to an orthopaedic trauma elderly care ward (Ballinger & Payne 2000); one on people admitted to an elder care ward after a fall sustained either in the community or hospital setting (Kong et al. 2002) and the other on patients admitted to an acute elderly care medical ward (reasons not given) (Simpson et al. 2003). The remaining studies were conducted on community-dwelling residents.

Four studies examined the views of non-English speaking people (Aminzedah & Edwards 1998; Commonwealth of Australia 2000; Kong et al. 2002; Health Education Board 1999). Four studies were conducted in the UK.

Quantitative

All studies were based in the community, except Simpson (1995) who surveyed patients on a rehabilitation ward; and Wielandt (2002) and Culos-Reed (2000) who covered all settings. Most studies were conducted in the United Kingdom, USA or Australia.

Outcomes

Qualitative

All studies examined people's views or knowledge of falls prevention. Two examined perceptions, motivations and barriers to physical activity (Grossman et al. 2003; Stead et al. 1997). Outcomes were measured in various ways, including semi-structured interviews and focus groups. Commonly, the output from data collection was condensed into themes and categories.

Quantitative

These studies mainly measured or reviewed the following: predictors of increased exercise compliance, behaviour change, falls history, fear of falling, ability and confidence, self-efficacy, participation rates, or activity levels. Variables were categorical, ordinal or open-ended.

5.8.9 Methodological quality of studies

A summary of the methodological quality of each study is shown in Appendix F.

Qualitative

Ten qualitative studies of reasonable quality were found and reviewed. The results of the quality assessment are included in Appendix F. Respondent validation – where the analysis of the study is fed-back to the participants for validation – was the one criterion for which studies exhibited the most variable quality. However, the studies mainly scored well on other criteria and all were considered worthy of data extraction.

Qualitative methods used ranged from phenomenology – a qualitative method used to gain information on patients' experiences, in their own words – to discourse analysis – in which the output was subject to interpretation by the researcher. Many studies did not state a theoretical position. However, all papers appeared to be based on a similar framework, aiming to capture and analyse participant accounts and experiences of falls prevention or physical activity, using focus groups or unstructured/semi-structured interviews to collect data.

Quantitative

Overall the quality of the available studies was poor to fair. There were a limited number of review or summary papers and only one of these was done systematically (Hillsdon 1995). The conclusions authors drew and the recommendations they made very often did not flow from their own study results and/or from synthesising their results with previous work. None of the randomised trials had undertaken power calculations, so it is difficult to assess the reliability of these results. More details on the quality of each included study are included in the column 'comments/quality issues' of the Evidence table 7a and 7b, Appendix E.

Characteristics of excluded studies are shown in Appendix G.

5.8.10 Evidence summary

Studies focussed on patient views of either specific interventions, such as assistive/mobility aids (Aminzedah & Edwards 1998); or multiple separate interventions (Commonwealth of Australia 2000; Simpson et al. 2003) or a single approach such as exercise (Health Education Board 1999; Stead et al. 1997; Grossman et al. 2003). There was no qualitative study that investigated older people's views on multifactorial packages. A number of studies also focussed on the likelihood of adopting preventative practices and need for information on falls prevention (Ballinger & Payne 2000; Kong et al. 2002; Porter 1999; Resnick 1999).

Table 13 summarises the facilitators to and barriers to falls prevention and physical activity from these studies.

Most of the studies investigating potential participants' views of falls prevention were conducted independently of trials of falls prevention. It is possible that if conducted concurrently as part of a trial the results may be different. Furthermore, it was not clear from many studies if any of the subjects had previously participated in falls prevention programmes. Nonetheless, important information is provided that requires consideration in addition to the clinical effectiveness evidence, when recommending which falls prevention programmes are suitable for whom and under what conditions.

Table 13: Summary of barriers/facilitators relating to falls prevention programmes

Community-dwelling older people	
Facilitators	**Barriers**
Information from a variety of sources (GP, mass media, community nurse, and published in different languages).	Lack of non-English speaking information.
Information that falls can be preventable rather than unpredictable.	The term 'fall prevention' is unfamiliar and the perceived relevance of falls prevention low until fall experienced.
Information that communicates life-enhancing aspects of falls prevention, such as maintaining independence, control.	Inaccessible and unappealing information.
Emphasis on social aspects of falls prevention programmes.	Social stigma attached to programmes targeting 'older people'.
Partnering with a peer who has successfully undertaken a falls prevention programme.	Low health expectations and low confidence in physical abilities.
Finding out which characteristics the person is willing to modify.	Differing agendas between older people and health professionals.
Countering the belief that nothing can be done for falls.	Pain, effort and age (in relation to exercise programmes).
Programmes with exercise which is of moderate intensity only. Addressing the following issues prior to participation in intervention strategies: activity avoidance, fear of falling, fear of injury, lack of perceived ability, fear of exertion.	Programmes with an emphasis on balance and strengthening.
Assistive/mobility aids and home modification most readily accepted interventions.	Lack of transport to venues.
People may be more receptive to messages around prevention when they have actually had a fall or near fall.	No support from family.

Extended care settings	
Facilitators	**Barriers**
Reminders by staff to be active.	Fear of falling; reluctance to walk; pain, effort and age (in relation to exercise programmes).

5.9 Rehabilitation: review methods and results

5.9.1 Background

The focus of this review was on rehabilitation interventions following an injurious fall, which resulted in treatment within either primary or acute care. Rehabilitation involves a number of approaches from intensive training programmes – from multifactorial interventions to single more targeted interventions that focus on balance or strength exercise training. These interventions can be given through specialist care from therapists or via a multidisciplinary team. Therefore the aim of this review was to determine the effectiveness of these programmes for rehabilitation, following a fall that resulted in hospitalisation.

Definitions

The following explains the differences between primary prevention, secondary prevention and rehabilitation for the purposes of this review. Also defined is injurious fall.

- Primary prevention – interventions that are targeted at those at risk or high risk of a fall.
- Secondary intervention – interventions that are targeted at those with a history of falls.
- Rehabilitation – interventions that are targeted at those who have suffered an injurious fall.
- Injurious fall – fall resulting in a fracture or soft tissue damage that required treatment.

5.9.2 Objectives

The review sought to answer the following questions:

What are the most effective methods of rehabilitation/intervention/process of care, following an injurious fall?

5.9.3 Selection criteria

The Cochrane review on interventions for the prevention of falls was the principle source of evidence for this review, as this provided the most up-to-date evidence of falls prevention programmes, including some specific to rehabilitation strategies. Data from the RCTs included in this review that met the selection criteria were extracted.

A further search was conducted to ensure all relevant trials specific to rehabilitation had been identified.

In addition, key relevant published documents relating to rehabilitation, such as guidelines and systematic reviews nominated by the GDG, were reviewed.

Types of studies

For individual studies we selected RCTs, controlled clinical trials, controlled before and after studies, and interrupted time series analyses. Included were studies in the Cochrane review, which had been conducted on participants who were selected on the basis of an injurious fall, and were given rehabilitation in residential settings or in the home. This included studies examining early discharge programmes.

In addition, key documents such as clinical guidelines, health technology assessments, systematic reviews and other important policy documents relating to rehabilitation were sought.

Participants

Older people – mainly more than 65 years of age but 60 acceptable – who had sustained an injurious fall and received care/treatment from primary care, or acute care as an inpatient or outpatient.

Settings

Accident & Emergency, community-dwelling and extended care. Rehabilitation programmes implemented within inpatient discharge plans/programmes.

Interventions

Any intervention that is implemented for the purposes of rehabilitation following an injurious fall. For example:

- exercise/strength training
- nurse/therapist interventions
- balance training
- home modification
- early discharge vs. hospital rehabilitation
- education
- assistive devices
- multidisciplinary and community support.

Outcomes

Reduction in number of falls/injurious falls.

5.9.4 Search strategy

A search was conducted to ensure all relevant papers were gathered for this review, in addition to those identified in the Cochrane review, and to identify key documents relating to rehabilitation. The first search was conducted in October 2002, and it was updated on all selected databases in July 2003. Seven electronic databases were searched between 1980 and October 2002, using a sensitive search strategy.

The search strategies and the databases searched are presented in Appendix B. All searches were comprehensive and included a large number of databases. All search strategies were adapted for smaller or simpler databases or for web-based sources, which did not allow complex strategies or multi-term searching.

A combination of subject heading and free text searches was used for all areas. Free text terms were checked on the major databases to ensure that they captured descriptor terms and their exploded terms.

5.9.7 Data abstraction

The following data were extracted from each study:

Country of origin	Participant and setting details
Intervention and comparison	Sample sizes
Follow-up period	Losses to follow-up
Outcomes	RR and confidence intervals
Randomisation process	Quality assessment

No statistical analysis of inter-rater reliability of dual data extraction was performed. Differences were resolved by discussion.

5.9.8 Appraisal of methodological quality

Once individual papers were retrieved, the articles were checked for methodological rigour, using quality checklists appropriate for each study design (Appendix F), applicability to the UK and clinical significance. Assessment of study quality concentrated on dimensions of internal validity and external validity. Information from each study that met the quality criteria was summarised and entered into evidence tables.

Quality appraisal for this review was based on the Cochrane review criteria of assessment of methodological quality (Appendix F). The two papers excluded from the Cochrane review relevant to rehabilitation (Tinetti 1999 and Crotty 2002) included here were quality appraised using the Cochrane quality criteria.

5.9.9 Data synthesis

Individual study results were reported in evidence tables.

5.9.10 Details of studies included

As detailed below, nine studies were relevant and included from the Cochrane review.

There were nine trials from the Cochrane review relevant to rehabilitation (see table 14). Included studies were: Close et al. (1999); Crotty et al. (2002); Ebrahim (1997); Kingston (2001); Lightbody (2001); Pardessus (2002); Rubenstein (1990); Shaw (2003); Tinetti (1999).

Table 14: Included studies for rehabilitation review

Cochrane review: Included studies	58
Sifted relevant to this review-	7 + 2 from the excluded 97 references related to the review topic
Included	9

Two of these papers – Tinetti (1999) and Crotty (2002) – were excluded from the Cochrane review on the grounds that falls were only measured as adverse events, rather than as a primary outcome. However, they are relevant to this review as they evaluate rehabilitation programmes post-injurious fall. Data were extracted directly from the original paper and relative risks (RR) calculated.

Results of the supplementary search for additional trials and key documents are shown in the table below.

Table 15: Results of supplementary search

Total number of hits	1684
N screened	26
N relevant	9
Final number articles included	1 trial 7 relevant documents

The supplementary search conducted for this review elicited one further RCT for inclusion (Crotty 2002), which had not been included in the Cochrane review. Many studies were identified that had examined the effects of rehabilitation on intermediate outcomes – for example: mobility, quality of life and psychosocial factors – but these studies did not measure subsequent falls as an outcome.

The key documents identified are listed below and summarised in Evidence table 9, Appendix E.

Table 16: Reviews and guidelines of relevance to rehabilitation following a fall

1. Cameron et al. (2000). Geriatric rehabilitation following fractures in older people: a systematic review. Health Technology Assessment 2000; 4 (2).
2. (2002) Prevention and management of hip fracture in older people, Scotland: Scottish Intercollegiate Guidelines Network.
3. (June 2000) Guidelines for the collaborative rehabilitative management of elderly people who have fallen, London: The Chartered Society of Physiotherapy and the College of Occupational Therapists.
4. Parker et al. (2002) Mobilisation strategies after hip fracture surgery in adults (Cochrane review) in The Cochrane Library, Issue 4 2002, Oxford.
5. Cameron et al. (2002). Co-ordinated multidisciplinary approaches for in patient rehabilitation of older patients with proximal femoral fractures, (Cochrane review), in The Cochrane Library, Issue 3, Oxford.
6. Ward et al. (2003). Care home versus hospital and own home environments for rehabilitation of older people (Cochrane review), in The Cochrane Library, Issue 3.

Settings

Five trials reported the effect of interventions in A&E settings. In two trials, the intervention was initiated within a hospital setting and continued in the community. Two further trials included participants from an extended care setting and community-dwelling.

Participants

Three trials recruited participants presenting to A&E, following a fall, who were discharged home following treatment. One trial set in an A&E setting, recruited cognitively impaired participants with a recent fall requiring treatment. Two trials recruited participants in a hospital setting following surgical treatment of a hip fracture, and one other recruited those who had been hospitalised following a fall. Two trials recruited participants with a history of falls in an extended care setting and community-dwelling.

Interventions

Close (1999) compared a multifactorial intervention with usual care in community-dwelling individuals presenting at A&E following a fall. The intervention involved medical and occupational therapy assessments and targeted interventions; medical assessment to identify primary cause of fall and other risk factors; with an intervention or referral as required, and home visit by occupational therapist. Participants were at least 65 years old with a history of falling, having presented at A&E with a subsequent fall. Falls data was obtained by a falls diary with four monthly follow-up for a period of one year.

Crotty (2002) compared accelerated discharge and home-based rehabilitation, including home modifications with conventional treatment in those admitted for surgical treatment for a hip fracture. The intervention included a home visit by a physiotherapist, an occupational therapist, a speech pathologist, a social worker and a therapy aid, who negotiated short-term goals with a participant and their carer. The sample size was small (n=66) but no losses to follow-up were reported.

Tinetti (1999) compared systematic multi-component rehabilitation with an 'aids to daily living' strategy, with usual care with limited activities, in non-demented older persons who underwent surgical repair of hip fracture and returned home within 100 days. This intervention included physical therapy involving assessment and exercise programmes individually tailored in strength, gait, balance, transfers and stair climbing. It also included functional therapy, based on principles of occupational therapy, to identify and improve performance of tasks of daily life. Both these programme elements involved tapered visits up to six months.

Ebrahim (1997) compared general advice on health and diet, and encouraging brisk walking for 40 minutes, three times per week, with general advice on health and diet with upper limb exercises. Participants were post-menopausal women identified from A&E and orthopaedic fracture clinic records who had a fractured upper limb in the last two years.

Kingston (2001) compared rapid health visitor intervention within five working days of index fall and multiple interventions, managed on an individual basis for 12 months, with usual post fall treatment in community-dwelling women attending A&E after a fall who were discharged directly home. The multiple interventions programme included pain control, getting up after a fall, education about risk factors, advice on diet and exercise to strengthen muscles and joints in an individualised programme.

Lightbody (2002) compared multifactorial assessment by a dedicated 'falls' nurse, with usual care in consecutive patients attending A&E following a fall. The intervention included one home visit for assessment of medication, vision, hearing, balance mobility, feet and environmental assessment, with referral to a range of other services as required. Advice was also given and education about home safety.

Pardessus (2002) compared a comprehensive two-hour home visit – with specialist health care professionals of multifactorial interventions – with usual care in those hospitalised with a recent fall, recruited in hospital. The intervention included assessment by specialist occupational therapist, rehabilitation doctor and physician prior to discharge. Environmental hazards were identified and modified and social support was given.

Rubinstein (1990) compared nurse practitioner assessment within seven days of a fall – with referral for intervention to physician for recommendations for action and referral for intervention – with usual care in men and women in long-term residential care.

Shaw (2003) compared multifactorial, multidisciplinary clinical assessment and intervention given for identified risk factors, with clinical assessment but no intervention in older people with cognitive impairment or dementia attending A&E after a fall. This intervention included medical, physiotherapy, occupational therapy and cardiovascular assessment with interventions for all identified risk factors.

5.9.15 Methodological quality of studies

A summary of the methodological quality of each study of the trials is shown in Appendix F.

In four studies, assignment of treatment was adequately

concealed. (Crotty 2002; Ebrahim 1997; Rubinstein 1990; Shaw 2003). In the remaining five studies, information was inadequate to judge concealment. (Close 1999; Kingston 2001; Lightbody 2002; Pardessus 2002; Tinetti 1999). The overall quality scores were high-medium for two studies. (Crotty 2002; Shaw 2003). They were medium in five studies. (Close 1999; Ebrahim 1997; Lightbody 2002; Pardessus 2002; Tinetti 1999). They were medium to low in one study (Rubinstein,1990) and low in one study (Kingston 2001).

Losses to follow-up ranged from 0 (or not stated), (Crotty 2002; Rubinstein 1990) to 41 per cent (Ebrahim 1997) mostly the studies fell within the 20 per cent quality cut-off or just outside at 23 per cent (Close 1999).

Five studies were based on intention to treat analysis (Crotty 2002; Pardessus 2002; Rubinstein 1990; Shaw 2003; Tinetti 1999) while for four studies, intention to treat analysis was not possible, as no outcome data were available (Close 1999; Ebrahim 1997; Kingston 2001; Lightbody 2002).

Active registration of falling outcomes or use of a diary was clearly indicated in five studies (Close 1999; Crotty 2002; Lightbody 2002; Rubenstein 1990; Shaw 2003) or was by participant recall, at intervals during the study or at its conclusion (Ebrahim 1997), or was not described in three studies (Kingston 2001; Pardessus 2002; Tinetti 1999).

Characteristics of excluded studies are shown in Appendix G.

5.9.16 Comparisons

Trials were included in which participants were 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.

5.9.17 Evidence summary

The studies reporting significant results suggest that a multifactorial approach, including multidisciplinary assessment and targeted interventions, could have some impact on reducing the incidence of falling as part of a rehabilitation programme, following a fall resulting in medical attention. It is less clear from this evidence of the impact of these complex interventions on other factors – such as confidence; quality of life and acceptability – as limited data were available. There perhaps also needs to be consideration of the planned withdrawal of such programmes and the ability of these individuals to sustain the improvement shown.

It is less clear which specific mechanisms of this multifactorial approach to rehabilitation are effective, but the fundamental key to success may be through comprehensive discharge planning.

This evidence is supported by key documents, in particular the expected standards of care outlined in the NSF for older people (standard six).

5.10 The effectiveness of hip protectors: review methods and results

5.10.1 Background

Although hip protectors do not prevent falling, they do prevent one of the consequences of falling, that is hip fracture. Therefore, they can be considered as a secondary prevention/rehabilitation strategy in patients at risk of falling. The use of padding worn around the hip has been advocated as a measure of reducing the impact of the fall and thereby the chance of fracturing the hip. The fracture is usually the result of a fall. The fall usually occurs whilst standing or walking and the impact with the ground is usually on the side in the region of the hip (Hopkinson-W 1998). The rationale and development of such protectors has been summarised in Lauritzen (1977) and Lauritzen (1996). Various types of padded hip protectors have been developed. Most consist of plastic shields or foam pads, which are kept in place by pockets within specially designed underwear.

A Cochrane review on the effectiveness of hip protectors has recently been updated (Parker et al. 2003). The methods and results of the review are summarised below and are taken from Parker et al. (2003). The full details are available at the Cochrane Library.

5.10.2 Objectives

The review sought to answer the following question:

Do hip pads or protectors worn about the hip reduce the risk of fracturing the hip?.

5.10.3 Selection criteria

Types of studies

All randomised controlled trials comparing the incidence of hip fractures in those allocated to wearing hip protectors with the incidence in those not allocated to using protectors. Quasi-randomised trials were also considered for inclusion.

Types of participants

Older people of either gender living in the community or in institutional care.

Types of intervention

Allocation to wearing of hip protectors, or to not wearing hip protectors.

Types of outcome

- Incidence of hip fractures over the study period.
- Incidence of pubic rami and other pelvic fractures.
- Incidence of other fractures.
- Incidence of reported falls.
- Mortality.
- Compliance with protectors.
- Reported complications of use of protectors, including skin damage/breakdown.
- Cost effectiveness of the protectors.

5.10.4 Search strategy

The following sources were searched:

- Cochrane Musculoskeletal Injuries Group's specialised register (April 2003)
- Cochrane Central Register of Controlled Trials (The Cochrane Library issue 1, 2003)
- MEDLINE (1966 to April 2003)
- EMBASE (1988 to 2003 Week 14)
- CINAHL (1982 to April 2003)
- reference lists of relevant articles
- trialists were contacted and ongoing trials identified in the National Research Register (http://www.update-software.com/national/ accessed 20/01/03) and Current Controlled Trials (http://controlled-trials.com/ accessed 20/01/03).

The search strategies and the databases searched are presented in Appendix B. All searches were comprehensive and included a large number of databases. All search strategies were adapted for smaller or simpler databases or for web-based sources, which did not allow complex strategies or multi-term searching.

5.10.5 Sifting process

Once articles were retrieved the following sifting process took place:

- First sift: for material that potentially meets eligibility criteria on basis of title/abstract by two reviewers.
- Second sift: full papers ordered that appear relevant and eligible and where relevance/eligibility not clear from the abstract by two reviewers.
- Third sift: full articles are appraised that meet eligibility criteria by two reviewers.

5.10.6 Data abstraction

Data from included trials were extracted by two reviewers into pre-prepared data extraction tables. Discrepancies were discussed and resolved. The following data were extracted from each study:

- patient inclusion/exclusion criteria
- care setting
- key baseline variables by group
- description of the interventions and numbers of patients randomised to each intervention
- description of any co-interventions/standard care
- duration and extent of follow-up
- outcomes
- acceptability and reliability if reported. If data were missing from reports then attempts were made to contact the authors to complete the information necessary for the critical appraisal. If studies were published more than once, the most detailed report was used as the basis of the data extraction.

5.10.7 Appraisal of methodological quality

The methodological quality of each trial was assessed by two researchers independently using a 10-item scale, with a total score for each trial. Full details of the principles of quality used in this review are reported in Appendix C. The following quality criteria were used:

- description of inclusion and exclusion criteria used to derive the sample from the target population
- description of a priori sample size calculation
- evidence of allocation concealment at randomisation
- description of baseline comparability of treatment groups
- outcome assessment stated to be blinded
- clear description of main interventions
- intention to treat analysis
- timing of outcome measures
- reporting of loss to follow-up
- compliance of treatment.

5.10.9 Data synthesis

For each study, relative risk (RR)(fixed effect) and 95 per cent confidence limits (CI) were calculated for dichotomous outcomes. However, the authors of the review caution that the results must be considered as exploratory for the studies that used cluster randomisation. As cluster randomisation results in reduced effective sample size and statistical power, analysis using the number of patients in each group gives inappropriately narrow confidence intervals (Parker et al. 2003). Results from individually randomised trials were pooled using the fixed effects model. Heterogeneity between comparable trials was

tested using a standard chi-squared test. All statistical analysis was performed on Revman (v3.1.1) and conducted by the CWG.

5.10.10 Details of studies included in the review

Thirteen randomised controlled trials were included (seven in the previous review 1999).

Settings

The 13 included studies involved a total of 6,849 older people in residential settings or community dwelling. Within these, three studies were in a community-dwelling setting (one UK-based); the remaining 10 were conducted in a residential setting (one UK).

Participants

Mean age of participants in the individual studies, where reported, ranged from 80 to 86 years.

Interventions

Protective hip pads placed in the region of the greater trochanter were used in all trials. Ordinary underwear with no special fixation for the hip pad was used in Ekman (1997). The hip pads were fixed or sewn into special underwear in 12 studies (Birks 2003; Cameron 2001; Cameron 2003; Chan 2000; Harada 2001; Jantti 1996; Hubacher 2001; Meyer 2003; Kannus 2000; Lauritzen 1993; Van Schoor 2003; Villar 1998). All studies except two used an 'energy shunting' design. In Jantti (1996) 'energy absorbing' safety pants were used and for Chan (2000) the pads of local design for which it was not possible to say if they were energy absorbing or shunting.

Outcomes:

See Evidence table 11 (Appendix E) for details of other outcomes measured in the included trials.

5.10.11 Methodological quality of the studies

A summary of the methodological quality of each study of the trials is shown in Appendix F and principles of quality assessment in Appendix C.

Eight studies were randomised by participant (Birks 2003; Cameron 2001; Cameron 2003; Chan 2000; Janitti 1996; Hubacher 2001; Van Schoor 2003; Villar 1998). In Birks (2003), randomisation was carried out by a remote randomisation service accessed by telephone. Cameron (2001), Cameron (2003) and Janitti (1996) randomised the patients individually by sealed envelopes. Van Schoor (2003) used computer generated random numbers. Chan (2000) stated that the method of randomisation was by 'taking draws literally'. About half the participants in Hubacher (2001) were randomised by the head of the nursing home; the remainder were randomised by a computer. No details of the method of randomisation were provided by Villar (1998).

The remaining five studies were cluster randomised. The unit of randomisation in Lauritzen (1993) was the nursing home ward occupied by the participants, selected by an independent physician drawing the number of the 28 nursing home wards. In Ekman (1997), residents of one of four nursing homes were offered the hip protectors with the other three homes acting as controls. Kannus (2000) used an independent physician drawing sealed envelopes to randomise treatment units within 22 community based health care centres. Losses within treatment units during the study were replaced from a 'waiting list'. It is unclear how selection bias was avoided in this process. Harada (2001) used the even or odd digit of the patient's room number to allocate participants. Each room had up to four patients. The unit of randomisation in Meyer (2003) was a nursing home or independently working wards in large nursing homes. Forty-nine clusters were randomised by phone from an external central location using computer-generated lists.

Characteristics of excluded studies are shown in Appendix G.

5.10.12 Comparisons

The comparisons relevant to this guideline and able to be made on the basis of the included studies were: allocation to wearing of hip protectors, or to not wearing hip protectors.

5.10.13 Evidence summary

Parker et al. (2003) report the following:

- Five studies involving 4,316 participants were cluster randomised by care unit, nursing home or nursing home ward rather than by the individual. Individually, each of these studies reported a reduced incidence of hip fractures within those units allocated to receive the protectors. Because of the use of cluster randomisation, pooling of results of these studies was not undertaken.
- Pooling of data from five individually randomised trials conducted in nursing/residential care settings (1,426 participants) showed no significant reduction in hip fracture incidence (hip protectors 37/822, controls 40/604, RR 0.83, 95% CI 0.54 to 1.29).
- Two individually randomised trials of 966 community-dwelling participants, reported no reduction in hip fracture incidence with the hip protectors (RR 1.11, 95% CI 0.65 to 1.90). No important adverse effects of the hip protectors were reported but compliance, particularly in the long-term, was poor.

See Evidence table 10 and 11, Appendix E for further details of studies and outcomes.

Implications for practice (Parker et al. 2003)

- Reported studies that have used individual patient randomisation, have provided insufficient evidence for the effectiveness of hip protectors when offered to older people living in residential care or in their own home.
- Data from cluster randomised studies provide some evidence of effectiveness of hip protectors in reducing the risk of hip fractures in those living in nursing homes and considered to be a high risk of hip fractures.
- Reported adverse effects of hip protectors are skin irritation, abrasion and local discomfort.
- Compliance with wearing the protectors remains a problem.

Full evidence reviews are included under the relevant recommendations in Section 6, along with evidence statements.

5.11 Cost effectiveness review and modelling: methods and results

To fulfil the DH and Welsh Assembly Government remit, NICE requested that the cost effectiveness evidence of interventions for the assessment and prevention of falls in older people be assessed. In accordance with the objectives of the scope, cost effectiveness was addressed in the following way:

- a comparison of the cost and cost effectiveness of falls prevention interventions compared with usual care, other intentions or no intervention; and
- an investigation of which types of falls prevention programmes are the most cost effective.

The aim of the review was twofold. Firstly, to identify economic evaluations that had been conducted alongside trials and secondly, to identify evidence that could be used in cost effectiveness modelling.

Health economic evidence

The searches for economic evidence were designed to identify information about the resources used in providing the existing service, and any additional resource use associated with increased interventions and the benefits that could be attributed. The searches were not limited to RCTs or formal economic evaluations. The search strategy is shown below and the number of papers, sorted by intervention.

Identified titles and abstracts from the economics searches were reviewed by the health economist and full papers obtained as appropriate. The full papers were critically appraised by the health economist. Consideration was given to each study design and the applicability of the results to the guideline context. Quality was assessed using the Drummond et al. (1999) economic evaluation checklist. An important issue in this respect is that much of the evidence on costs and benefits comes from health care systems outside a UK setting and are therefore of limited value to a UK guideline.

Searching for health economics evidence

The searching was carried out by an information scientist at the School of Health and Related Research (ScHARR), with guidance on the search terms from the health economist.

Search strategy

The search strategy used was as follows:

Economic evaluations

Fall or falls or falling or fallers

"Accidental-falls"/all subheadings

old or older or senior* or elder* or aged or geriatric*

explode "Aged"/all subheadings

"Middle-Age"/all subheadings

1. economics/
2. exp "costs and cost analysis"/
3. economic value of life/
4. exp economics, hospital/
5. exp economics, medical/
6. economics, nursing/
7. economics, pharmaceutical/
8. exp models, economic/
9. exp "fees and charges"/
10. exp budgets/
11. ec.fs
12. (cost or costs or costed or costly or costing$).tw
13. (economic$ or pharmacoeconomic$ or price$ or pricing).tw
14. or/1-13
15. exp quality of life/
16. quality of life.tw
17. life quality.tw.
18. hql.tw

19. (sf 36 or sf36 or sf thirtysix or sf thirty six or short form 36
20. qol.tw.
21. (euroquol or eq5d or eq 5d).tw.
22. qaly$.tw
23. quality adjusted life year$.tw
24. hye$.tw
25. health$ year$ equivalent$.tw.
26. health utilitie$.tw.
27. hui.tw.
28. quality of well-being$.tw.
29. quality of well being.tw.
30. qwb.tw.
31. (qald$ or qale$ or qtime$). Tw.
32. or/15-31
33. from 32 keep 1

Searches were done from 1966 to the present (April 2003) and initially with no language restrictions. The following databases were searched

- Medline
- Embase
- NHS EED
- OHE HEED

Databases were searched in April 2003 and from these searches there were 2,354 hits.

In addition, reference lists from appraised papers were checked for further useful references. The systematic reviewer at the NCC also noted any potentially suitable references and passed them on to the health economist.

Inclusion criteria

The titles and, where available, the abstracts were screened to assess whether the study met the following inclusion criteria:

– Population: older people who had had a fall or were deemed at risk of a fall.

– Economic evidence: the study was an economic evaluation or included information on resources, costs or specific quality of life measures.

– Study design: no criteria for study design were imposed a priori.

Exclusion criteria

Papers were excluded if they did not contain cost effectiveness data, quality of life data or were simply a description of costs. An exception to this was made when examining papers that were of use in providing data on the costs of an intervention for any cost effectiveness modelling. Papers of this type needed to include a breakdown of resource use, unit costs, the source of the data, the year it was collected and the level of discounting applied.

Sifting was carried out by one assessor. Initially all papers that included the terms 'cost effectiveness', 'quality of life' or 'costs' were selected. The abstracts were checked where possible and those papers that were descriptive or commentary were excluded.

Summary of results

After reviewing titles, abstracts and CRD/OHE HEED commentaries (where available), 106 potentially useful papers were included. A small number of these papers included background information and more detailed input about the interventions and issues involved. Six papers were in languages other than English and were not obtained.

Full papers were obtained and a significant number proved to be unhelpful. Papers had been ordered that contained at least one of the key words, costs, or quality of life and/or economics. On review, these papers were often found not to contain any data. This was particularly the case in papers that mentioned cost and quality of life in the title or abstract. This reduced the included papers to 14. Very few of these were good quality formal economic evaluations. Table 17 shows the areas directed by the GDG and the number of papers that were reviewed in each area.

Table 17: Cost effectiveness papers reviewed

Area	Number of papers reviewed
Financial cost of falls to the NHS	1
Pharmaceutical interventions	2
Exercise programmes	4
Tai Chi	1
Home hazard assessment and modification	2
Multifactorial interventions	2
Hip protectors	2

Table 18 below details the papers included, the methodology used in the studies and the cost effectiveness results

Table 18

Author, year & country	Intervention	Client group Age	Outcome measure	Method e.g. RCT	Costs included	Cost per person	Cost effectiveness
Robertson 2001a NZ	Home-based exercise	≤80	Fall reduction	Yes	All costs associated with the intervention. Treatment costs.	NZ$432	NZ$1,803 per fall prevented
Robertson 2001b NZ	Home-based exercise	≥80	Fall reduction	Yes	All cost associated with the intervention. Treatment costs.	NZ$418	NZ$1519 per fall prevented
Buchner 1997 USA	Centre-based exercise	68-85	Balance, gait fall reduction	Yes	Not reported. Treatment costs.	N/A	N/A
Schnelle 2003 USA	Exercise and incontinence care	≥80 in residential care	Overall health including falls	Yes	Not stated. Treatment costs.	N/A	N/A
Salkeld 2000 Aus.	Home hazard	≥65 mean 74	Fall reduction	Yes	All costs associated with the intervention. Treatment costs.	A$98	A$4986 per fall prevented
Smith 1998 Aus.	Home hazard model	≥75	Fall reduction	Decision analytic model	All costs.	A$172	A$1721
Tinetti 1994 Rizzo 1996 USA	Multifactorial	≥70	Fall reduction	Yes	Costs for intervention only. Treatment costs.	$891	$2150

Refer to Section 6 for recommendations and cost effectiveness details for each intervention.

In addition to the evidence reported in Section 6, the report by Scuffham et al. (2003) was also considered as it contains information on the incidence and costs of falls in the UK. The authors accessed the dataset from the Department of Trade and Industry (DTI) to examine the data collected in the year 2000 from the participating A&E departments.

They report the total cost of falls to the UK government as more than £1 billion. Just over half this cost was incurred by the NHS and rest by personal social services mainly in long-term care costs. They demonstrate the correlation between increasing age and less favourable outcomes after a fall.

Excluded studies

A study by Wilson and Datta (2001) *Tai Chi for the prevention of fractures in a nursing home population: an economic analysis* is a literature based cost-benefit analysis. This study was reviewed and has been excluded on the grounds that the data used to populate this model was inappropriate. The data on the relative risk of falls is not compatible with the risk of hip fracture.

In addition the GDG requested that we review the following studies. Two studies by Kenny were obtained and appraised. Neither of these studies met the inclusion criteria for economic evaluation. (Kenny 2001; Kenny 2002).

A further abstract from the PROFET study (Close 1999) was appraised. This reports on an economic evaluation however, as an abstract, there is insufficient information to allow a full crucial assessment.

Hip protectors

Hip protectors are considered as a secondary prevention/rehabilitation strategy in patients at risk of falling. The use of padding worn around the hip has been

advocated as a measure of reducing the impact of the fall and thereby the chance of fracturing the hip. The recent updated evidence on clinical effectiveness is inconclusive (Parker et al. 2003). For an intervention to be cost effective, it must first be clinically effective.

Summary of the health economics evidence

Although clinical and cost effectiveness data exists for falls prevention, there are no UK studies. The quality of reporting in these studies is often patchy, as some costs and benefits are reported and not others. The above studies did not use the same costing methods or always report incremental costs or discounting.

Those from countries other than the UK have limited applicability as the health care systems are often very different. Even in the small number of studies included, few comparisons can be made between studies due to the differences in methodology.

Identifying those individuals who may benefit most from an intervention is not always reported. Who should be targeted for screening; when screening should take place; and at what intervals is an area of considerable uncertainty in terms of costs and benefits.

There is a lack of cost effectiveness evidence in this area and therefore, we would recommend further research.

The cost effectiveness of interventions to prevent falls in the elderly: modelling report

Introduction

Successive Government initiatives have identified falls in the elderly as a major cause of morbidity and mortality (DTI 2002). It has been estimated that between one-third and half of people above the age of 65 fall each year. Falls in the elderly result in extensive use of National Health Service resources. Scuffham and Chaplin report that in 2002, 400,000 A&E attendances per annum were attributable to accidents involving older people. There is also evidence of substantial mortality associated with such accidents.

Interventions that reduce the likelihood of falling or injury in the event of a fall have the potential to save NHS resources and improve the health of the UK's increasingly elderly population.

A systematic review of the published literature up to August 2003 found no published cost effectiveness analyses of strategies for falls prevention in the elderly. In this chapter we report cost effectiveness analyses of two falls prevention strategies; exercise programmes for at risk individuals dwelling in the community and multifactorial interventions for at risk individuals dwelling in the community. For results and discussion please refer to Section 6.

Methods

A simple life table model was constructed for people aged 60 and over. The model starts with a cohort of 100 people aged 60 and runs on an annual cycle until all the members of the cohort are dead.

In each year, each person faces a risk of death and a risk of experiencing a fall leading to a contact with local accident and emergency department. For each year of life there is a health related quality of life weight. This weight is on a scale between zero and one; where one is the value of full health and zero is the value given to a health state equivalent to being dead.

The risk of a fall is taken from the report by Scuffham and Chaplin. The risk of mortality is taken from the all cause mortality statistics published in Office of National Statistics Population Trends. The quality of life weight is taken from the population norms for the EQ-5D published by Kind et al. (1998).

Each fall incurs a cost of care and a reduction in quality of life. The cost of fall related injuries, except for hip fractures, is based upon the data reported by Scuffham and Chaplin. The cost reflects NHS and social service costs only – that is the cost effectiveness analysis is from the NHS perspective, not that of society as a whole. Using the data from Scuffham and Chaplin, it is assumed that the severity of the injury determines the NHS services received. Thus all events lead to an attendance at A&E with an ambulance journey. It was necessary to make assumptions about the relationship between event and subsequent treatment, as no data was available. The assumptions were:

- Ordinary fractures are assumed to be treated at A&E with an outpatient follow-up.
- Other fractures are assumed to be treated by hospital admission.
- Bruises, cuts, abrasions, and tenderness or swelling are assumed to be treated at A&E, with GP follow-up.
- Concussion and loss of consciousness are assumed to be treated by hospital admission.

The follow-up from hospital admissions was modelled on the basis of the data reported in Table 3.8 of Scuffham and Chaplin. Currently, the expected cost of each injury varies by age group, but not by injury site, with the exception of hip fracture. The unit costs of these events were obtained from the unit costs of health and social care report (Netton et al. 2003).

The direct cost of treating hip fractures is taken from a study by Parrot (2000), published by the UK Department of Trade and Industry. The utility reduction associated with injury was defined as a proportion of baseline utility,

therefore it varied by age. The utility decrement for hip fracture was ranged from 0.166 (aged 60-69 years) to 0.146 (aged >=80 years) associated with hip. The utility decrement for all other fractures ranged from 0.074 (aged 60-69 years) to 0.065 (aged >=80 years).

This model structure is used to estimate the total costs and QALYs accruing to treated and untreated cohorts for two interventions:

1. Exercise programme to prevent falls in at risk older people dwelling in the community; and
2. Multifactorial assessment and intervention programmes to prevent falls in at risk older people dwelling in the community.

The relative risk of falling associated with each intervention is taken from the meta-analyses reported in Appendix H of the clinical practice guideline. Detailed descriptions of these interventions are included in Section 5 of this guideline.

The cost of the exercise programme is taken from the work by Munro et al. (2002) and adjusted using the NHS Pay and Prices Indices to 2003 prices. The cost of risk assessment for both interventions is taken from the work by Close et al. on the PROFET study. (Personal Communication J. Close).

All costs and quality adjusted life years (QALYs) are discounted at 3.5 per cent per annum. This is based upon the recommendations in the National Institute's *Guideline development methods technical manual.*

The incremental cost effectiveness of each of the interventions is calculated as the difference in the mean costs for the intervention and control cohorts, divided by the difference in the mean QALYs lived by each cohort.

In line with current best practice, we undertook probabilistic sensitivity analysis of the incremental cost effectiveness ratio. For this purpose, we defined probability distributions for the effectiveness of each of the interventions, representing our uncertainty as to the actual effectiveness of these interventions in practice. In addition to modelling the uncertainty on the effectiveness of the interventions, we considered the uncertainty relating to the costs of the intervention, the costs of treating injuries and the probability that a fall will lead to a hip fracture rather than any other injury.

Costs were assumed to have a log normal distribution – that is there is a small chance that the actual cost is much higher than the reported mean cost. This characteristic of cost data has been routinely reported in economic evaluations in many different areas of health care. The effectiveness of each intervention is described using a beta distribution. The beta distributions are characterised to reflect the 95 per cent confidence intervals reported in the guideline meta-analysis (Appendix H).

A Monte Carlo simulation, with 10,000 simulations, was then used to produce a probability distribution for the value of the mean costs and mean QALYs for an untreated cohort; a cohort receiving the exercise intervention; and a cohort receiving the multifactorial intervention. It is the mean value of the simulations that are used to estimate the incremental cost effectiveness ratios (ICERs). 95 per cent confidence intervals around the ICERs are then estimated using the bootstrap method.

The table on page 56 (Table 20) gives the parameter values used for the cost effectiveness analysis.

Results

The mean and incremental costs and QALYs and the ICERs for each of the interventions are given in Table 19.

Table 19: ICERS for Multifactorial intervention in the at risk population and the exercise programme in the community population

Group	Mean Costs (£)	Mean QALYs	Incremental costs	Incremental QALYs	Incremental cost effectiveness Ratio, £s per QALY
Control	14,431	8.766			
Multifactorial intervention	14,285	8.915	- 146	0.149	-980
Exercise intervention	15,645	8.893	1,214	0.127	£9,559

Note: negative ICERs must be interpreted with great caution as they can be produced by negative costs and positive QALYs, or positive costs and negative QALYs. These outcomes are clearly not equivalent. The ICERs are highly labile; that is the small changes in the mean QALY gain will have a large impact upon the ICER.

Sensitivity analysis

The bootstrapped 95 per cent confidence interval for the exercise is -£184,828 to +£187,149. Figure 1 is a scatter plot of the incremental costs and incremental QALYs for the exercise intervention.

The bootstrapped 95 per cent confidence interval for the multifactorial intervention is -£19,533 to +£75,270. Figure 2 is a scatter plot of the incremental costs and incremental QALYs of the multifactorial intervention.

Discussion

The central estimates for the ICER for both the multifactorial and exercise intervention indicate that both

Table 20: Parameter values used in the cost effectiveness model

Parameter	Source	60-64 years	65-69 years	70-74 years	75+ years
Quality of life	Kind et al.	0.8	0.8	0.75	0.75
QoL decrement for injury	Assumption	-0.05	-0.075	-0.1	-0.12
Mortality	ONS	0.00914	0.01536	0.02429	0.03733
Baseline risk of injury	Scuffham and Chaplin	0.73	0.727	0.732	0.73
Hip fractures as a proportion of injuries from fall		0.0324	0.0324	0.0324	0.0324
Effectiveness of multi-modal intervention	Guideline meta-analysis	0.86	0.86	0.86	0.86
Effectiveness exercise	Guideline meta-analysis	0.76	0.76	0.76	0.76
Cost ambulance	PSSRU	201	201	201	201
Cost of A&E contact	PSSRU	57	57	57	57
Cost of hospitalisation without follow-up	PSSRU	110	110	110	110
Cost of hospitalisation with outpatient follow-up	PSSRU	166	166	166	166
Cost of hospitalisation with GP follow-up	PSSRU	130	130	130	130
Cost of hospitalisation with long-term care	PSSRU	22,360	22,360	22,360	22,360
Cost of treating hip fracture	Parrot S	25,425	25,425	25,425	25,425
Cost of exercise intervention	Munro et al. PSSRU	370	370	370	370
Cost of multi-modal intervention	PROFET Trial abstract	164	164	164	164
Discount rate	NICE Guideline Development Methods Guidance	6% pa	6% pa	6% pa	6% pa
Time horizon	NICE Guideline Development Methods Guidance	Lifetime	Lifetime	Lifetime	Lifetime

interventions are cost effective, compared to doing nothing. However, these results most be interpreted with great caution. The bootstrapped confidence intervals around the ICERS are large, reflecting the great uncertainty surrounding the evidence for the effect, and indeed the costs of providing the interventions and the costs of treating fall related injuries.

The ICERs are labile. The health gain from the interventions is small and small absolute variations in this gain lead to very large changes in the ICER. This is shown in Figures 1 and 2, which show that whilst there is no evidence that interventions will do any harm to the recipients (and are therefore better than many other health care interventions); the actual location of the intervention in the cost effectiveness plane is unclear. The intervention may save money and produce health or it may produce health at a substantial price.

More evidence is needed about almost all the parameters considered in the model; *inter alia:*

- the quality of life impact of the full range of fall-related injuries
- the cost of treating fall-related injuries and
- the cost of the interventions.

Section 6 contains the full results under recommendations for multifactorial interventions and strength and balance.

Figure 1: Cost effectiveness of exercise intervention in falls prevention: plot on the cost effectiveness plane of 10,000 simulations

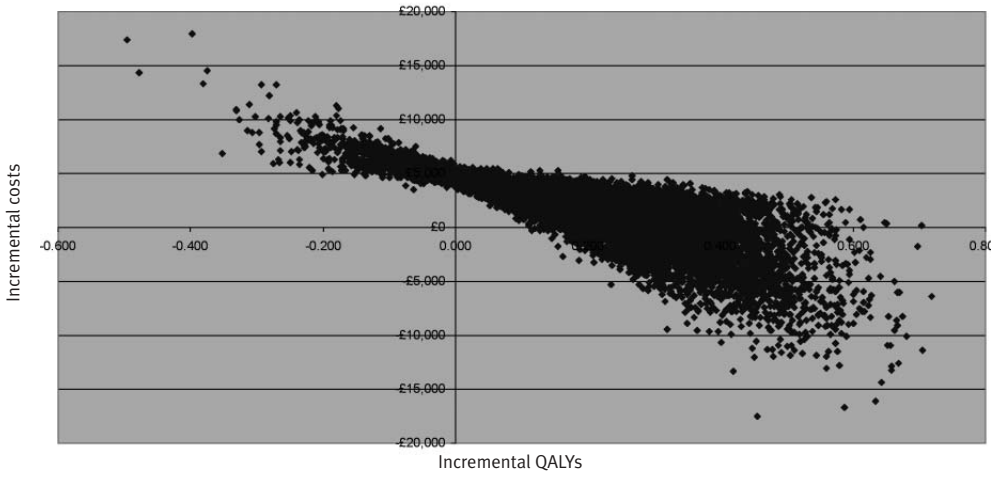
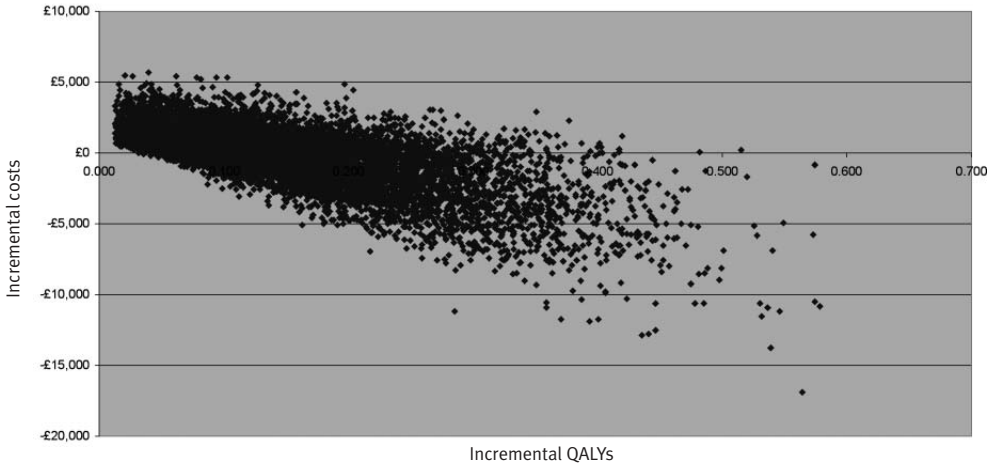


Figure 2: Cost effectiveness of multifactorial intervention in falls prevention: plot on the cost effectiveness plane of 10,000 simulations



5.12 Submission of evidence process

In December 2002, stakeholders registered with NICE (Appendix D) were invited to submit a list of evidence for consideration to ensure that relevant material to inform the evidence base was not missed.

The criteria for the evidence included:

- systematic reviews
- randomised controlled trials (RCTs) that examine clinical or cost effectiveness, and/or quality of life and economic analyses based on these findings
- representative epidemiological observational studies that have assessed the incidence of falls in the UK
- qualitative studies/surveys that examine patient/carer experiences of having fallen or fear of falling
- studies of any design which have attempted to formally assess the cost effectiveness of fall prevention programmes; assess the cost of falls or fall prevention programmes; assess quality of life in relation to falls.

Information not considered as evidence included:

- studies with 'weak' designs when better studies are available
- commercial 'in confidence' material
- unpublished secondary endpoint trial data, 'data-on-file' and economic modelling
- promotional literature
- papers, commentaries or editorials that interpret the results of a published study
- representations or experiences of individuals not collected as part of properly designed research.

Submissions were received from:

Abbott laboratories Limited (BASF/Knoll)
Alzheimers's Society
Ambulance Service Association
British Geriatric Society
British Urological Institute
BUPA
Chartered Society of Physiotherapy
College of Occupational Therapists
Health Development Agency
Help the Aged (Department of Trade and Industry)
Limbless Association
Medtronic Limited
National Osteoporosis Society
Novartis Pharmaceuticals UK Ltd

Pfizer Limited
Roche Products Limited
Royal College of Physicians
Shire Pharmaceuticals Limited
Society of Chiropodists & Podiatrists

Submitted material received included notification of published, unpublished and ongoing research related to falls prevention. All references were screened for relevance and design criteria and those considered eligible were checked with our databases to ensure our search had captured such studies. None of the submitted references provided relevant material additional to the studies we had already identified.

A list of registered stakeholders is included in Appendix D.

5.13 Evidence synthesis and grading

Evidence gradings were assigned to evidence statements that were derived from the evidence reviews. The evidence hierarchy used is shown below (Table 21) and was the hierarchy recommended at the time by NICE. (It should be noted that the hierarchy applies to questions of effectiveness, though it is used here to grade evidence other than clinical effectiveness).

Table 21: Levels of evidence

I	Evidence from meta-analysis of randomised controlled trials or at least one randomised controlled trial
II	Evidence from at least one controlled trial without randomisation or at least one other type of quasi-experimental study
III	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Adapted from Eccles M, Mason J (2001) How to develop cost-conscious guidelines. Health Technology Assessment 5:16

The evidence tables and reviews were distributed to GDG members for comment and discussion.

5.14 Formulating and grading recommendations

In order for the GDG to formulate a clinically useful recommendation, it was agreed that the following factors be considered:

- the best evidence with preference given to empirical evidence over expert judgement where available, including:
- results of economic modelling
- effectiveness data, taking into account the strength of evidence – the level, quality, precision – as well as the size of effect and relevance of the evidence
- where reported, data regarding additional outcomes such as adverse events, patient acceptability and patient views
- a comparison between the outcomes for alternative interventions where possible
- the feasibility of interventions including, where available, the cost of the intervention, acceptability to clinicians, patients and carers and appropriateness of intervention
- the balancing of benefits against risks – including, where reported, all patient-relevant endpoints and the results of the economic modelling
- the applicability of the evidence to groups defined in the scope of the guideline, having considered the profile of patients recruited to the trials.

This information was presented to the group in the form of evidence tables, accompanying evidence summaries and evidence statements, with associated level of evidence grading. Interpretations of the evidence were discussed at GDG meetings. Where the GDG identified issues that impacted on considerations of the evidence and the ability to formulate implementable and pragmatic guideline recommendations, these have been summarised in the GDG commentary sections under each recommendation, though not all recommendations required a 'GDG commentary' section.

Issues relating to interpretation of the evidence and the wording of recommendations were discussed by the GDG, until there was agreement on the wording and grading of recommendations.

Where the GDG decided that hard evidence was essential before any recommendations could be considered, recommendations for future research were made using the NICE guidance on formulating recommendations.

The grading of the recommendations was agreed at the GDG meeting prior to first stage consultation using the scheme below.

Table 22: Recommendation grading

Adapted from Eccles M, Mason J (2001) How to develop cost-conscious guidelines. Health Technology Assessment 5:16.

A	directly based on category I evidence
B	directly based on category II evidence or extrapolated recommendation from category I evidence
C	directly based on category III evidence or extrapolated recommendation from category I or II evidence
D	directly based on category IV evidence or extrapolated recommendation from category I, II or III evidence

The resulting recommendations with evidence statements, abbreviated evidence summaries and GDG commentary are presented in Section 6.

6. Guideline recommendations with supporting evidence reviews

Below are the recommendations agreed by the GDG, with associated evidence statements, evidence summaries and, where relevant, GDG commentaries on the consideration and interpretation of the evidence.

1.1 Case/risk identification *(please see Sections 5.2 and 5.3 for evidence review methods)*

1.1.1 Recommendation

Older people in contact with health care professionals should be asked routinely whether they have fallen in the past year and asked about the frequency, context and characteristics of the fall/s. [C]

Level of evidence	Evidence statement
Level III	Level III A previous fall is the most frequently reported risk factor in prospective cohort studies, suggesting that an older person with a history of falling would be at high risk of a subsequent fall.

Evidence summary

Falls history

Falls history is a frequently reported significant risk factor and predictor of potential further falls. Ten studies reported falls history as statistical significant, among community-dwelling older people (Northridge 1996; Covinsky 2001;Tromp 2001; Friedman 2002; Stenbacka 2002; Wood 2002), and among residents of extended care facilities (Thapa 1996; Cavanillas 2000; Kallin 2002). For older people in community-dwelling settings, the range of summary statistics (OR/RR) reported was: 1.5-4.0. Three studies were of high quality; three of medium quality and one was low quality, with a reported OR of 4.0.

Studies conducted in extended care settings reported significant results, of which one high quality study reported a incident density ratio of 2.23 (1.4-4.37). Two other studies, of low quality, reported an odds ratio range of 1.9-4.65. Seven studies reported falls history as significant in bivariate analysis but not in multivariate. Heterogeneity between these studies hinders interpretation of the clinical relevance of this finding.

GDG commentary

There is good evidence from cohort studies that an older person who has had a previous fall would be at risk of a subsequent fall. The group was keen to recommend that an older person be asked about their falls history based on this evidence. The purpose of obtaining this history would be to establish where possible, the frequency of falling; context and circumstances of the fall; and severity or injuries sustained from the fall. There was debate within the group of the best approach to identifying older people at risk, based on their previous falls history. Some were in favour of an annual review based on screening. Others considered that a case finding approach was more appropriate, asking an older person if they had fallen in the last year when seen by a health care professional. The group was in support of this being done yearly but did not want to reflect this in the recommendation.

1.1.2 Recommendation

Older people reporting a fall or considered at risk of falling should be observed for balance and gait deficits and considered for their ability to benefit from interventions to improve strength and balance. (Tests of balance and gait commonly used in the UK are detailed in Section 5.) [C]

Level of evidence	Evidence statements
Level III	• Mobility impairment, gait disorders and balance deficits have frequently been reported as significant risk factors in prospective cohort studies. • Many tests for the assessment of balance and gait are available to support clinical skill and the choice of such a tool should be determined at a local level.
Level I	• Intervention trials focusing on gait and balance have shown a reduction in falls.

Evidence summary

Mobility impairment, gait disorders and balance deficits have frequently been reported as significant predictors of future falling in prospective cohort studies (Bueno-Cavanillas 2000; Cesari 2002; Covinsky 2001; Northridge 1996; O'Loughlin 1993; Stalenhoef 2002).

Tests are available for the assessment of an older person's balance and gait that can inform clinical judgement. A detailed list of such tests is provided in Appendix E, Evidence table 3. These range from simple, pragmatic tests that require no special equipment, to those that require a trained health care professional with skill to administer.

GDG commentary

The group felt that assessment of older people who have fallen at least once should include observation for balance and gait deficits. This could be done on first contact by an appropriately trained health care professional in any setting. Clinical judgement should support the use of any test referred to in the clinical evidence and many other tests, developed by different disciplines, are likely to be available in trusts. However, a simple observation of a patient's ability to stand, turn and sit is considered adequate as a first level assessment.

Older people with observed gait or balance problems should be referred for targeted interventions. Identifying those most likely to benefit should also be considered.

The group was unable to recommend specific tests for use in practice, as there was a lack of robust validation studies. A profile of tools and tests identified in the assessment review is provided in Appendix E, Evidence table 3. The choice of tests should be determined at local level.

1.2 Multifactorial falls risk assessment

(please see Sections 5.2 and 5.3 for evidence review methods)

1.2.1 Recommendation

Older people who present for medical attention because of a fall, or report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should be offered a multifactorial falls risk assessment. This assessment should be performed by a health care professional with appropriate skills and experience, normally in the setting of a specialist falls service. This assessment should be part of an individualised, multifactorial intervention. [C]

1.2.2 Recommendation

Multifactorial assessment may include the following: [C]

- identification of falls history
- assessment of gait, balance and mobility, and muscle weakness
- assessment of osteoporosis risk
- assessment of the older person's perceived functional ability and fear relating to falling
- assessment of visual impairment
- assessment of cognitive impairment and neurological examination
- assessment of urinary incontinence
- assessment of home hazards
- cardiovascular examination and medication review.

Level of evidence	Evidence statements
Level III	Many individual risk factors have been proven to be predictive of a subsequent fall; therefore presence of more than one of the factors listed below increases the risk of falling: • falls history • gait deficit • balance deficit • mobility impairment • fear of falling • visual impairment • cognitive impairment • urinary incontinence • home hazards • number of medications • psychotropic and cardiovascular medications • muscle weakness.

Evidence summary

Gait deficit

Three community-dwelling studies reported this risk factor as statistically significant with a range of OR: 1.96-2.2 (Koski 1998; Cesari 2002; Northridge 1996). Four studies in community-dwelling settings reported non-significance in multivariate analysis (Northridge 1996; Stalenhoef 2002; Wood 2002; Tinetti 1995).

No studies in extended care settings reported gait deficit as significant (Cavanillas 2000; Kallin 2002) although one study carried out detailed gait analysis and found 'sitting down incorrectly' as significant in multivariate analysis significant (Cavanillas 2000).

In all of the above studies, the method of measuring gait and aspects of gait analysis differed between studies.

Balance deficit

Three studies conducted among community-dwelling participants, reported balance as statistically significant with a range of summary statistics of 1.83-3.9 (O'Loughlin 1993; Stalenhoef 2002; Covinsky 2001). However, each study measured different aspects of balance including dizziness, unbalanced and postural sway.

Eight studies did not find aspects of balance significant in multivariate analysis, two of which were conducted in extended care settings (Bueno-Cavanillas 2000; O'Loughlin 1993; Tinetti 1995; Northridge 1996; Koski 1998; Wood 2001; Stalenhoef 2002; Kallin 2002). Again, different aspects of balance were analysed.

Mobility impairment

Two community-dwelling studies reported statistical significance: In study one: trouble walking 400m: IRR=1.6(1.2-2.4); trouble bending down: IRR=1.4(1.0-2.0) (O'Loughlin 1993). Study two conducted statistical modelling adjusting for different variables and reported the range for both multivariate models: OR=2.64-3.06 for mobility impairment (Covinsky 2001).

Four studies reported non-significance but as discussed earlier, different methods and aspects of mobility were measured (Bueno-Cavanillas 2000; Kallin 2002; Cesari 2002; Stalenhoef 2002).

Fear of falling

Three community-dwelling studies reported statistical significance of this factor, with a range of summary statistics 1.5 –3.2, although different methods of measuring fear were used (Arfken 1994; Cumming 2000; Friedman 2002). This included use of the falls efficacy scale (FES) to explore different cut-off values for determining risk and verbal rating scales to identify the degree of fear present. One study measured fear at baseline and reported non-significance in the results (Tromp 2001).

Friedman et al. (2002) carried out a prospective cohort study to examine the temporal relationship between falls and the fear of falling with n=2212 community-dwelling participants aged between 65 and 84 years. Fear was measured at baseline and at one-year follow-up with a simple yes/no answers to whether they were worried or afraid of falling, with a further question relating to their activity limitation when afraid of falling. This study was of high quality with a large sample and detailed baseline measurement. Logistical regression with adjustment for other variables in the model was performed on the data and results as follows. Fear of falling at baseline was significantly predictive of falling at follow-up with OR=1.78 (1.41-2.24), as well as fear at baseline predictive of fear at follow-up OR=5.40 (4.23-6.91). In addition to this, a fall at baseline was predictive of fear at follow-up 1.58 (1.24-2.01). Shared predictors of both falls and fear at follow-up include female gender and history of stroke.

Cumming et al. (2000) carried out a prospective study to assess the impact of fear of falling with n=418 community-dwelling aged 65 and over. This study was of medium quality with a smaller sample size than others. The FES was administered at baseline with a total score of 100 indicating high fall related self-efficacy and 0 low fall related self-efficacy. Cut-off points were tested for predictive ability of falling in the analysis. Adjusted hazard ratio for all study participants with a FES score of <75 = 2.09 (1.31-3.33).

Tromp et al. (2001) conducted a prospective study to examine all predictors for falls with n=1285 community-dwelling participants aged 65 years and more. This was a high quality study, with detailed baseline measurement and fall events measured with falls calendars. Fear was determined using a modified FES where answers were rated on a scale 0 (no confidence) to 3 (completely confident). Odds ratio for 1 fall and recurrent falls were significant in bivariate analysis but non-significant in logistic regression analysis.

Arfken et al. (1994) recruited patients from a prospective cohort study in which the purpose was to develop a screening tool for predicting falls in older people. The sample was 890 community-dwelling participants stratified in age groups ranging from 66 to 81+years. Baseline data were collected as part of the parent study and falls surveillance was conducted with participants reporting falls to a hotline plus monthly postcards reporting the incidence of falls. At one-year follow-up, the participants received a structured in-home assessment including demographics, health status, activity level, satisfaction with life, depressed mood and a brief physical assessment. Fear was determined with a three point verbal rating scale and dichotomised to summarise outcome as odds ratios: A= moderately fearful and not fearful, B= very fearful. Logistic regression models adjusted for gender and age. Results indicated that those who were moderately or not fearful predicted falling at least once: A= 1.52 (1.06-2.17) and very fearful participants: (B= 2.49 (1.48-4.20). Those experiencing frequent falls were more likely to be very fearful of falling: B=3.12 (1.61-6.06) than those moderately or not fearful A=1.71 (1.01-2.89).

Visual impairment

Two community-dwelling studies found that older people with a visual impairment were significantly at risk of falling, OR range=1.18-2.3 (Northridge 1996; Koski 1998). One extended care study of low quality reported OR =5.85 (Kallin 2002).

Eight studies reported non-significance in multivariate analysis, two of which were extended care setting studies (Tinetti 1995; Northridge 1996; Tromp 1998; Cesari 2002; Stalenhoef 2002; Wood 2002; Thapa 1996; Bueno-Cavanillas 2000).

Different aspects of vision were measured in these studies and included: visual impairment, visual acuity, depth perception and others.

Furthermore, there are a number of prospective cohort studies which we have been alerted to by stakeholders that demonstrate that visual impairment is an independent risk factor for falls and hip fractures (Felson et al. 1989;Cummings et al. 2003; Ivers et al. 2000 and 2004).

Cognitive impairment

Two studies in community-dwelling settings reported that older people with cognitive impairment were significantly at risk of falling OR=2.2-2.4 (Tinetti 1995; Van Schoor 2002). One low quality study in an extended care setting reported OR 6.2 (1.7-23.3) (Bueno-Cavanillas 2000).

However, nine studies did not find older people with cognitive impairment significantly at risk of falling in both settings (Tinetti 1995; Northridge 1996; Tromp 1998; Cesari 2002; Stalenhoef 2002; Van Schoor 2002; Thapa 1996; Kallin 2002; Wood 2002).

Urinary incontinence, including stress and urge incontinence

Two studies reported that older people suffering from urinary incontinence were at risk of falling with OR range=1.26-1.8 (Tromp 1998, 2001; Brown 2000). Additional studies that support incontinence as a significant risk factor include Luukinen 1996 and Tinetti 1995.

Five studies did not find incontinence a significant predictor of falling (Tinetti 1995;Koski 1998; Brown 2000; Cesari 2002; Thapa 1996).

Home hazards

Two studies reported that the presence of home hazards increased an older persons risk of falling, One study reported OR=1.51 (95% CI1.43-1.69) (Cesari 2002). The other study (Gill 2000) carried out detailed analysis and reported that the following contributes to the risk of falls:

Loose rugs and mats: hazard ratio=5.87(95% CI 1.42-24.2)

Carpet fold or tripping hazard: hazard ratio=3.45(95% CI 1.29-9.27).

Multiple medications

Seven studies were included in a systematic review and meta-analysis of cardiac and analgesic drugs (Leipzig et al. 1999a). All report that patients taking more than three to four medications were at risk of recurrent falls compared with patients taking fewer medications (range of results: OR 1.61 to 3.16). The studies included in this review were cohort, case control and cross sectional in design.

Anti-arrhythmic medications

In a meta-analysis of cohort, case control and cross-sectional studies (Leipzig 1999a), the following pooled results of 14 studies indicated that taking type 1A anti-arrhythmic drugs increase the risk of falling (OR 1.22, 95% CI 1.05 to 1.42).

Psychotropic medications

In a systematic review and meta analysis of cohort, case control and cross-sectional studies examining psychotropic drugs and falls (Leipzig 1999b) the pooled results for the association between taking any psychotropic drug and risk of falling was 1.73 (1.52 to 1.97).

Muscle weakness

Muscle weakness has been reported as a significant risk factor (Perell 2001). Our updated review did not identify any studies reporting statistical significance of this factor. One study conducted in extended care and one in community-dwelling setting reported non-significance in multivariate analysis (Bueno-Cavanillas 2000; Koski 1998).

Discussion

We have reported here risk factors that are associated with falling. These results were statistically significant in multivariable analyses. The evidence suggests that although each factor can be a predictor of falls, in some population groups or settings some risk factors may be more important than others. This is illustrated by studies that have carried out multivariate analysis and reported non-significance for each factor. However, there was substantial heterogeneity between studies and within each risk factor. Many different methods of measurement of risk factors are reported and no one study replicates another. An important example of this is those studies examining gait, balance and mobility problems. There is substantial overlap between each study's definition of each domain and method of measurement. The possible synergism between different risk factors should also be considered.

GDG commentary

Assessment of older people with a history of falling and the presence of other risk factors should be undertaken. The identification of older people at risk will enable practitioners to refer older people for effective interventions targeted at specific factors. Multifactorial assessment is an important process but must be linked to interventions. The grading of this recommendation reflects both the evidence on risk factors and level I evidence of assessment linked to intervention(s).

This multifactorial assessment should be done in the context of a comprehensive geriatric assessment where indicated.

1.3 Multifactorial interventions *(please see Sections 5.5, 5.6, 5.9, 5.11 for evidence review methods)*

1.3.1 Recommendation

All older people with recurrent falls, or assessed as being at increased risk of falling, should be considered for an individualised multifactorial intervention. [A]

In successful multifactorial intervention programmes the following specific components are common (against a background of the general diagnosis and management of causes and recognised risk factors): [A]

- strength and balance training
- home hazard assessment and intervention
- vision assessment and referral
- medication review with modification/withdrawal.

1.3.2 Recommendation

Following treatment for an injurious fall, older people should be offered a multidisciplinary assessment to identify and address future risk and individualised intervention, aimed at promoting independence and improving physical and psychological function. [A]

Level of evidence	Evidence statement
Level I	Multidisciplinary, multifactorial, tailored interventions are effective in reducing falls in the following population groups and settings: • community-dwelling older people • older people in extended care settings • older people presenting at A&E following a fall.
Level I	Three trials suggest that multifactorial, multidisciplinary rehabilitation programmes are effective in reducing the incidence of further falling in older people who have suffered an injurious fall. This evidence is supported by key documents, in particular the expected standards of care outlined in the NSF for older people (standard six).

Evidence summary – multifactorial interventions

Community-dwelling, unselected (fallers and non-fallers in the population studied)

Of the eight studies that 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 were pooled from four (Fabacher 1994; Jitapunkul 1998; Newbury 2001; Wagner 1994) involving 1,651 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. Only the total number of falls in each group in the month before the final interview was reported. The trialists reported significantly fewer falls in the experimental group during that period, 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 (580 participants) found no difference in the incidence of falls between the intervention and control groups, but no data were provided. Vetter (1992) (674 participants) was cluster randomised (by household). There were 95 of 350 fallers in the intervention group and 65 of 324 in the control group.

Community-dwelling, targeted (population studied are known fallers or have identified risk factors prior to enrolment)

Data from two studies in this category were not pooled as cluster randomisation was employed. Coleman (1999) (169 participants) reported that screening and intervention in a chronic care clinic provided no significant 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). Data were pooled from the other five studies (Close 1999; Hogan 2001; Kingston 2001; Lightbody 2002; van Haastregt 2000). 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).

Exercise, visual correction, and home safety intervention

Day (2002), in a study of factorial design, 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). Further analysis was carried out for 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.

Extended care

In Jensen (2002), a 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 significant 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.

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 1,000 resident years was also reduced in the intervention group (RR 0.55, 95%CI 0.41 to 0.73, trialists' analysis).

Cognitively impaired (any residence)

Shaw (2003), in a comparison of multifactorial assessment and intervention in 274 older people with cognitive impairment or dementia recruited from an A&E department following a fall, could not confirm the effectiveness of this intervention (RR 0.92, 95%CI 0.81 to 1.05). There is a lack of evidence of effective interventions for this group of older people. Many trials specifically excluded older people with a cognitive impairment.

Economic evidence

Tinetti et al. (1994) and Rizzo et al. (1996) both report on the same study. Tinetti reported on the clinical effectiveness. Rizzo undertook the cost effectiveness analysis. This study reported that the intervention package was cost effective in the high risk individuals. The high cost of the intervention was offset against the treatment costs of the high risk individuals. However, in this study not many of the control group had costly hospital admissions and the data was skewed. They undertook sensitivity analysis. There still remained a number of individuals in the intervention group who required costly treatment. The overall effect of this was to reduce the expected benefit in the intervention group. The analysis presented in the cost effectiveness analyses chapter (see Section 5.11) assumes that the at risk population can be reliably identified. Clearly the specificity and the sensitivity of the assessment tools will impact upon the cost effectiveness of the interventions.

The systematic review of assessment tools did not identify any information on the sensitivity and specificity of the existing assessment tools. In this context, there is even greater uncertainty about the true cost effectiveness of these interventions. The greater the ability of assessment tools to differentiate between those who are likely to fall without the intervention and the rest of the elderly population, the more cost effective the interventions will be. The figures presented in this chapter represent a best case, where the assessment is completely accurate. Nandy et al. (2004) report a high specificity (0.92) but a relatively low positive predictive value (0.57). Using this assessment tool, slightly more than 40 per cent of patients identified as being at high risk using this tool would not be expected to fall. This would have a significant upward impact upon the cost effectiveness results presented above. This evidence became available too late in the process for it to be incorporated directly in cost effectiveness modelling.

The existing evidence base for judging the cost effectiveness of these interventions is poor. If the at risk population can be identified, our analysis indicates that the multifactorial intervention is likely to be cost effective compared to conventional thresholds, although there is a large degree of uncertainty around the actual incremental cost effectiveness ratio.

GDG commentary

The evidence above suggests that multifactorial interventions targeted to risk factors are effective in reducing falls in older people. However, it is difficult to make a definite recommendation of the key effective components for specific settings and populations. It is sensible therefore to refer a patient for intervention(s) that target known risk factors. Illustrative examples of good practice were nominated from trials by Close (1999), Jensen (2002) and Tinetti (1994).

Close (1999) identified older people living in the community who presented at A&E following a fall. The intervention included a detailed medical and occupational therapist assessment, with referral to relevant services for targeted interventions either by modification of risk factors where possible; referral to multidisciplinary team for further interventions; and drug medication review by the GP. Advice and education was given by the occupational therapist (OT) about safety in the home and

modifications were made where appropriate. The OT supplied minor equipment or referral was made to social or hospital services as required.

Jensen (2002) recruited older people from extended care settings who received assessment by a physician and physiotherapist. This assessment included a full clinical examination and medication review. Targeted interventions included staff education, environmental modifications, exercise, supply or repair of aids, medication review and hip protectors.

Tinetti (1994) recruited older people living in the community with the presence of one of the following risk factors: postural hypotension; use of sedatives; use of at least four medications; impairment in arm or leg strength or range of motion, balance, and ability to move safely from chair to bed. Assessment was conducted by a study nurse practitioner and physiotherapist. The intervention group was given either a combination of adjustment of their medications; or behavioural instructions and exercise programmes aimed at modifying their risk factors in the form of decision rules and intervention protocols for each risk factor.

These trials provide an example of approaches to providing effective multifactorial interventions, but the fundamental element is to prescribe or refer for targeted interventions.

Evidence summary: rehabilitation

Two trials reported a significant reduction in the incidence of further falling in those who had received attention for a previous fall (Close 1999; Crotty 2002). The intervention in the trial by Tinetti (1999) did not show an effect on the risk of falling, but there was a significant reduction in the incidence of individuals hospitalised. The key components of these studies included medical, physiotherapy and occupational therapy assessments with follow-up interventions, medical assessment to identify primary cause of fall and other risk factors with intervention or referral as required. Interventions may involve individually tailored exercise programmes aimed at improving strength, gait, balance, transfers and stair climbing. Social care and support were also part of some programmes.

The safety and efficacy of an exercise protocol designed to improve strength, mobility, and balance and to reduce subsequent falls in older patients with a history of injurious falls was examined in Hauer (2001). This RCT was a three-month intervention trial, with an additional three-month follow-up in an outpatient geriatric rehabilitation unit. The participants included 57 female patients, above the age of 75 years, admitted to acute care or inpatient rehabilitation, with a history of recurrent or injurious falls, including patients with acute fall-related fracture. Fall incidence was reduced non-significantly by 25 per cent in the intervention group, compared with the control group (RR: 0.753 CI: 0.455-1.245).

The studies reporting significant results suggest that a multifactorial approach, including multidisciplinary assessment and targeted interventions, could have some impact on reducing the incidence of falling as part of a rehabilitation programme following a fall resulting in medical attention. It is less clear from this evidence of the impact of these complex interventions on other factors – such as confidence; quality of life and acceptability – as limited data were available. Perhaps there also needs to be consideration of the planned withdrawal of such programmes and the ability of these individuals to sustain the improvement shown.

The evidence from geriatric hip fracture (GHFP) and early supported discharge (ESD) programmes suggest that they decrease the total length of hospital stay for older people who have suffered a hip fracture and inpatient treatment. In addition, these structured programmes of care achieve higher rates of return to previous residential status (Cameron et al. 2002). However, it is unclear what the effect these programmes have on reducing the incidence of a further fall. Furthermore, less is known about the impact on function, morbidity and quality of life for older people participating.

Two trials suggest that a multidisciplinary, multifactorial approach to management of older people, who have suffered an injurious fall and who have received treatment in a primary care or acute care setting, is an effective intervention package. Important components include assessment and a targeted intervention(s), underpinned by detailed discharge planning.

It is less clear which specific mechanisms of this multifactorial approach to rehabilitation are effective, but the fundamental key to success may be through comprehensive discharge planning.

In addition, the overall aim of these programmes for older people should be to regain confidence and subsequently prevent further falling. However, practitioners need to assess the extent to which the older person is likely to co-operate with the intervention programme and the usefulness of the overall prevention strategies in the Cochrane review.

GDG commentary

There was substantial overlap between secondary prevention interventions and rehabilitation strategies. It was not possible to review the evidence of the effect of these interventions on important rehabilitation outcomes – such as improvement in function, mobility and psychosocial health – as these outcomes were outside the

scope of the guideline. In this guideline, rehabilitation is considered as part of the secondary prevention of falls, but users of the guideline need to be aware of the potential for improvement in outcomes other than falls prevention.

1.4 Strength and balance training *(please see Sections 5.5, 5.6, 5.9, 5.11 for evidence review methods)*

1.4.1 Recommendation

Strength and balance training is recommended. Those most likely to benefit are older community-dwelling people with a history of recurrent falls and/or balance and gait deficit. A muscle strengthening and balance programme should be offered. This should be individually prescribed and monitored by an appropriately trained professional. [A]

Evidence summary

Exercise and/or physical therapy

Level of evidence	Evidence statement
Level I	A programme of muscle strengthening and balance training, individually prescribed at home by a trained health care professional is effective in reducing falls (pooled results from three trials).

Community-dwelling: targeted interventions

Pooled data from three studies from New Zealand, 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).

These three studies involved older participants, but the components of the successful intervention suggest that balance retraining may be an important component of successful exercise programmes.

Economic evidence

The two papers by Robertson et al. (2001a, 2001b) report on the trials of the same home-based exercise programme in different centres carried out by different health care professionals. The programme delivered by the practice nurse was less costly than that delivered by the physiotherapist. However, the study undertaken with the practice nurse did not reduce hospital costs overall between the control and intervention groups.

The cost effectiveness analyses of exercise programmes for older people at risk of falling are reported. The exercise programme is likely to be cost effective but less cost effective than the multifactorial intervention. This said, exercise may produce other health benefits that have not been incorporated into the analysis presented in Section 5.11. However, in the absence of a sensitive and specific method for identifying those older people at high risk of falling, the cost effectiveness of exercise falls prevention strategies cannot be confirmed and any recommendation to implement such programmes should be treated with caution.

GDG commentary

The group agreed that strength and balance training should be administered by an appropriately trained professional. Although the evidence is relevant to community-dwelling older people with either a history of falls and/or a balance and gait deficit, this evidence could be generalised to other settings. At present, individually prescribed exercise has been shown to be effective in falls prevention. Evidence of effectiveness of group exercise interventions is emerging and will be considered in the update of the guideline. In addition, the health benefits of exercise should be considered.

1.5 Exercise in extended care settings *(please see Sections 5.5, 5.6, 5.11 for evidence review methods)*

1.5.1 Recommendation

Multifactorial interventions with an exercise component are recommended for older people in extended care settings who are at risk of falling. [A]

Level of evidence	Evidence statement
Level I	The evidence suggests individually prescribed or group approached exercise interventions in extended care settings are not effective in reducing falls (pooled results from two trials and one single trial, non-significant). However, three trials report effectiveness of exercise as a component in multifactorial programmes.

Evidence summary

Nowalk (2001) in a study in long-term care facilities – ranging from independent living to skilled nursing care –

reported no significant difference in number of falls between a control group and two untargeted exercise groups (resistance endurance training or Tai Chi).

Data were pooled from two studies. Donald (2000) studied the effect of a targeted physiotherapy programme in 54 patients in an elderly care rehabilitation ward. Mulrow (1994) studied elderly nursing home residents (194 participants), comparing a three times weekly exercise programme with a friendly visit of the same duration. The pooled data showed no evidence of effectiveness in this context (RR 1.02, 95%CI 0.74 to 1.41).

Schnelle (2003) compared a low intensity functionally oriented exercise and incontinence care programme with usual care in 190 incontinent nursing home residents. There was a non-significant trend towards a reduction in the number of fallers in this study, which may have been underpowered (RR 0.62, 95%CI 0.37 to 1.06).

GDG commentary

Whilst there is insufficient evidence to recommend exercise as a single intervention in extended care settings, multifactorial interventions in this setting with an exercise component have been shown to be effective. Please refer to page 66 for further details.

1.6 Home hazard and safety intervention

(please see Sections 5.5, 5.6, 5.11 for evidence review methods)

1.6.1 Recommendation

Older people who have received treatment in hospital following a fall should be offered a home hazard assessment and safety intervention/modifications by a suitably trained health care professional. Normally this should be part of discharge planning and carried out within a timescale agreed by the patient or carer, and appropriate members of the health care team. [A]

1.6.2 Recommendation

Home hazard assessment is shown to be effective only in conjunction with follow-up and intervention, not in isolation. [A]

Level of evidence	Evidence statements
Level I	Home safety interventions/home hazard modifications have been shown to reduce the incidence of falls, especially in older people with a history of falling (pooled results from four trials).
Level I	There is no evidence for the effectiveness of home hazard modification in those without a history of falls in the previous year before enrolment (one trial, non-significant).

Evidence summary

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

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 reported data that supports its effectiveness, particularly in those with a history of previous falls. Cumming (1999) cautioned 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, and in the study reported by Stevens (2001). 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.

Five studies evaluated home safety interventions alone (Cumming 1999; Day 2002; Nikolaus 2003; Pardessus 2002; Stevens 2001). Data for number of participants falling are 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 in 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.

Stevens (2001), in a population with mixed fall status, reported results of a cluster randomised study in which the individual household was the unit of randomisation. After one year there was no significant 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.

Economic evidence

In a well-conducted cost effectiveness analysis, Salkeld et

al. (2000) recruited patients during hospital admission, a number of whom had a history of falls. The intervention was implemented by an experienced occupational therapist. There was little improvement in the falls in the intervention group as a whole, but there was a statistically significant reduction in the number of falls in those with a previous history. The cost effectiveness relates to the high risk groups of older people.

Smith and Widiatmoko (1998) modelled the costs of fall with the costs of a home hazard intervention. Over the 10-year period of the model, they demonstrated a cost saving of A$92 per person. However the various sources of the data used, and assumptions made, indicate that although useful, it is not necessarily a substitute for empirical evidence.

GDG commentary

It is clear from the evidence that providing a home hazard assessment with an intervention aimed at modification for older people with a history of falling is effective. It is not clear which component of this intervention has the most impact on preventing further falls. However, a combination of advice, education interventions aimed at increasing confidence, risk awareness and home modifications are effective. Cumming (1999) reported a significant reduction in two or more falls in older people with a history of falls. Assessment was carried out by an occupational therapist and recommendations for prevention supervised as necessary. This intervention not only reduced the incidence of falls within the home but also falls outside the home.

There was debate about who should carry out home hazard assessments. The GDG acknowledged that in practice this may not always be carried out by a health care professional, but by a suitably trained member of the health care team. The personnel involved in assessment within the studies reviewed were trained health care professionals – including a doctor, and occupational therapist (Pardessus 2002); nurses, physiotherapists, occupational therapists and social workers (Nikolaus 2003); occupational therapist (Cumming 1999); and a trained assessor (Day 2002).

1.7 Psychotropic medications *(please see Sections 5.5, 5.6 for evidence review methods)*

1.7.1 Recommendation

Older people on psychotropic medications should have their medication reviewed, with specialist input if appropriate, and discontinued if possible to reduce their risk of falling. [B]

Level of evidence	Evidence statement
Level II	One trial of older people above 65 years suggests that a psychotropic medication withdrawal programme, involving a gradual withdrawal of psychotropic medication over a 14-week period, is effective in reducing the risk of falls.

Evidence summary

Psychotropic drugs include neuroleptics, sedatives/hypnotics, antidepressants, and benzodiazepines. These can increase an older person's risk of falling, as can the use of multiple medications. Results of a systematic review and meta analysis to identify particular medications that may increase an older person's falls risk suggest that older people taking more than three to four medications were at risk of recurrent falls; and those taking psychotropic medications were also at risk of falling.

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; a walking plan (also used in Campbell 1997 and Robertson 2001a); and a placebo-controlled psychotropic medication withdrawal programme. This was gradual withdrawal of psychotropic medication over a 14-week period. Inclusion criteria included those above the age of 65 years who were currently taking benzodiazepine, any hypnotic, antidepressant or major tranquilliser.

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).

Economic evidence

One Australian and one US study (Andrews et al. 2001 and Coleman & Fox 2002) looking at the contribution of medication use were also assessed. These involved pharmacy reviews of medication, which may have resulted in falls. Neither of these studies provides strong economic evidence, but they highlight the importance of assessment following a fall. The costs detailed in the paper by Andrews (2001) show the relationship between medication and the outcomes for patients. The study by Coleman illustrates some potential cost savings in reviewing medications.

GDG commentary

In addition to the evidence for psychotropic medication review, polypharmacy was identified as a risk factor for falling and medication review should be part of a multifactorial assessment, as described in recommendation 3.

1.8 Cardiac pacing *(please see Sections 5.5, 5.6 for evidence review methods)*

1.8.1 Recommendation

Cardiac pacing should be considered for older people with cardioinhibitory carotid sinus hypersensitivity who have experienced unexplained falls. [B]

Level of evidence	Evidence statement
Level II	Cardiac pacing in fallers with cardioinhibitory carotid sinus hypersensitivity is effective in reducing falls and syncope (one trial).

Evidence summary

Cardiac pacing in fallers with cardioinhibitory carotid sinus hypersensitivity (Kenny 2001) was associated with a statistically significant reduction in the number of participants who were not cognitively impaired, sustaining syncope (RR 0.48, 95%CI 0.32 to 0.73). In addition, the mean number of falls in 12 months in the intervention group was significantly reduced (WMD -5.2, 95%CI -1.0 to -9.4).

GDG commentary

This recommendation reflected the evidence for a stand-alone intervention for older people who have cardioinhibitory carotid sinus hypersensitivity. The evidence is also reflected in recommendation 3, which indicates that the GDG considered it necessary that a cardiovascular assessment should be carried out as part of a multifactorial assessment, where appropriate.

1.9 Encouraging the participation of older people in falls prevention *(please see Sections 5.7, 5.8 for evidence review methods)*

1.9.1 Recommendation

To promote the participation of older people in falls prevention programmes the following should be considered. [D]

- Health care professionals involved in the assessment and prevention of falls should discuss which changes a person is willing to make to prevent falls.
- Information should be relevant and available in languages other than English.
- Falls prevention programmes should also address potential barriers such as low self-efficacy and fear of falling, and encourage activity change, as negotiated with the participant.

1.9.2 Recommendation

Practitioners who are involved in developing falls prevention programmes should ensure that such programmes are flexible enough to accommodate participants' different needs and preferences, promoting the social value of such programmes. [D]

Level of evidence	Evidence statements
Level III-IV	People may be reluctant to participate in falls prevention programmes if they have not previously exercised, do not perceive a risk of falling, have a fear of falling or perceived poor functional ability or have not been adequately consulted about what changes they are willing to make.
Level IV	Much of the current information provision on falls prevention programmes may alienate rather than encourage participation by stereotyping older people, not being available in languages other than English, not emphasizing that many falls may be preventable and not promoting the social value of falls prevention programmes.

Evidence summary

The review of the quantitative and qualitative evidence on older people's views and experiences enabled the identification of factors that may promote the idea of falls prevention. Multiple barriers to participation in falls programmes were identified, the most significant of which are summarised in Table 16.

Some studies indicate that much of the information on falls prevention alienates rather than encourages participation by stereotyping older people (Aminzedah & Edwards 1998; Ballinger & Payne 2000); and by not producing information in languages other than English (Aminzedah & Edwards 1998; Kong et al. 2002). Other information needs include giving special advice to older people about the benefits of physical activity and falls prevention and how to stay motivated in the face of multiple barriers (Commonwealth of Australia 2000; King 1995).

Some studies also reported a mismatch between the strategies willingly accepted by older people – for example, walking aids, home modification, low intensity exercise – and those that are most effective (balance and strengthening training) (Commonwealth of Australia 2000; Health Education Board 1999; Stead et al. 1997; King 1998). Two studies pointed out that imposition of strategies thought most optimal by health professionals may alienate the target group (Simpson et al. 2003; Porter 1999) and that health professionals need to find out which characteristics people are willing to modify and what changes they are prepared to make (Porter 1999) before suggesting strategies. This should be an ongoing process (Grossman et al. 2003).

Some of the individual factors that were shown to increase participation in falls prevention programmes or specific components of these programmes were: high exercise self-efficacy, past exercise history and general good health and functional ability (Rejeski 1997; King 1995; Oman 1998; Resnick 2000). Aspects of the format of falls prevention programmes that appeared to improve participation and maintenance included: home-based, telephone supervised, peer role models, low intensity exercise – for example, walking – moderate frequency – for example, two to three times per week – and be perceived as relevant, beneficial and fun for the participants. The social aspects of falls prevention programmes are probably their strongest selling point (Health Education Board 1999; Kong et al. 2002), particularly to older people without a history of physical activity.

Factors that appeared to be barriers to either initial participation or long-term maintenance of falls prevention programmes were mainly personal, rather than programme format issues. These included: low self-efficacy or lack of perceived ability to undertake components of the programme; fear of falling; fear of exertion; illness; denial or under-estimating personal risk of falling; embarrassment or increased inconvenience regarding use of assistive devices (Bruce 2003; King 1998; Yardley 2002).

In addition, the economic systematic review identified two studies that used quality of life measures (SF36) to look at the impact of fear of falling. The paper by Cumming et al. (2000) showed a link between fear of falling, SF36 measures and the admission to a long-term care institution. The study by Suzuki et al. 2002 showed that those subjects who expressed a great deal of fear of falling had SF36 scores, reflecting their increased anxiety and depression.

The most commonly occurring and consistent themes across all studies (observational and qualitative) were as follows:

Preferred strategies

- People may be reluctant to participate in falls prevention programmes that have an exercise-based component (including balance training), if they have not previously regularly exercised and in which the social value of participation is not promoted. This requires consideration in light of the Cochrane review findings that a) a programme of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional and b) a 15-week Tai Chi group exercise intervention are likely to be beneficial (Gillespie et al. 2003).
- Interventions not involving behaviour change, such as home modification and assistive aids, appear to be more readily accepted among potential participants. There was a fairly consistent finding across the reviewed studies that prevention programmes that were home-based, moderate or low intensity exercise with frequent professional contact were most acceptable and showed higher participation rates (Hillsdon 1995; King 1998; Oman 1998). Other single interventions reported as being beneficial in the Cochrane review (Gillespie et al. 2003) – such as cardiac pacing and withdrawal of medicines – similarly may be more acceptable to some people.

Individual factors

- Although trials of multifactorial packages have reported beneficial results (Gillespie et al. 2003), in clinical practice there may need to be more emphasis on finding out what characteristics a person is willing to modify and what changes are they prepared to make at what stage in their lives. This somewhat concurs with the finding that individually tailored interventions delivered by a health professional are more effective than standard or group delivered programmes (Gillespie et al. 2003).
- There was also evidence that the following factors are associated with activity avoidance: increasing age, being female, increasing anticipation of loss of function (Yardley 2002), not facing up to the risk of falling, (Simpson 1995) lack of perceived ability (King 1998), fear of falling (Bruce 2003) and fear of exertion (Grossman et al. 2003). However, fall prevention programmes that address self-efficacy and encourage activity change may result in increased uptake of falls prevention programmes (Cheal 2001; Resnick 2002). This suggests that consideration of these factors is important when devising falls prevention programmes to ensure practical and appealing interventions are developed.
- Barriers need to be addressed prior to participation in a falls prevention programme to ensure commitment to the strategies.

Health promotion and information needs

- There is a need to inform and educate older people that many falls are preventable.
- Perceived relevance of falls prevention may be low until a fall has been experienced.
- The social value of falls prevention programmes, as well as the physical benefits, needs to be promoted to make them attractive to intended participants.
- Those from non-English speaking backgrounds may require targeted health promotion.

1.10 Education and information giving *(please see Sections 5.8 for evidence review methods)*

1.10.1 Recommendations

All health care professionals dealing with patients known to be at risk of falling should develop and maintain basic professional competence in falls assessment and prevention. [D]

1.10.2 Recommendations

Individuals at risk of falling, and their carers, should be offered information orally and in writing about: [D]

- what measures they can take to prevent further falls
- how to stay motivated if referred for falls prevention strategies that include exercise or strength and balancing components
- the preventable nature of some falls
- the physical and psychological benefits of modifying falls risk
- where they can seek further advice and assistance
- how to cope if they have a fall, including how to summon help and how to avoid a long lie.

Evidence summary

See evidence summary above associated with 'encouraging participation in falls prevention programmes'.

1.11 Interventions that cannot be recommended *(please see Sections 5.5, 5.6 for evidence review methods)*

1.11.1 Brisk walking

Level of evidence	Evidence statement
Level II	There is no evidence that brisk walking reduces the risk of falling. One trial showed that an unsupervised brisk walking programme increased the risk of falling in post-menopausal women with an upper limb fracture in the previous year. However, there may be other health benefits of brisk walking by older people.

Evidence summary

In one study (Ebrahim 1997), brisk walking in n=165 women with an upper limb fracture in the previous two years, reported RR 0.69,95% CI 0.12-4.03. This UK study included postmenopausal women identified from A&E and orthopaedic fracture clinic records, with a history of an upper limb fracture in the last two years. The intervention group received initial advice on general health/diet and then encouraged to build up to brisk walking 40 minutes, three times per week. The control group received initial advice on general health/diet and encouraged to perform upper limb exercises to improve post-fracture function. Falls events were greater in the intervention group.

GDG commentary

The group had reservations about this trial. It was a small trial with a specific group of older women. Although there was a significant increase of falls (I=52/81 vs. C=50/84 and fractures (I=2/81 vs. C=3/84) in the intervention group, the GDG recognise the limitations of the generalisability of these findings. For some other groups of older people, walking may have health benefits and should not be discouraged.

1.12 Interventions that cannot be recommended because of insufficient evidence *(please see Sections 5.5, 5.6 for evidence review methods)*

We do not recommend implementation of the following interventions at present. This is not because there is strong evidence against them, but because there is insufficient or conflicting evidence supporting them.

1.12.1 Low intensity exercise combined with incontinence programmes

Level of evidence	Evidence statement
Level I	There is no evidence that low intensity exercise interventions, combined with continence promotion programmes, reduces the incidence of falls in older people in extended care settings (one trial, non-significant).

Evidence summary

Schnelle (2003) compared a low intensity functionally oriented exercise and incontinence care programme with usual care in 190 incontinent nursing home residents. There was a non-significant trend towards a reduction in the number of fallers in this study, which may have been underpowered (RR 0.62, 95%CI 0.37 to 1.06).

Economic evidence

The study by Schnelle et al. (2003) made a number of assumptions that were not all reported in the paper. They acknowledge that this was an expensive and labour intensive intervention. They do not detail the costs but refer to them in the discussion. This intervention resulted in no significant difference between the control and intervention groups in the costs of assessing and treating acute conditions. The only statistically significant result was the stable fall rate in the intervention group. However,

the authors recommend caution when interpreting these results, as this was a *post hoc* decision to analyse the data in this way.

1.12.2 Group exercise (untargeted)

Level of evidence	Evidence statements
Level I	Exercise in groups should not be discouraged as a means of health promotion, but there is little evidence that exercise interventions that were not individually prescribed for community-dwelling older people are effective in falls prevention.

Evidence summary

Community-dwelling: untargeted interventions:

Using the FICSIT definition of falling, participants (n=200) exposed to the 15-week Tai Chi intervention had a lower rate of falling than controls in one trial (risk ratio 0.51, 95%CI 0.36 to 0.73) (Wolf 1996). Local advertisements and direct contact recruited the participants in this study. Inclusion criteria included ambulatory older people, above the age of 70 years, living in unsupervised environments.

Eleven studies, involving a total of 1,480 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.

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 a six-week supervised low to moderate intensity programme designed to improve balance and mobility. Thirty-one participants practised on an obstacle course, in addition to the exercise intervention, while 34 did not. No statistically significant difference in the mean number of falls was reported.

There were three complex intervention studies that 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 was the most potent single intervention in this study RR 0.82 (0.70-0.97), falls were also reduced when exercise was combined with home hazard management, or reduced vision management, or both.

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.

Conclusion

The evidence for effectiveness of group exercise interventions remains limited, apart from the Tai Chi intervention of Wolf (1996) and Day (2002). However, the three trials from New Zealand (Campbell 1997; Campbell 1999; Robertson 2001a), which used an individually tailored exercise programme of progressive muscle strengthening, balance retraining and a walking plan, demonstrated effectiveness. These three studies involved older participants, but the components of the successful intervention suggest that balance retraining may be an important component of successful exercise programmes. However, there is no evidence of clinical effectiveness of other exercise interventions that was untargeted to specific older people at risk of falling.

GDG commentary

The GDG recognises the emerging positive evidence for group exercise with two studies published beyond the date of the literature review underpinning these guidelines (Lord et al. 2003; Barnett et al. 2003). This new evidence will need to be included in the guideline update. In addition the global health benefit of exercise needs to be emphasised.

Economic evidence

The study by Buchner et al. (1997) reported a relative risk for falls in the control group of 0.61. This study also measured quality of life using the SF36. They note that the hospital use between the two groups was very similar and the length of stay for the control group was likely to be longer resulting in additional costs.

1.12.3 Cognitive/behavioural interventions

Level of evidence	Evidence statements
Level I	There is no evidence of effect that cognitive/behavioural interventions alone reduce the incidence of falls in community-dwelling older people of unknown risk status (two single trials, non-significant). Such interventions have included risk assessment with feedback and counselling and individual education discussions. There is no evidence that complex interventions – in which group activities included education, behaviour modification programme aimed at modifying risk, advice and exercise – are effective in falls prevention with community-dwelling older people (four single trials, non-significant).

Evidence summary

Cognitive/behavioural therapy alone

In Gallagher (1996) (100 participants), comparison of the two risk assessment interviews and a feedback/counselling 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.

Complex interventions including cognitive/behavioural intervention

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 had 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 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 that 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.

1.12.4 Referral for correction of visual impairment

Level of evidence	Evidence statements
Level I	Exercise in groups should not be discouraged as a means of health promotion, but there is little evidence that exercise interventions that were not individually prescribed for community-dwelling older people are effective in falls prevention.

Evidence summary

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 0.88, 95%CI 0.54 to 1.43). This study, using a factorial design, compared a control group with groups receiving exercise, correction of visual impairment, and home hazard modification, each alone, and in combination. Results above reflect analysis for the visual correction alone group.

GDG commentary

Whilst there is insufficient evidence that single interventions targeting vision impairment are effective in reducing falls, referral for visual correction as part of a multifactorial intervention has a significant impact on falls reduction.

Identifying older people with visual impairment and referral for intervention should be considered within a multifactorial intervention.

1.12.5 Vitamin D and oral supplementation

Level of evidence	Evidence statement
Level I	There is evidence that vitamin D deficiency and insufficiency are common amongst older people and that when present they impair muscle strength and possibly also neuromuscular function via CNS-mediated pathways. In addition, the use of combined calcium and vitamin D3 supplementation has been found to reduce fracture rates in older people in residential/nursing homes and sheltered accommodation. Although there is emerging evidence that correction of vitamin D deficiency or insufficiency may reduce the propensity for falling, there is uncertainty about the relative contribution to fracture reduction via this mechanism (as against bone mass) and on the dose and route of administration required. No firm recommendation therefore can currently be made on its use for this indication. Guidance on the use of vitamin D for fracture prevention will be contained in the forthcoming NICE clinical practice guideline on osteoporosis that is currently under development.

Evidence summary

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 this case, a high energy, nutrient-dense supplement – in preventing falls in a group of frail elderly women RR 0.10 (0.01 to 1.69).

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 Bischoff (2003); Pfeifer (2000) and Latham (2003) (461 participants). In these studies both intervention and control groups received calcium supplementation; the intervention group in each received oral vitamin D supplementation. Within this group of pooled studies, no evidence was produced 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 Sato (1999) (86 participants), the administration of 1-alpha-hydroxyvitamin D alone to people with Parkinson's disease (Hoehn and Yahr Stage <5) significantly reduced the number of fracture falls (RR 0.12, 95%CI 0.02 to 0.98), 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.

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 numbers of the intervention group who reported falls in the six months of therapy (RR 0.48, 95%CI 0.29 to 0.78).

A recent published meta-analysis of vitamin D supplementation suggests there is a reduction in falls (Bischoff-Ferrari, 2004). There results showed that vitamin D supplementation appears to reduce the risk of falls among ambulatory or institutionalised individuals with stable health by 20 per cent.

However, although there is emerging evidence that correction of vitamin D deficiency or insufficiency may reduce the propensity for falling, there is uncertainty about the relative contribution to fracture reduction via this mechanism (as against bone mass) and on the dose and route of administration required. No firm recommendation therefore can currently be made on its use for this indication. Guidance on the use of vitamin D for fracture prevention will be contained in the forthcoming NICE clinical practice guideline on osteoporosis that is currently under development.

1.12.6 Hip protectors *(please see Section 5.10 and 5.11 for evidence review methods)*

Level of evidence	Evidence statements
Level I	Reported trials that have used individual patient randomisation have provided no evidence for the effectiveness of hip protectors for the prevention of hip fractures when offered to older people living in extended care settings or in their own homes. Data from cluster randomised trials provides some evidence that hip protectors are effective in the prevention of hip fractures in older people living in extended care settings who are considered at high risk.

Evidence summary

Incidence of hip fractures

Data from the five cluster randomised studies were not

pooled with data from the individually randomised studies. Cluster randomisation methods were used in five studies (Ekman 1997; Harada 2001; Kannus 2000; Lauritzen 1993; Meyer 2003). However, an uncorrected exploratory analysis of the five cluster randomised studies was conducted by the trialists. In Kannus (2000), the exploratory analysis (RR 0.34, 95% CI 0.19 to 0.61) that uses the raw numbers of participants sustaining fracture in each group differs slightly from that in the primary report (relative hazard 0.4, 95% CI 0.2 to 0.8), which used Cox proportional hazards analysis adjusted for age, sex, body mass index, mental status, ability to walk, previous falls and previous fractures.

The cluster randomised trial by Ekman (1997) reports RR 0.34 (0.12-1.01) for the incidence of hip fractures, randomised by unit or nursing home. Harada (2001) reported the number of hip and other fractures, number of falls and compliance with hip protectors. Results for the incidence of hip fractures was RR 0.11 (0.01-0.84) and the incidence of other fractures RR 4.33 (0.21-88.74).

In the trial by Lauritzen (1993), the incidence of hip fractures, randomised by unit or nursing home, was RR 0.44 (0.20-0.93) and the incidence of pelvic fractures was RR 0.34(0.02-7.01).

The incidence of other fractures was RR 1.02 (0.55-1.89) in this trial.

Meyer (2003) reported the number of hip fractures, and other fractures; falls; mortality; compliance of wearing the hip protectors and the reasons for non-compliance. The incidence of hip fractures, randomised by unit or nursing home, was RR 0.53 (0.32-0.87) and the incidence of other fractures RR 1.14 (0.74-1.78).

Pooling of data from the seven trials in which randomisation was by individual showed no significant reduction in the incidence of hip fracture in those allocation to wearing hip pads (64/1306 (4.9%) versus 64/1086 (5.9%), RR 0.94, 95% CI 0.67 to 1.31).

Pooling of data from five individually randomised trials conducted in nursing/residential care settings (1,426 participants) (Cameron 2001; Chan 2000; Jantti 1996; Hubacher 2001; Van Schoor 2003) showed no statistically significant reduction in hip fracture incidence (hip protectors 37/822 (4.5%), controls 40/604 (6.6%), RR 0.83, 95% CI 0.54 to 1.24). The reviewers note that by the end of the one-year observation period, nearly half (16/36 versus 17/36) of the individuals in Jantti (1996) had been lost to follow-up through death or permanent hospitalisation.

Two individually randomised studies recruited community-dwelling older people (Birks 2003; Cameron 2003). These studies did not achieve a statistically significant reduction in the incidence of hip fractures (27/484 (5.6%) versus 24/482 (5.0%), RR 1.11, 95% CI 0.65 to 1.90).

Villar (1998) studied compliance with wearing hip pads in a study with a follow-up period of 12 weeks. As this study excluded mentally incapacitated patients, participants were at lower risk of hip fracture. No hip fractures occurred in either the 101 participants allocated to receive protectors or the 40 participants in the control group. Thus this study contributed no data to the meta-analysis.

Incidence of pubic ramus and other pelvic fractures

There is insufficient evidence to confirm whether the use of hip protectors significantly reduces the incidence of pelvic fractures. Data on the incidence of pubic ramus and other pelvic fracture were available in 10 studies. In the six studies that used individual randomisation there were 16/1266 (1.3%) in the protector group and 13/1055 (1.2%) in the control group (RR 1.15, 95% CI 0.58 to 2.31).

Incidence of other fractures/injuries

The use of hip protectors appears to have no effect on the incidence of other fall associated fractures. Data on the incidence of other fractures that occurred over the study periods were reported in 10 studies. Pooling of results from the individual randomised studies showed that 63/1266 (5.0%) occurred in the protector group and 56/1055 (5.3%) in the control group (RR 1.06, 95% CI 0.75-1.50).

Compliance

Amongst those who were assigned to their use, compliance with wearing of hip protectors was limited. It is not clear in some trials how compliance was measured, but for those that stated the method of measurement, the length of time wearing them was calculated.

Chan (2000) reported a compliance of 50.3 per cent, with dementia given as a reason for non-compliance. Ekman (1997) reported an average compliance of 44 per cent, although it is not clear how this was calculated. Harada (2001) reported that 17/88 (19 per cent) of those allocated to the protectors refused to wear them. Complete compliance estimated by hours worn was 70 per cent and partial compliance 17 per cent. Jantti (1996) stated that, of the 19 participants available at one year, 13 (68 per cent) were still using hip protectors. Of the subgroup of 45 individuals allocated to hip pads monitored in Lauritzen (1993), only 11 (24 per cent) wore the protectors regularly. In Kannus (2000), 31 per cent of those eligible declined to participate in the study, while a further 71 of 446 patients discontinued use during the study. Compliance in those who agreed to participate in the study – assessed as the number of days the protector was worn as a percentage of all available follow-up days – was 48 per cent (±29%,

range <1 to 100%). Van Schoor (2003) used random visits to assess compliance and found that, at one month, 39 per cent were not compliant with wearing the protectors. This figure had risen to 55 per cent at six months and 63 per cent at one year. Hubacher (2001) reported that for 384 allocated to the protector group, 138 were regular wearers, 124 discontinued wearing them and 122 refused to wear them. Even the 138 'regular wearers' only wore the pads 49.1 per cent of the time. Birks (2003) gave an overall compliance figure of 34 per cent. Cameron (2001) stated total compliance was 57 per cent. At the end of the study only 37 per cent were still regular wearers of the protectors. Meyer (2003) reported that the hip protectors were worn by 34 per cent of the intervention group participants. Cameron (2003) approached 1,807 potential subjects living in their own homes and 34 per cent of these agreed to participate. By two years, the end of this study, only 33-38 per cent of participants were wearing the protectors all the time. In Villar (1998), of the 288 individuals approached only 141 consented to participate. Of the 101 who received the protectors only 27 (27 per cent) wore them throughout the 12-week study period. In a breakdown of the reasons for non-compliance presented by Villar (1998), discomfort and poor fit were the most common reasons for discontinued use.

Other evidence reporting compliance problems is also worth summarising, as these sources of evidence also confirm many of the Cochrane review findings reported above.

A systematic review of the literature reported that the acceptance of, and compliance with, of hip protectors (Van Schoor 2002) ranged from 37 per cent to 72 per cent (median 68 per cent) for acceptance and 20 per cent and 92 per cent (median 56 per cent) for compliance. No details were given of specific settings or populations.

In a randomised controlled trial (Cameron 2000), the effect of hip protectors on fear of falling was examined in 131 women aged 75 and above who had two or more falls in the previous year. The results of this study report that hip protector users had greater improvement in falls self efficacy at follow-up.

In a prevalence study (Villar 1998), which aimed to assess compliance with the use of hip protectors in a residential setting, only 27 per cent wore the hip protectors for the full 12-week study period and half of the women wore them for less than one week. The reasons for non-compliance were poor fit or discomfort.

Pakkari (1998) conducted a before and after study assessing the acceptability and compliance with hip protectors in 19 ambulatory residents in a nursing home. The small sample size for this study prevents generalisability, but results indicated that the tight fit of the hip protectors reduced the ability for independent toileting.

Complications (including skin damage/breakdown)

Ekman (1997) mentioned that the occurrence of skin irritation was used as a reason for non-compliance. Villar (1998) reported three individuals who were unable to tolerate the special undergarments during a heatwave and also mentioned discomfort as the prime reason for non-compliance. Kannus (2000) reported skin irritation or abrasion in 15 cases. In addition, one person reported the protector caused swelling of the legs and another that it caused bowel irritation. Hubacher (2001) reported that aches and pains and an uncomfortable feeling with wearing the protectors was given as a reason for non-compliance. Minor skin irritation was reported in Cameron (2001), and Cameron (2003) reported minor skin irritation or infection caused by hip protectors in 16 users (5 per cent). Meyer (2003) reported five cases of skin irritation. In addition some of the care homes reported increased dependency of some of the residents at toileting, more difficulty in dressing and discomfort from wearing the protectors.

For the results of other outcomes measured in this review, see Evidence table 11 (Appendix E).

Summary

The cluster randomised studies, which formed the bulk of the evidence from the previous review (2001), supported a significant beneficial effect of hip protectors in reducing the incidence of hip fracture (Parker et al. 2003). However, this significant protective effect was not confirmed by pooling of data from studies using individual randomisation in the updated version (Parker et al. 2003). For those living in their own homes, the review authors suggest there is insufficient evidence from randomised trials to support any benefit of hip protectors. The authors note that in a number of the cluster randomised studies, although allocation was by institution, analysis was by individual, without allowing for the effect of clustering. This leads to an estimation of the treatment effect in which the confidence intervals are inappropriately narrow. Thus there is a risk that a statistically significant effect appears to exist, when in fact it may not. This may have encouraged inappropriate interpretation of the strength of the evidence.

The authors of the Cochrane review also noted other shortcomings – such as evidence of heterogeneity amongst the populations studied in respect of baseline risk of fracture; that most of the individually randomised studies were underpowered; that the use of protectors appears to have varied between trials and within trials; and that initial acceptance of, and later compliance with,

wearing the hip protectors were reported as problems in all of the studies.

The reader is referred to the Cochrane report for full details.

Finally, the studies included in the Cochrane review (Parker et al. 2003) and additional studies on hip protectors involve the use of a number of different designs of hip protector. It is not possible to be sure that the different types of hip protector used had equal effectiveness. A variety of different types of hip protectors have now been produced and clinical studies will be required to see if these new designs of protector are equally effective in reducing the risk of hip fracture. In addition, the compliance may vary for the different types of hip protector.

Economic evidence

Two studies were identified as being relevant to the use of hip protectors. The first paper by Kumar and Parker (2000) looked at the cost effectiveness of hip protectors using the audit data from an English hospital and the Cochrane review of musculoskeletal injuries (Parker et al. 2001). The intervention was the wearing of hip protectors and the control was no intervention. The outcome measure was the number of hip fractures prevented. As the cost and benefit period was calculated over one year, discounting was not necessary. Direct costs only were used in the analysis and the number of protectors needed per person was obtained from previous studies and communication with the authors. The cost per item was obtained from the manufacturer. The authors use a previously published paper to estimate the average cost of a hip fracture the data updated to their cost year (1998).

The cost results showed that the three hip protectors required for each person cost £113 per year. The average cost of treating a hip fracture was £7,200. The results were presented by age group. The cost of fracture prevented in the 50 to 59 age group was £508,500. The cost per fracture prevented in the above 85 age group was £2,485. The authors conclude that the use of hip protectors in the above 85 age group appears to be cost effective.

However, there are a number of assumptions made in this study that may influence the results shown. The costs were calculated for those people who complied. They did not cost the supply of protectors to people who did not comply. They report a compliance rate of 36 per cent, which suggests that there is a problem. In addition, no sensitivity analysis was carried out on the price of the protectors. No indirect costs for hip fracture were included. The results of this study should be treated with caution.

The second study by Segui-Gomez, Keuffel and Frick (2002) was a state transition model. This models the movement of patients through the probability of sustaining a fall resulting in a hip fracture, not falling or dying from any cause. That is to say the patient is in one of three states: well, hip fracture or dead. Data for models are obtained from published literature, epidemiological data, quality of life data or utility data. The data driving the model was obtained from published literature of trials. The authors state that they made some assumptions concerning the effectiveness of the protectors, which is normal when modelling. However, these assumptions need to be explicit in order to give validity to the model.

This model was populated by two hypothetical groups of 500,000 65-year-old men and women in the USA. The model was run for 35 years.

As with other studies it is difficult to generalise between health care systems. However, they did include a cost utility analysis. They obtained QALY data from expert opinion (a sample of gerontologists) and a sample of older people using a VAS scale. The authors do not give information about the sample other than it being one of convenience. There have been recent concerns about the use of VAS scales in deriving QALY data and this does raise some questions about their results (Brazier et al. 2003).

The authors showed that hip protectors are cost effective in the above 85 age group. The QALY data they collected showed that women gained QALYs overall, but with men there was a decrement. This is attributed to the inconvenience for men of wearing the protector.

There is considerable uncertainty about some of the sensitivity analysis. Compliance is an issue, as the authors state that hip protectors only result in cost savings when compliance is 70 per cent. The literature illustrates that there are problems with compliance and achieving 70 per cent would be difficult.

There are methodological questions with this model that make it difficult to use the results to inform practice.

Both of these studies have no intervention – that is doing nothing is the comparator. It is likely that this may not be the case in some areas where prescribed vitamin D and calcium or bisphosphonates may occur as part of a fracture prevention programme.

In view of recent effectiveness data, which show fewer benefits than previously anticipated, these two flawed cost effectiveness studies demand that their results be treated with caution.

GDG commentary

The GDG acknowledged that the evidence is less convincing of the effectiveness of hip protectors in the prevention of falls, following the update of the Cochrane systematic review on hip protectors. There was discussion

about the benefit of hip protectors for high risk groups of older people. Older people at high risk might include those with the presence of multiple risk factors. However, the GDG felt that it was not possible, on the basis of the current clinical effectiveness evidence, to make a potentially expensive recommendation about their use until there are trials evaluating the newer types of hip protectors and national standards for their manufacture and safety are made.

7. Recommendations for research

The following research gaps were identified by the GDG. Following NICE requirements, the first five are those prioritised by the GDG.

- Further analysis of existing trial data to identify which components of multifactorial interventions are important in different settings and amongst different patient groups.
- Future trials designed and analysed with the intention of identifying cost effective components of multifactorial programmes for particular groups of older people in different settings.
- Evaluation of multi-agency falls prevention programmes to measure the impact of these programmes on reducing falls, injurious falls and fractures in older people.
- Falls prevention trials with a focus on injury reduction, such as fracture outcomes and fall related outcomes.
- Research on the optimal methods of risk assessment for falls in older people and evaluation of whether fall-prone individuals can be risk stratified, in terms of whom will most benefit from assessment and intervention.
- Trials investigating the most effective strategy for preventing falls in older people with cognitive impairment and dementia.
- UK-based cost effectiveness studies of falls prevention interventions.
- Trials to investigate the effectiveness of hip protectors compared with other fracture prevention interventions in older people at high risk of falling.

8. Audit criteria

The audit criteria below are to assist with implementation of the guideline recommendations. The criteria presented here are considered to be the key criteria associated with the guideline recommendations. They are suitable for use in primary and secondary care, for all patients at risk of falling or who are known fallers.

Possible objectives for an audit

Audits can be carried out in different care settings to ensure that individuals who are known fallers or at risk of falling are offered appropriate information, assessment and interventions aimed at reducing the incidence of falls and are involved in decisions about their care having been informed about the rationale for falls assessment and prevention.

People that could be included in an audit

An audit could be conducted in settings where people are known to be at high risk of falling, for example those who attend A&E with fall-related trauma and within extended care settings.

Data sources and documentation of audit

Systems for recording the necessary information, which will provide data sources for audit, should be agreed by trusts. Whatever method is used for documentation, the processes and results of assessment and planned interventions should be accessible to all members of the multidisciplinary team. In relation to assessment, this should include the name of the assessment tool or process used.

Documentation of the factors taken into consideration when deciding the most appropriate intervention should occur. In addition, the reasons for any changes in the intervention should also be documented.

The fact that carers and patients have been informed about falls prevention should be documented. Patients and carers should be directly questioned about their satisfaction with, and the adequacy of, the information provided and this should be documented in either the patient notes or in another source as agreed by the trust.

Trusts should establish a system of recording when relevant staff have been educated in falls assessment and prevention and should implement a process for reviewing education needs relating to this topic.

Measures that could be used as a basis for an audit

The table below suggests measures that could be used as a basis for audit.

Criterion	Exception	Definition of terms
1. Case/risk identification Health care professionals routinely ask older people in their care about previous falls.	None	Older people will be asked if they have fallen in the past year, and about the frequency, context and characteristics of the fall.
Older people with a history of falling or considered at risk of falling are observed for gait and balance problems and considered for interventions to improve strength and balance.	None	
2. Interventions to prevent falls Older people presenting to a health care professional because of a fall or reporting recurrent falls in the past year should be offered a multifactorial falls assessment and be considered for individualised multifactorial interventions.	Those patients who decline particular interventions	Multifactorial assessment may include the following: • identification of falls history • assessment of gait, balance and mobility, and muscle weakness • assessment of osteoporosis risk • assessment of the older person's perceived functional ability and fear relating to falling • assessment of visual impairment • assessment of cognitive impairment and neurological examination • assessment of urinary incontinence • assessment of home hazards • cardiovascular examination and medication review.
• All older people with recurrent falls or assessed as being at increased risk of falling are considered for an individualised multifactorial intervention.	None	In successful multifactorial intervention programmes the following specific components are common: • strength and balance training • home hazard assessment and intervention • vision assessment and referral • medication review with modification/withdrawal.
3. Rehabilitation Following treatment for an injurious fall, older people should be offered an assessment to identify and address future risk and tailored intervention aimed at promoting independence and improving physical function.	None	
4. Education and information giving Older people at increased risk of falls are offered information on reducing risk of falls and appropriate interventions.	None	Information may be given orally or in writing.
5. Health care professionals caring for older people are trained in: • falls risk assessment • appropriate referral of people at increased risk of falls • measures to decrease the likelihood of falls.	None	

Clinicians should review the findings of measurement, identify whether practice can be improved, agree on a plan to achieve any desired improvement and repeat the measurement of actual practice to confirm that the desired improvement is being achieved.

9. Dissemination of guideline

- The guideline will be produced in a full and summary format and a version for the public (*Information for the public*).
- Full copies of the guideline will be available through the NICE website (http://www.nice.org.uk) in PDF format and summary through the National Electronic Library for Health NeLH (http://www.nelh.nhs.uk/) and National Guideline Clearinghouse (http://www.guidelines.gov).

10. Validation

The guideline was validated through two stakeholder consultation processes. The first and second drafts were submitted to NICE in January and April 2004. They obtained and collated stakeholders' comments, which were considered by the GDG.

11. Scheduled review of guideline

The process of reviewing the evidence is expected to begin four years after the date of issue of this guideline. Reviewing may begin earlier than this, if significant evidence that affects the guideline recommendations is identified sooner. The updated guideline will be available within two years of the start of the review process.

12. References

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Appendix A: Guideline Development Group membership and acknowledgements

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National Collaborating Centre for Nursing and Supportive Care

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Appendix B: Generic search strategies and databases searched

Search strategies and databases searched

Twelve search strategies are categorised under four headings: risk assessment, prevention, psychosocial and rehabilitation. Unless otherwise stated, each search covered all study designs indexed by the bibliographic databases. The major databases searched were: Medline, Embase, Cinahl, Psycinfo, HMIC (Health Management Information Consortium), AMED (Allied and Alternative Medicine), BNI (British Nursing Index), SIGLE (Grey Literature in Europe), Biological Abstracts, and Healthstar to 2000 (now incorporated in Medline). These databases were searched using Silver Platter Version 4.0, the windows-based WinSpirs platform. Other platforms - such as Ovid - require different conventions and symbols, but the strategies will translate directly.

The search strategies represent textword, free text or 'natural language' searches, and exact terms in descriptor fields. Free text search terms have been preferred to pure descriptor terms (or subject headings) that are database-specific, as these can be transferred easily between major databases. The indexing of pure descriptor terms is also inconsistent between databases, and may be too specific for the high sensitivity searches of the kind required here. A check is made to ensure that any corresponding descriptors would be included in the free text search.

The free text search strings were suffixed with field search qualifiers so that the terms were searched only in the major fields of each record (title, abstract, descriptors) and not, for example, in journal title or address fields. This differs between databases. For example, Medline would require "risk* in ti,ab,mjme,mime", and Embase would require "risk* in ti,ab,dem,der". The ? symbol is a "wildcard" standing for 1 or 0 characters within a word. The * (asterix) symbol is a "truncation" or "stemming" symbol, which captures variant word-endings by including any number of characters (including 0) at the end of a word.

Further sources searched include: the Cochrane Library, ZETOC, Web of Science (now re-named Web of Knowledge) and the National Research Register. The search strategies used with these databases were, by necessity, shorter and simpler than the strategies used with the main databases listed above.

Hand searching was not undertaken following NICE advice that exhaustive searching on every guideline review topic is not practical (Mason et al., 2002). Reference lists of articles were checked for further articles of potential relevance.

Risk assessment

Database	**Risk Assess.**	**MDS**
Medline	96-Jul02	95-Mar03
EMBASE	98-Jan03	95-Mar03
CINHAL	98-Nov02	95-Dec02
PSYCINFO	98-Nov02	*Not relvnt*
AMED	98-Jul02	95-Apr03
British Nursing Index	98-May02	95-Apr03
Biological Abstracts	98-Jun02	*Not relvnt*
Cochrane Library	98-Dec02	93-Apr03
ZETOC	98-Dec02	*Not relvnt*
WoS	*Not relvnt*	95-Apr03
NRR (inc.Current Controlled Trials)	98-Dec02	*Not relvnt*
HMIC	98-Jul02	95-Apr03
Grey Literature		
SIGLE	98-Dec02	*Not relvnt*
Dissertation Abstracts	*Not relvnt*	*Not relvnt*
Index to Theses	*Not relvnt*	*Not relvnt*

Risk and risk assessment search strategy

#1 (fall or falls or falling or faller* or fallen or slip* or trip*) in ti,ab,mesh

#2 (old or older or senior* or elder* or aged or geriatric* or middle?age*) in ti,ab,mesh

#3 (risk* or assess* or predict* or histor* or screen* or probabilit*) in ti,ab,mesh

#4 #1 and #2 and #3

MDS assessment instrument strategy

#1 (mds-hc or “resident assessment instrument” or “resident assessment protocol”) in ti, ab, mesh

#2 mds near4 (instrument* or assess* or tool*) in ti,ab,mesh

#3 “minimum data set” near4 (instrument* or assess* or tool*) in ti,ab,mesh

#4 #1 or #2 or #3

#5 (reliable or reliability or effect* or valid* or “psychometric properties”) in ti,ab,mesh

#6 (improv* near4 outcome*) in ti,ab,mesh

#7 #5 or #6

#8 #4 and #7

Psychosocial

These strategies searched for studies of interventions to reduce the psychosocial consequences of falls and to maximise participation in falls prevention programmes. The strategies came into three categories: quality of life studies, psychosocial impact studies and fear of falling/falls efficacy scales studies.

Database	**Quality of Life**	**Psychosocial Impact**	**Fear of Falling & Falls Efficacy Scales**
MEDLINE	80-Oct02	80-Jan03	80-Feb03
EMBASE	80-Oct02	80-Jan03	80-Feb03
CINHAL	80-Oct02	80-Dec02	82-Dec02
PSYCINFO	80-Oct02	80-Dec02	80-Dec02
AMED	80-Oct02	85-Dec02	*Not relvnt*
British Nursing Index	*Not relvnt*	*Not relvnt*	*Not relvnt*
Biological Abstracts	*Not relvnt*	*Not relvnt*	*Not relvnt*
Cochrane Library	80-Oct01	*Not relvnt*	*Not relvnt*
ZETOC	*Not relvnt*	*Not relvnt*	02-Feb03
WoS	*Not relvnt*	*Not relvnt*	*Not relvnt*
NRR (inc.Current Controlled Trials)	*Not relvnt*	*Not relvnt*	*Not relvnt*
HMIC	*Not relvnt*	85-Dec02	80-Jan03
GREY LITERATURE			
SIGLE	*Not relvnt*	*Not relvnt*	*Not relvnt*
Dissertation Abstracts	*Not relvnt*	*Not relvnt*	*Not relvnt*
Index to Theses	80-Dec01	*Not relvnt*	*Not relvnt*

Quality of life studies

Five electronic databases were searched between 1980 and September/October 2002 using a sensitive search strategy. The bibliographies of all retrieved and relevant publications were searched for further studies.

#1 (fall or falls or falling or faller* or fallen or slip* or trip*) in ti,ab,mesh
#2 (quality near life) in ti,ab,mesh
#3 (well being or well?being) near quality
#4 (utility or utilities or rosser* or ihql or euro qol or euro?qol or eq?5d or 12d or 15d or qwb) in ti,ab,mesh
#5 (12 or 15) near4 dimension*
#6 (life near4 table*) in ti,ab,mesh
#7 (health near related near quality) in ti,ab,mesh
#8 (qol or ql or hrqol or hrql or well?being) in ti,ab,mesh
#9 #2 or #3 or #4 or #5 or #6 or #7 or #8
#10 #1 and #9

Psychosocial impact search strategy

#1 (fall or falls or falling or faller* or fallen or slip* or trip or trips or tripped) in ti,ab,mesh
#2 “Accidental-Falls”/all subheadings
#3 #1 and #2
#4 (old or older or senior* or elder* or aged or geriatric* or middle?age*) in ti,ab,mesh
#5 (impact* or psycholog* or psychosocial* or emotion* or experience* or subjective* or status or perception* or consequence* or sequelae or effect* or meaning* or rating*) in ti,ab,mesh
#6 #3 and #4 and #5

Fear of falling/falls efficacy scales search strategy

#1 (old or older* or senior* or elder* or geriatric* or middle?age*) in ti,ab,mesh
#2 “fear of falling” in ti,ab,mesh
#3 (fall* efficacy scale*) in ti,ab,mesh
#4 #2 or #3
#5 #1 and #4

Rehabilitation

Database	**Rehabilitation**
MEDLINE	1980-Jun03
EMBASE	1980-Jun03
CINHAL	1982-May03
PSYCINFO	1980-May03
AMED	1980-May03
British Nursing Index	*Not relevant*
Biological Abstracts	*Not relevant*
Cochrane Library	1980-Jun03
ZETOC	*Not relevant*
WoS	*Not relevant*
NRR (inc.Current Controlled Trials)	*Not relevant*
HMIC	1980-May03
GREY LITERATURE	
SIGLE	*Not relevant*
Dissertation Abstracts	*Not relevant*
Index to Theses	*Not relevant*

Rehabilitation search strategy

#1 (fall or falls or falling or faller* or fallen* or slip* or trip*) in ti,ab,mesh

#2 (old or older or senior* or elder* or aged or middle?age*) in ti,ab,mesh

#3 (rehabil* or support* or discharge* or educat* or counsel* or cope* or coping or strateg* or manag* or “follow up” or follow?up or prevent* or improv* or reduc* or “self efficacy” or self?efficacy or mobility or mobile or functional* or independen* or dependen* or re?admit* or re?admission*) in ti,ab,mesh

#4 (home* or domiciliary) near4 visit*

#5 #3 or #4

#6 #1 and #2 and #5

Interventions for the prevention of falls: Cochrane review

Search strategies for CINAHL and EMBASE

CINAHL (OVID ONLINE)	EMBASE (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$1 or elderly or older).tw. 19. or/17-18 20. and/16,19 21. and/13,20	1. exp Randomized Controlled trial/ 2. exp Double Blind Procedure/ 3. exp Single Blind Procedure/ 4. exp Crossover Procedure/ 5. or/1-4 6. ((clinical or controlled or comparative or placebo or prospective$ 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

Hip protectors: search strategies

EMBASE (OVID WEB)	CINAHL (OVID WEB)
1. Hip Protector/ 2. Protective Clothing/ 3. Protective Devices/ 4. Orthotic Devices/ 5. (hip adj (protector$ or pad$)).tw. 6. or/2-5 7. exp Hip Fracture/ 8. ((hip or femur$ or femor$) adj fracture$).tw. 9. or/7-8 10. and/6,9 11. or/1,10 12. exp Randomized Controlled trial/ 13. exp Double Blind Procedure/ 14. exp Single Blind Procedure/ 15. exp Crossover Procedure/ 16. Controlled Study/ 17. or/12-16 18. ((clinical or controlled or comparative or placebo or prospective$ or randomi#ed) adj3 (trial or study)).tw. 19. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. 20. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. 21. (cross?over$ or (cross adj1 over$)).tw. 22. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. 23. or/18-22 24. or/17,23 25. limit 24 to human 26. and/11,25	1. Protective Clothing/ 2. Protective Devices/ 3. Orthotic Devices/ 4. (hip adj (protector$ or pad$)).tw. 5. or/1-4 6. exp Hip Fractures/ 7. ((hip or femur$ or femor$) adj fracture$).tw. 8. or/6-7 9. and/5,8 10. exp Clinical Trials/ 11. exp Evaluation Research/ 12. exp Comparative Studies/ 13. exp Crossover Design/ 14. clinical trial.pt. 15. or/10-14 16. ((clinical or controlled or comparative or placebo or prospective or randomi#ed) adj3 (trial or study)).tw. 17. (random$ adj7 (allocat$ or allot$ or assign$ or basis$ or divid$ or order$)).tw. 18. ((singl$ or doubl$ or trebl$ or tripl$) adj7 (blind$ or mask$)).tw. 19. (cross?over$ or (cross adj1 over$)).tw. 20. ((allocat$ or allot$ or assign$ or divid$) adj3 (condition$ or experiment$ or intervention$ or treatment$ or therap$ or control$ or group$)).tw. 21. or/16-20 22. or/15,21 23. and/9,22

Appendix C: Principles of quality for main study designs - summary sheet

	Tick if 'yes'
Systematic reviews	
adequate search strategy	
inclusion criteria appropriate	
quality assessment of included studies undertaken	
characteristics and results of included studies appropriately summarised	
methods for pooling data	
sources of heterogeneity explored	
Randomised controlled trials	
study blinded, if possible	
method used to generate randomisation schedule adequate	
allocation to treatment groups concealed	
all randomised participants included in the analysis (intention to treat)	
Withdrawals/dropouts reasons given for each group	
Cohort studies	
all eligible subjects (free of disease/outcome of interested) selected or random sample	
$\geq$ 80% agreed to participate	
subjects free of outcomes on interest at study inception	
if groups used: comparable at baseline	
potential confounders controlled for	
measurement of outcomes unbiased (blinded to group)	
follow-up sufficient duration	
follow-up complete and exclusions accounted for ($\geq$80% included in final analysis)	
Case control studies	
eligible subjects diagnosed as cases over a defined period of time or defined catchment area or a random sample of such cases	
case and control definitions adequate and validated	
controls selected from same population as cases	
controls representative (individually matched)	
$\geq$ 80% agreed to participate	
exposure status ascertained objectively	
potential confounders controlled for	
measurement of exposure unbiased (blinded to group)	
groups comparable with respect to potential confounders?	
outcome status ascertained objectively	
$\geq$ 80% selected subjects included in analysis	
Cross-sectional/survey	
selected subjects are representative (all eligible or a random sample)	
$\geq$ 80% subjects agreed to participate	
exposure/outcome status ascertained standardized way	
Qualitative	
criteria for selecting sample clearly described	
methods of data collection adequately described	
analysis method used rigorous (i.e. conceptualised in terms of themes/typologies rather than loose collection of descriptive material)	
evidence of efforts to establish validity (truth value)?	

evidence of efforts to establish reliability (consistency)	
respondent validation (feedback of data/researcher's interpretation to participants)	
interpretations supported by data	
Studies of diagnosis	
independent/blind comparison with a reference ('gold') standard of diagnosis	
diagnostic test evaluated in an appropriate spectrum of patients (those in whom it would be used in practice) selected consecutively	
reference standard applied regardless of the diagnostic test result	
test and reference standards measured independently (blind to each other)	
test validated in a second, independent group of patients	
results of the diagnostic study important	
is the test available, affordable, accurate and precise?	
Risk factor studies	
eligible cohort of participants	
high participation at baseline and follow up > 70%	
risk factors conceptually relevant	
baseline measurement of risk factors	
reporting of methods, explicit inclusion criteria and demographic information	
adequate length of follow up > 6 months	
measurement of falls as outcome	
statistical methods detailed - adequate reporting for data extraction.	
methods of adjustment for confounding reported	

Full quality checklists and data extraction forms available on request from the National Collaborating Centre for Nursing and Supportive Care.

Interventions for prevention: 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
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
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
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
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
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
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
Item H: Were the inclusion and exclusion criteria clearly defined? 3= Clearly defined 2= Poorly defined 1= Not defined
Item J: Were the outcome measures used clearly defined? 3= Clearly defined 2= Poorly defined 1= Not defined
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
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

Hip protectors: quality appraisal

For each study, data for the outcomes listed above were independently extracted by two reviewers. Methodological quality of each trial was assessed by two reviewers independently, without masking of the study names. Differences were resolved by discussion. The main assessment of methodology was by the method of randomisation. A further nine aspects of methodology were assessed, giving a maximum score for each study of 12.

1. Was there clear concealment of allocation? Score 3 (and code A) if allocation clearly concealed (for example, numbered sealed opaque envelopes drawn consecutively). Score 2 (and code B) if there was a possible chance of disclosure before allocation. Score 1 (and code B) if the method of allocation concealment or randomisation was not stated or was unclear. Score 0 (and code C) if allocation was clearly not concealed (for example quasi-randomisation by even or odd date of birth, or where randomisation was clustered, but analysis was by individual participant)

2. Were the inclusion and exclusion criteria clearly defined? Score 1 if text stated type of participants included and those excluded. Otherwise score 0.

3. Were the outcomes of patients who withdrew or were excluded after allocation described and included in an intention to treat analysis? Score 1 if yes or text states that no withdrawals occurred or data are presented clearly showing 'participant flow' which allows this to be inferred. Otherwise score 0.

4. Were the treatment and control groups adequately described at entry and if so were the groups well matched, or appropriate co-variate adjustment made? Score 1 if at least four admission details given (for example, age, sex, mobility, function score, mental test score) with either no important difference between groups or appropriate adjustment made. Otherwise score 0.

5. Were the care programmes other than the trial options identical? Score 1 if text stated they were or this can be inferred. Otherwise score 0.

6. Were the outcome assessors blind to assignment status? Score 1 if assessors were blinded to study group. Otherwise score 0.

7. Was the timing of outcome measures appropriate? A minimum of 12 months follow-up for all surviving patients. Score 1 if yes. Otherwise score 0.

8. Was loss to follow-up reported and if so were less that 5 per cent of patients lost to follow-up? Score 1 if yes. Otherwise score 0. Deaths during the study period were not included as loss to follow-up.

9. Was compliance of treatment monitored? Score 1 if yes. Otherwise score 0.

10. Was follow-up active/scheduled as opposed to simple reporting of incidents as they occurred? Score 1 if yes. Otherwise score 0.

Appendix D: List of Stakeholders

Abbott Laboratories Limited (BASF/Knoll)
Age Concern Cymru
Age Concern England
All Wales Senior Nurses Advisory Group (Mental Health)
Alzheimer's Society
Ambulance Service Association
Association for Continence Advice (ACA)
Association of British Health-Care Industries
Association of the British Pharmaceuticals Industry,(ABPI)
Association of Tissue Viability Nurses- Southern Group
Aventis Pharma
British Association for Accident and Emergency Medicine
British Cardiac Society
British Dental Association
British Dietetic Association
British Geriatrics Society
British Geriatrics Society-Special Interest Group in Diabetes
British Healthcare Trades Association
British Medical Association
British National Formulary (BNF)
British Orthopaedic Association
British Psychological Society, The
British Society of Rehabilitation Medicine
BUPA
Chartered Society of Physiotherapy
College of Occupational Therapists
College of Optometrists, The
Community District Nurses Association
Community Practitioners' and Health Visitors' Association
Department of Health
Eli Lilly and Company Ltd
Faculty of Public Health Medicine
General Medical Council
Health Development Agency
Health Technology Board of Scotland
Help the Aged
Help the Aged - Falls
Limbless Association
Long Term Medical Conditions Alliance
Lundbeck Limited
Medtronic Limited
Mencap
Merck Sharpe & Dohme
National Osteoporosis Society
Novartis Pharmaceuticals UK Ltd
Pfizer Limited
Procter and Gamble Pharmaceuticals
Prodigy
Relatives and Residents Association
Royal College of General Practitioners
Royal College of Nursing
Royal College of Nursing - Falls
Royal College of Ophthalmologists
Royal College of Physicians
Royal College of Psychiatrists
Royal Pharmaceutical Society of Great Britain
Sanofi-Synthelabo

Scottish Intercollegiate Guidelines Network (SIGN)
Shire Pharmaceuticals Limited
Society of Chiropodists & Podiatrists
Strakan Limited
Sue Ryder Care
The Royal Society of Medicine
UK Pain Society
Welsh Assembly Government (formerly National Assembly for Wales)
Wyeth Laboratories

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
AGS/BGS 2001 Guidelines and Perell review	All settings including inpatient.	The Perell review was written following the AGS guidelines and refers to such guidelines. Risk factors are summarised. Perell refers to Rubenstein's review of risk factors and reports the mean RR (OR) for each factor. The AGS guideline refers to individual studies (16) and reports the same figures. No details on study design are given. Perell review illustrates other studies that have examined risk factors. Two are not referred to in the AGS guidelines: • Rawsky: review of 100 studies and reports the frequency of selected intrinsic risk factors but no RR reported. All settings were included. • Connell carried out a review of extrinsic risk factor studies but no summary statistics are reported.	*Mean RR/OR (range*) Muscle weakness= 4.4 (1.5-10.3) History of falls= 3.0 (1.7-7.0) Gait deficit= 2.9 (1.3-5.6) Balance deficit= 2.9 (1.6-5.4) Use of assist dev= 2.6 (1.2-4.6) Visual deficit= 2.5 (1.6-3.5) Arthritis= 2.4 (1.9-2.9) Impaired ADL= 2.3 (1.5-3.1) Depression= 2.2 (1.7-2.5) Cog impairment= 1.8 (1.0-2.3) Age>80= 1.7 (1.1-2.5)	AGS/BGS Guidelines All study designs used: cohort, case control and cross sectional Quality: this guideline was evaluated with the AGREE (appraisal of guidelines for research and evaluation) instrument. The following scores for the specified six domains are given below. The quality of the result is represented by a higher percentage. 1. Scope and purpose 77% 2. Stakeholder involvement 58% 3. Rigour of development 81% 4. Clarity of expression 66% 5. Applicability 55% 6. Editorial independence 50%

Appendix E: Evidence table 1 risk factors

Prospective cohort studies				
Study	**Population/setting**	**Methods**	**Results**	**Quality & comments**
Malmivaara 1993 Finland	Community dwelling sub sample of general population study. N=3909 aged 60 years and over (n=1769 men, n=2140 females) N= 244 injuries from falls (n=68 men, n=176 females)	Risk factors - postal questionnaire included socio-demographic, mental and physical health. Outcome measurement - follow-up period for eight-11 years. Data source for injurious falls obtained from National Hospital Discharge Register.	*Relative risk (95%CI)* Widows over 64 years: 2.7 (1.00-7.00) Anti-anxiety drugs: Men 2.9 (1.15-7.09) Women 1.7 (1.09-2.68) History of MI/cardiovascular disease: Men 2.7 (1.84-8.72) Women 3.3 (1.68-6.59) Male diabetics 3.5 (1.07-11.60	Quality: low No details of participation rates and percentage at follow-up. Response and recall bias for the identification of risk factors No details of (n) for each sub group.
O'Loughlin 1993 Canada	Community dwelling, aged 65 and over randomly selected from Quebec electoral list. N=417 (75%) agreed to participate N=409 (98%) included in final analysis N=119 fallers (197 falls)	Risk factors - at home interviewer administered questionnaire with telephone interview every four weeks for 48 weeks. Stable and time varying exposure variables related to demographic information, physical activity, mobility, ADL and others were measured by self-report. Previous 12 months falls history also obtained. Outcome measurement - a memory aid calendar was provided in which participants placed a label on the date of a sustained fall.	*Incidence rate ratios: IRR (95%CI)* Variables associated with increased rate of falls Dizziness 2.0 (1.3-2.8) ≥10 activities in past week 2.0 (1.3-3.0) Activity limited days 1.9 (1.3-2.6) Trouble walking 400m 1.6 (1.2-2.4) Trouble bending 1.4 (1.0-2.0) 2ndry analysis with history of fall = 2.0 (1.5-2.7) Independent predictors of injurious falls Stroke 2.4 (1.3-4.5) Activity limited days 2.2 (1.4-3.6) ≥10 activities in past week 2.1 (1.1-3.8) Respiratory disorder 1.7 (1.1-2.8)	Quality: medium Method of measurement of risk factors and falls relying on self-report and memory (recall bias).

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Tinetti 1995 USA	Community dwelling aged 72 and over. N=1103 (79% agreed to participate) N= 927 at follow-up N=96 (10%) reported 2 or more falls.	Risk factors - baseline data included socio-demographic, health status, Folstein mini-mental state (FMMS), physical performance, sensory impairment, medications, incontinence and functional dependence. Face-to-face interview method. Outcome measurement - falls were recorded by self-report using a falls calendar daily that was posted to researchers monthly for one year and follow-up face-to-face interview.	*Relative risks RR (95%CI)* FMMS <20 2.6 (1.7-4.0) Insulin 2.2 (1.2-4.1) Arm strength imp. 2.2 (1.5-3.2) Gait deficit Range 2.2- 3.0 Functional dependence 2.0 (1.3-3.1) >2 chronic conds. 1.9 (1.3-2.8) Impairment 1.8 (1.1-2.9) Self rated health 1.8 (1.2-2.6) Chronic dizziness 1.7 (1.1-2.5) Vision imp >50% 1.6 (1.1-2.4) Vision and Hearing Psychotropic 1.4 (1.1-1.8) >5 medications 1.3 (1.1-1.6)	Quality: high
Tinetti 1995 USA	Community dwelling aged 72 and over. N=1103 (79% agreed to participate) N= 927 at follow-up N=96 (10%) reported 2 or more falls. Same data set as above.	Risk factors - baseline data included socio-demographic, health status, Folstein mini-mental state (FMMS), physical performance, sensory impairment, medications, incontinence and functional dependence. Face-to-face interview method. Outcome measurement - falls were recorded by self-report using a falls calendar daily that was posted to researchers monthly for one year and follow-up face-to-face interview.	*Adjusted odds ratio (95%CI)* Serious injury resulting from a fall: entire cohort: FMMS <26 2.2 (1.5-3.2) > 2 chron. Cond. 2.0 (1.4-2.9) Balance/gait score <12/22 1.8 (1.3-2.7) Body mass index <22 1.8 (1.2-2.5) Serious injury resulting from a single fall FMMS <26 2.4 (1.6-3.5) Female 1.9 (1.1-3.1) Body mass index <22 1.8 (1.2-2.6) > 2 chron. Cond. 1.5 (1.1-2.1)	Quality: high

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Northridge 1996 USA	Community dwelling, aged 60-93 with a fall history in the previous year. N=325 participants at baseline n=315 at follow-up N= 109 at least one fall N= 56 experienced a second fall N=26 experienced three or more falls.	Risk factors - baseline data included socio-demographic, physical exam, neuromuscular performance, vision and mental status. Data were collected from interview questionnaire, physician examination, clinical tests. Outcome measurement - pre-paid postcards, weekly for one year with telephone prompting.	*Adjusted odds ratio (95%CI)* (One) non-environmental fall (n=58) Parkinson's 7.66 (1.15-51.1) Home alone >10 hours per day 2.36 (1.20-4.61) (One) environmental fall (n=51) Arthritis 2.60 (1.32-5.09) (Two) non-environmental falls (n=31) Arthritis 2.69 (1.12-6.50) (Two) environmental falls (n=25) Arthritis 2.87 (1.17-7.04)	Quality: medium Only previous fallers included. Subjective self-report assessment of functional status and ADL independence-response bias.
Koski 1998 Finland	Community dwelling aged 70 and over. N=942 (>85%) agreed to participate N=785 participated in final data collection Participants categorised as *disabled (n=222)* or *independent (n=151)* N=373 reported falls.	Risk factors - data collection included socio-demographic, functional ability, physical factors, health indicators, history of falls. Various methods of data collection including postal questionnaire, clinical measurements, medical records Outcome measurement - telephone contacts, falls diary and medical records over a two-year period.	*Disabled* *OR (95%CI)* Low body mass Index 4.1 (1.20-8.24) Benzodiazepines 2.4 (1.01-5.87) Acuity (<0.3) 2.3 (1.18-4.63) Impaired gait 2.2 (1.11-4.17) Divorced, widowed or unmarried 2.2 (1.09-4.40) Poor distant visual *Independent* Insomnia 4.1 (1.70-9.79) Peripheral neuropathy 2.5 (1.13-5.71)	Quality: high Data analysis only included fallers. Recall bias/ measurement bias.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Stalenhoef 1998 Netherlands	Community dwelling aged 70 and over. N=1238 (75% agreed to participate) N=311 selected due to intensive assessment required (one in four sample obtained). Final at baseline n= 311 N=287 at follow-up N=98 fallers N=198 falls.	Risk factors - home safety checklist. Same data set as Stalenhoef (2002). Outcome measurement - telephone follow-up every six weeks for a period of 36 weeks.	*Odds ratio (95%CI)* Hazards associated with falls occurring in the entrance hall of homes: 2.5 (1.4-4.6) ***Other environment hazards not significant***	
Cesari 2002 Italy	Community dwelling admitted to home care programme aged 65 and over. N=5570 (95% participated) N=1997 falls at follow-up.	Risk factors - MDS-HC assessment data set. Outcome measurement: fall events within 90 days.	*Odds ratio (95%CI)* Wandering 2.38 (1.81-3.12) Gait problems 2.13 (1.81-2.51) Depression 1.53 (1.36-1.73) Environmental hazards 1.51 (1.34-1.69)	No details of how outcome was measured.
Brown 2000 USA	Community dwelling aged 65 and over. Subjects were participants in the study of osteoporotic fractures (SOF) N=9704 at baseline N=7847 at follow-up for SOF study N=6049 (77.1%) at visit five follow-up for this study.	Risk factors - urge urinary and stress incontinence Outcome measurement - incident falls. Postcards sent out four-monthly with telephone follow-up. Data collected between 1994-1996.	*Odds ratio (95%CI)* Weekly or more frequent urge incontinence was associated independently with falls: 1.26 (1.14-1.40) Weekly or more frequent stress incontinence was not associated with falling: 1.06 (0.95-1.19)	Multivariate model with adjustment for all factors.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Tromp 1998 Netherlands	Community dwelling aged 65 and over. N=1508 (87% agreed to participate) N=1469 (97%) at follow-up Single falls n= 464 (32%) Recurrent fallers n=217 (15%).	Risk factors - baseline interview with questionnaire component including socio-demographic, physical function, ADL, functional performance, falls history. Outcome measurement – self-reported falls history at three-year follow-up interview. See Tromp 2001 for further study.	*Adjusted odds ratio (95%CI)* Risk profile for recurrent falls Incontinence 1.8 (1.2-2.7) Low physical performance 1.2 (1.1-7.4) Low physical activity 1.2 (1.0-3.4)	Quality: medium Follow-up for three years, outcome status identified by self-reported falls history therefore predictor status may have changed.
Cumming 2000 Australia	Community dwelling aged 65 and over.N=418 (79%) able to participate for Falls Efficacy Scale Other data excluded (see excluded studies) N=169 fell during follow-up.	Risk factors – socio-demographic, falls efficacy scale (o=low 100=high), falls history ADL from self-report during interview-administered questionnaire. Outcome measurement - daily falls calendar posted monthly to researchers for a period of one year.	*Adjusted hazard ratio (95%CI)* Falls Efficacy Scale ≤ 75 (n= 88) =2.09 (1.31-3.33)	Quality: high Subjects divided into sub categories based on scores and previous reported categorisation.
Gill 2000 USA	Community dwelling aged 72 and over. N=1103 (79% agreed to participate) N=822 at follow-up N=520 participants reported a fall N=1110 total falls *(same data set as Tinetti et al 1995).*	Risk factor - environmental hazards were assessed at baseline and one year later. Outcome measurement - falls were recorded by self-report using a falls calendar daily that was posted to researchers monthly for three years (99% completion rate).	*Proportional hazards ratio HR (95%CI)* Carpet folds or tripping hazard = 2.33 (1.15-4.72) All other = ns.	Quality: high At follow-up 188 had died, 93 had been admitted to nursing homes Follow-up period three years but environmental assessment at baseline and one year.
Covinsky 2001 USA	Retirement community dwelling 70 years and over. N=667/ N=557 at follow-up (84%) N=122 (22% reported a fall).	Risk factors - baseline interview data included falls history, socio-demographic, health status, ADL, and physical examination. Outcome measurement – follow-up one year and final interview conducted with previous years fall history reported.	*Univariate/ multivariate regression: odds ratio (95%CI)* Model one: History of falls 3.15 (2.00-4.95) Model two: Abnormal mobility 3.06 (1.93-4.86) Unbalanced /dizzy 1.96 (1.25-3.07) Model three: Abnormal mobility 2.64 (1.64-4.26) Fall history 2.42 (1.49-3.93) Unbalanced /dizzy 1.83 (1.16-2.89)	Quality: low Retrospective falls history at follow-up. Recall bias. Subjective self-rated risk factor identification.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Tromp 2001 Netherlands	Community dwelling aged 65 and over. N=1374 (94% agreed to participate) N=1285 (93%) completed all four data points. Single falls n= 281 (22%) Recurrent fallers n=146 (11%).	Risk factors - baseline interview with questionnaire component, including socio-demographic, physical function, ADL, functional performance, falls history and fear of falling. Outcome measurement - participants completed a falls diary weekly that was posted to researchers every three months for a period of one year.	*Odds ratio (95%CI) Risk profile model* Single fallers: Previous falls 2.6 (2.0-3.3) Incontinence 1.8 (1.4-2.4) Visual impairment 1.7 (1.3-2.3) Benzodiazepines 1.6 (1.2-2.3) Recurrent fallers: Previous falls 3.1 (2.2-4.4) Visual impairment 2.6 (1.8-3.8) Incontinence 2.3 (1.6-3.2) Functional limitation 1.7 (1.6-3.3)	Quality: high
Biderman 2002 Israel	Community dwelling aged 60 and over. N=361 (64% agreed to participate). N=283 at follow-up (78%) N=155 frequent fallers.	Risk factors - data collection included socio-demographic, functional ADL, self-rated health and physical activity, falls history, depressive symptoms (GDS) and elderly falls screening test (EFST) from interview questionnaire. Outcome measurement - retrospective falls history by self-report at one year follow-up.	*Relative risk RR (95%CI)* ADL limitations 6.23 (3.51-11.04) ADL 2 or more limitations 5.89(2.76-12.54) Poor health (self rated) 4.82 (1.19-19.6) Female 3.93 (1.57-9.87) Depression 2.83(1.50-5.34) >3 chronic diseases 2.27(1.02-5.05) Physical activity (self rated) 2.19(1.16-4.14)	Quality: medium Retrospective falls history at follow-up. Recall bias Subjective self-rated health and physical activity.
Ensrud 2002 USA	Community dwelling females aged 65 and over. N=8127 (93% participated) N= 6301 at follow-up (77%) N= 2241 (28%) reported falling once N=917 (11%) experienced frequent falls.	Risk factors - medication history from participant and drug categorisation by physicians. Socio-demographic, function including gait speed, ADL, mini mental state examination, and geriatric depression scale and BMD. Outcome measurement - participants were contacted every four months by postcard or telephone for frequency of falls for a period of one year.	*Multivariate analysis adjusted for confounders. Relative risk (95%CI)* One fall: Benzodiazepines 1.34 (1.09-1.63) Anticonvulsants 1.75 (1.13-2.71) Frequent falls: Benzodiazepines 1.51 (1.14-2.01) Antidepressants 1.54 (1.14-2.07) Anticonvulsants 2.56 (1.49-4.41)	Quality: medium Incompleteness of data, losses to follow-up. Self-reported falls history over four months.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Leveille 2002 USA	Community dwelling females aged 65 and over, living at home with disabilities. N=1002 (71% agreed to participate) N= 940 (93%) at one year follow-up. N=366 reported a fall at the end of year one N=2078 total falls for the three-year study period.	Risk factors - pain classification was described in terms of location and intensity measured with a 0-10 numerical rating scale (NRS). A cut off of four differentiated those with mild or no pain (0-3) and moderate/severe pain (4-10). Outcome measure - interviews at home every six months for three years, participants were asked about their falls history.	*Odds ratio (95%CI)* One or more falls: Moderate/severe pain 1.36 (1.02-1.82) Widespread pain 1.66 (1.25-2.21) Recurrent falls: Moderate/severe pain 1.54 (1.01-2.35_ Widespread pain 2.97 (1.45-6.08)	Quality: medium Retrospective falls history at follow-up.
Stenbacka 2002 Sweden	Community dwelling. Data from population study (N=4023) age range 20-89. Age range 60-89= N=1148 at baseline N=109 sustained one injurious fall N=107 >2 falls.	Risk factors - postal questionnaire including socio-demographic, alcohol consumption, use of hypnotics or sedatives. Outcome measure - one or more falls leading to hospitalisation or death from inpatient register records and death register records during a one-year follow-up.	*Relative risks RR(95%CI)* Age >80 Range 3.95- 5.85 Men (n=31) Earlier injuries 2.48 (1.19-5.13) Living alone 2.02 (1.09-3.73) Women (n=78) High alcohol consumption 2.13 (1.05-4.32) Sedatives/hypnotics 1.50 (1.03-2.19)	Quality: medium Response and recall bias (questionnaire). Confounding: outcome status of death.
van Schoor 2002 Netherlands	Community dwelling aged 55 and over. N=1437 (95% agreed to participate) N=1437 at follow-up. N=370 recurrent fallers.	Risk factors - cognitive tests were determined at baseline with: mini-mental state examination(MMSE), Raven's coloured progressive matrices (RCPM), coding task (CT) and 15-word test (15WT). Memory was tested with modified version of auditory verbal learning test. Outcome measure - falls were recorded by self-report or proxy, using a falls calendar weekly and mail to researchers every three months for three years, with telephone reminder.	*Odds ratio OR (95%CI)* Recurrent falls 15WT/Age >75 1.12 (1.05-1.19)	Quality: medium

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Wood 2002 UK	Community dwelling participants with a diagnosis of Parkinson's Disease. Age ranges 54-92 (mean 75) 77% agreed to participate resulting in n=109 N=74 fallers.	Risk factors - baseline assessment included: Falls history, demographic information, disease severity, gait and balance function, visual acuity, cardiovascular function, bone density. Outcome measurement - participants were given a set of weekly pre-paid postcards in which to record the number of falls sustained during that week. These were then returned weekly for the duration of one year. Fallers were followed up and circumstances of the fall were determined.	Independent predictors for falling *Logistic regression OR (95%CI)* Dementia 6.7 (1.1-42.5) Loss of arm swing 4.3 (1.3-13.7) Previous falls 4.0 (1.3-12.1) Each year of disease 1.3 (1.1-1.6)	Quality: medium Subjective rating scales used for health status and disease severity.
EXTENDED AND COMMUNITY DWELLING				
Leipzig 1999 USA reported	Systematic review and meta analysis (1975-1993). All settings although predominantly community dwelling and extended care N= 40 studies.	Risk factors – benzodiazepines, antidepressants, neuroleptics, hypnotics or sedatives, other psychotropic drugs. Outcome measurement - **f**allers and recurrent fallers.	Fixed effect model Comparison of pooled ORs and pooled RRs from cohort studies. Psychotropics n=11 studies OR RR 1.66)1.40-1.97) 1.35 (1.22-1.48) Antidepressants n=11 studies 1.62 (1.23-2.14) 1.27 (1.12-1.44) Neuroleptics n=10 studies 1.90 (1.35-2.67) 1.31 (1.15-1.49) Sedatives/hypnotics n=9 studies 1.25 ((0.98-1.60) 1.12 (0.99-1.26) Benzodiazepines n=8 studies 1.40 (1.11-1.76) 1.20 (1.07-1.36) Tricyclics n=8 studies 1.40 (0.96-2.02) 1.16 (0.99-1.35)	Quality: medium All settings. Limited database search. All study designs included although cohort design as sub group analysis. Minimal adjustment for confounders, dosage or duration of therapy.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Leipzig 1999 USA reported	Systematic review and meta analysis (1975-1993). All settings although predominantly community dwelling and extended care N= 29 studies.	Risk factors - cardiac drugs: Thiazides, loop diuretics, Digoxin, nitrates, beta blockers, calcium channel blockers, ACE inhibitors, centrally acting antihypertensiveces, type 1A antiarrythmics. Analgesics: narcotics, NSAIDs, Aspirin, unclassified. Outcome measurement - fallers and recurrent falls.	Cardiac drugs *Odds ratio (95%CI)* *All studies*: Type 1A antiarrythmics: n=10 studies 1.59 (1.02-2.48) Digoxin: n=17 studies 1.22 (1.05-1.42) Any diuretic: n=26 studies 1.08 (1.02-1.16) *Cohort studies* Digoxin: n=9 studies 1.29 (1.01-1.65) *Community* Any diuretic: n=13 studies 1.07 (1.00-1.15) Digoxin: n=9 studies 1.21 (1.01-1.44) *Extended care* Nil significant Analgesic: Nil significant Multiple medication use N= 14 studies Single fallers/ ≥3 drugs: 4/11 significant OR: range 1.57-3.16 Single fallers/ ≥4 drugs: 3/9 significant OR: range 2.07-2.9 Recurrent fallers ≥3 drugs: 3/4significant OR: range 2.02-3.16 Recurrent fallers ≥4 drugs: 4/5 significant OR: range 1.71-2.91	Quality: medium All settings. Limited database search. All study designs included although cohort design as sub group analysis. Minimal adjustment for confounders, dosage or duration of therapy.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Lowery 2000 UK	Community dwelling. (n=21)and extended care (n=41) N=65 dementia patients. Mean age 78.3 95% (n=62) at follow-up N=44 >1 fall N=12 > 5 falls.	Risk factors - MMS, psychiatric history, physical examination. Multidisciplinary assessment by an occupational therapist using the environmental hazards checklist blind to contents of diary. Outcome measurement - falls and circumstances were reported over a three-month period using a weekly diary completed by carers.	Differences between exposed and non-exposed and outcome status was explored using Mann-Whitney U test and association between number and individual environmental hazards tested with Spearman's rank correlation analysis. Results Significant difference between number of environmental hazards found in own home (mean 5.4) compared to extended care environment (mean 1.8) MWU Z=4.16, p=0.0001. Number of environmental hazards and individual hazards =ns	Quality: high Small sample size. Short length of follow-up.
EXTENDED CARE				
Thapa 1996 USA	Extended care settings. N=1228 residents of 12 nursing homes over 65 years of age, n=725 non-ambulatory and n=503 ambulatory. N=548 fallers (n=1585 falls).	Risk factors - baseline data included demographic, body mass index, cognitive impairment, psychotropic drugs, previous falls history obtained from staff and resident records (minimum data set MDS). Outcome measurement - nursing home incident reports, MDS, hospital records for a period of one year.	*Non-ambulatory* *IDR (95%CI)* Fewer mobility Limitations 2.92 (1.07-7.99) Male gender 2.62 (1.31-5.26) Lowest tertile BMI 2.47(1.28-4.78) Previous fall 2.23 (1.14-4.37) *Ambulatory* Psychotropic drugs 2.49(1.43-4.33)	Quality: high Follow-up ceased with occurrence of study event.

Appendix E: Evidence table 1 risk factors

Study	Population/setting	Methods	Results	Quality & comments
Ray 2000 USA	Extended care setting. N=2510 residents aged 65 and over N=853 (34%) had at least one day of benzodiazepine use during follow-up. N= 3706 falls.	Risk factors - benzodiazepine use from records was categorised as *current, recent, none* and users classified by dose, duration and elimination half-life. Other data from MDS. Outcome measurement - incident reports and medical records. Follow-up continued until participant exited the facility or there was a change in antidepressant use status. Mean follow-up = 225 days.	*Adjusted rate ratio (95%CI)* Recent user 1.23 (1.07-1.42) Current user 1.44 (1.33-1.56) Dose 2-8mg range 1.30-1.38 >8mg 2.21 (1.89-2.60) Days since start: <7 days 2.96 (2.33-2.75) 7-29 days 2.23 (1.64-3.03) >30 days 1.30 (1.17-1.44) Elimination half-life 12-23 hours 1.45 (1.33-1.59) >24 hours 1.73 (1.40-2.14)	Quality: high
Bueno-Cavanillas 2001 Spain	Extended care settings. N=190 residents of two nursing homes aged 65 and over. N=72 fallers / N=106 falls (n=63 extrinsic falls n=43 intrinsic falls).	Risk factors - baseline data included socio-demographic, dependence, psychological, physical, falls history, gait, balance and strength obtained from medical records, carers and self-report from participants, clinical examination. Outcome measurement - records with details of 'intrinsic' and 'extrinsic' causes for a period of one year.	*Density ratio: DR (95%CI)* *Independent risk factors* Intrinsic falls: Dementia 6.2 (1.7-23.3) Antidepressants 5.7 (1.5 –22.0) Neuroleptics 4.5 (1.6-12.6) Romberg incorrect 4.0 (1.2-13.3) Diabetes 3.8 (1.6-9.0) Sitting down incorr 3.4 (1.5-7.6) Cardiotonic glycoside 2.9 (1.2-6.9) Slow pace 2.6 (1.2-5.3) Previous falls 1.9 (1.3-2.9) Extrinsic: Oral bronchodilators 5.6 (1.6-19.7) Diabetes 4.1 (1.9-8.8) Neuroleptics 3.2 (1.6-6.6)	Quality: low 9% dropout rate.
Kallin 2002 Sweden	Extended care setting. N=83 (n=58 females, n=25 men) N= 52 fallers (at least once), Total falls n=163.	Risk factors - baseline data included functional clinical tests, medications, cognitive, depression and mini-mental state. A physician or a physiotherapist assessed all participants. Outcome measurement - falls were reported by staff to researcher, and standardised form completed for a follow-up period of one year.	*Odds ratio (95%CI)* One time fallers: Impaired vision 5.85 (1.14-30.08) Antidepressants 4.66 (1.23-17.59) Recurrent fallers: Antidepressants 6.31 (1.60-24.93) Previous fall 4.65 (1.48-14.60) Age 1.12 (1.02-1.23)	Quality: low Small sample.

Appendix E: Evidence table 2 risk factors: multivariate analysis (please refer to Evidence table 1 for further details)

Falls history

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Northridge 1996	Baseline status for all analysis included one fall prior to baseline. *OR (95%CI)* One non-environmental fall at follow-up 1.15 (1.01-1.31) One environmental fall at follow-up 1.20 (1.05-1.36) Two non-environmental falls 1.19 (1.05-1.36) Two environmental falls 1.15 (1.00-1.32).	Medium	Only previous fallers were recruited. Subjective baseline measurement of risk factors Analysis of two falls at follow-up n= less than 50. OR are adjusted for all other variables.
Covinsky 2001	*OR (95% CI)* 2.42 (1.49-3.93).	Medium	Retrospective falls history at follow-up. Subjective baseline measurement of risk factors. Three models were computed and each adjusted for falls history. All risk factors significant at p<0.05 were retained in multivariate analysis.
Tromp 2001	*OR (95%CI)* Single fallers 2.6 (2.0-3.3) Recurrent fallers 3.1 (2.2-4.4).	High	All risk factors were adjusted for the others and all were adjusted for age, gender. Recurrent falls and fractures.
Friedman 2002	*OR (95% CI)* 2.51(2.04-3.09)	High	Logistical regression. Adjusted for other variables in the model. (Please refer to Evidence table 5 for further details).
Stalenhoef 2002	*OR (95%CI)* 3.1 (1.5-6.7).	High	Variables meeting an OR of two or more in bivariate analysis were entered into multivariate analysis. Stratification included age and sex were also entered. Adjustment reported but unclear.
Stenbacka 2002	*RR(95%CI)* Earlier injuries: men >60years 2.48(1.19-5.13).	Medium	
Wood 2002	*OR (95%CI)* 4.0 (1.3-12.1.	Low	Variables significant at p<0.1 were entered in logistic regression analysis. No adjustment for covariates reported. Small sample n=74 fallers. Parkinson's disease only.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Extended care: statistically significant results

Study	Results	Quality	Comments
Thapa 1996	*IDR (95%CI)* Non-ambulatory 2.23 (1.14-4.37).	High	Multivariate model included factors with a significance of p=≤0.10. Separate analysis was conducted for the non-ambulatory and ambulatory participants. Each variable was adjusted for other variables with exception of falls history. Falls history was assessed in a separate model.
Bueno-Cavanillas 2000	*DR (95%CI)* Intrinsic falls 1.9 (1.3-2.9).	Low	Adjusted density ratios referred to but no details. Small sample n=106 falls.
Kallin 2002	*OR (95%CI* 4.65 (1.48-14.60).	Low	Small sample multivariate analysis. No adjustment for confounding.

Extended care: statistically non-significant results

Study	Comments
O Loughlin 1993	Falls history not included in pooled logistical regression for other factors. Secondary analysis including falls history in the model (IRR= 2.1 (1.4-3.3). Poor methods of reporting.
Tinetti 1995	*Adjusted RR (95%CI)* 1.2 (0.9-1.5)
Thapa 1996	*Adjusted IDR (95%CI)* *Ambulatory* 1.22(0.73-2.04)
Koski 1998	Measured but not reported.
Tromp 1998	Previous falls established by history of fracture.
Cesari 2002	Unsure if measured at baseline. MDS at baseline. Not reported as significant in results.
Stenbacka 2002	Adjusted for age *RR(95%CI)* Earlier injuries: Women>60 years 1.21(0.76-1.92)

Appendix E: Evidence table 2 risk factors: multivariate analysis

Muscle weakness

Statistically non-significant results (ns)

Study	Comments
Bueno-Cavanillas 2000	*DR (95%CI) Adjusted but unclear reporting* Intrinsic fall Poor muscle tone in hand: 1.4 (0.9-2.4) Extrinsic fall Poor muscle tone in hand: 1.3 (0.7-2.3).
Koski 1998	Ns in multivariate analysis.

Gait deficit

Gait, mobility and balance described separately but some overlap may be present due to some tests examining both aspects

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Koski 1998	*OR (95%CI)* Incomplete step continuity 2.2 (1.11-4.17).	High	Logistic regression with adjustment for age and gender.
Cesari 2002	*OR (95%CI)* Gait problems 2.13 (1.81-2.51).	Medium	Logistic regression with adjustment for age and gender.
Northridge 1996	*OR (95%CI)* Tandem walk performance: non-environmental single fall 1.96(1.44-2.68).	Medium	Only previous fallers were recruited. Analysis of two falls at follow-up n= less than 50. OR are adjusted for all other variables.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Extended care: statistically non-significant results

Study	Comments
Bueno-Cavanillas 2000	Gait disorders were examined in this study but categorised into twelve domains. Adjusted density ratios referred to but no details Small sample n=106 falls: Multivariate analysis: sitting down incorrectly: (? Not specific enough) DR=3.4 (1.5-7.6)
Kallin 2002	Ns in logistic regression.

Community dwelling: non-significant results

Northridge 1996	Adjusted for all variables. Tandem walk performance: environmental single fall 1.24 (0.91-1.69) Non-environmental and environmental second fall both ns in multivariate analysis (no data).
Stalenhoef 2002	TUGT: Ns in logistical regression.
Wood 2002	Parkinson's disease only. Gait measured at baseline, ns in multivariate analysis (no data).
Tinetti 1995	Gait speed: Ns Multivariate analysis.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Balance (including dizziness)

Community dwelling: statistically significant results

Study	Results	Quality	Comments
O Loughlin 1993	*IRR(95%CI) (Adjusted)* *Dizziness*= 2.0(1.3-2.8).	Medium	Pooled logistical regression, with all ns risk factors that were not retained in the model were entered one by one to identify potential confounders.
Stalenhoef 2002	*OR(95%CI)* *Abnormal postural sway* 3.9 (1.3-12.1).	HIgh	Variables meeting an OR of two or more in bivariate analysis were entered into multivariate analysis. Stratification included age and sex were also entered. Adjustment reported but unclear.
Covinsky 2001	*OR(95%CI)* *Unbalanced or dizzy:* Model 2 adjusted for falls history= 1.96(1.25-3.07) Model 3 included falls history= 1.83(1.16-2.89).	Medium	Multivariate logistic regression.

Extended care: statistically significant results

Bueno-Cavanillas 2000	Eight aspects of balance examined and analysis according to intrinsic or extrinsic fall. All ns in multivariate analyses with exception of Romberg incorrect: DR=4.0 (1.2-13.3)	Low small sample	Cox regression analysis no adjustment variables reported.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Extended care: statistically non-significant results (ns)

Study	Comments
O Loughlin 1993	NS in pooled logistical regression, with all ns risk factors that were not retained in the model were entered one by one to identify potential confounders.
Tinetti 1995	Balance and Gait score= ns in multivariate analysis.
Northridge 1996	*Balance on one leg* Multivariate analysis with adjustment for all other variables First fall Environmental= ns Non-environmental = ns. Second fall Environmental= OR 1.12(0.94-1.32) Non-environmental = OR 0.71(0.55-0.93).
Koski 1998	*Unsteady standing* NS in multivariate analysis.
Wood 2001	Balance score ns in multivariate analysis. Small sample n= 69 fallers/ 32 non fallers.
Stalenhoef 2002	Trendelenburg test (abnormal), bending down test, functional reach test. All ns in logistic regression.
Bueno-Cavanillas 2000	Eight aspects of balance examined and analysis according to intrinsic or extrinsic fall. All ns in multivariate analyses with exception of Romberg incorrect test as above.
Kallin 2002	Functional reach: ns in multivariate analysis.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Mobility impairment

Community dwelling: statistically significant results

Study	Results	Quality	Comments
O Loughlin 1993	*IRR(95%CI) (adjusted)* *Trouble walking 400m=* 1.6(1.2-2.4) *Trouble bending down=* 1.4(1.0-2.0).	Medium	Pooled logistical regression, with all ns risk factors that were not retained in the model were entered one by one to identify potential confounders.
Covinsky 2001	*OR(95%CI)* *Impaired mobility:* Model 2 adjusted for falls history= 3.06(1.93-4.86) Model 3 included falls history= 2.64(1.64-4.26).	Medium	Multivariate logistic regression.

Community dwelling: statistically non-significant results

Study	Comments
Bueno-Cavanillas et al (2000)	See gait and balance.
Kallin et al (2002)	*User of walking aid* ns in logistic regression.
Cesari et al (2002)	Unsure if measured at baseline. MDS at baseline. Not reported as significant in results.
Stalenhoef et al (2002)	Mobility was assessed with balance and gait tests. SIP68 MC also utilised within the mobility domain= ns in multivariate analysis. Bivariate= 2.6(1.3-5.3).

Appendix E: Evidence table 2 risk factors: multivariate analysis

Fear of falling

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Arfken 1994 USA	*OR (95%CI)* 1 fall A= 1.52 (1.06-2.17) B= 2.49(1.48-4.20) Recurrent falls A=1.71(1.01-2.89) B=3.12(1.61-6.06).	High	Statistical methods: Logistic regression adjusted for age, gender. (Please refer to Evidence table 5 for further details).
Cumming 2000	*Adjusted hazard ratio (95%CI)* Falls efficacy scale ≤ 75 (n= 88) =2.09 (1.31-3.33).	High	Linear regression with adjustment for other related variables.
Friedman 2002	*OR(95%CI)* Fear of falling at baseline/ falls at follow-up= 1.78(1.41-2.24) Fear of falling at baseline and follow-up= 5.40(4.23-6.91) Fear of falling at baseline with no history of falling= 1.79(1.33-2.42).	Medium	This study explored the temporal relationship between falls and the fear of falling. Logistic regression analysis with all other factors entered into the model.

Community dwelling: statistically non-significant results

Study	Comments
Tromp 2001	Ns in multivariate analysis.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Visual deficit

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Northridge 1996	*OR(95%CI) adjusted* *Second fall: non-environmental* *Corrected visual acuity (5 units worse)* 1.18(1.00-1.39) *Environmental* 1.22(1.02-1.46).	Low	Multivariate logistic regression. Each variable adjusted for others.
Koski 1998	*OR (95%CI)* *Poor distant visual acuity* 2.3(1.18-4.63).	High	Logistic regression with adjustment for age and gender.

Extended care: statistically significant results

Kallin 2002	*OR (95%CI)* *Impaired vision* 5.85(1.14-30.08).	Low - small sample	Logistic regression. No adjustment for confounding reported.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Extended care: statistically non-significant results (ns)

Study	Comments
Tinetti 1995	*Visual impairment* Ns in multivariate analysis.
Northridge 1996	*OR(95%CI)* *Depth perception score* Multivariate analysis with adjustment for all other variables First fall Environmental= 0.81(0.70-0.94) Non-environmental = 1.04(0.92-1.18).
Tromp 1998	Multivariate analysis adjusted for age and gender, and recurrent falls: *Vision problems:* OR 1.7(0.9-3.0).
Cesari 2002	*Visual impairment* Ns in multivariate analysis.
Stalenhoef 2002	*Distant vision* Ns in multivariate analysis.
Wood 2002	*Visual acuity* Ns in multivariate analysis.
Thapa 1996	Visual impairment measured but ns in multivariate analysis. No data reported.
Bueno-Cavanillas 2000	Many aspects of vision were measured. Ns in multivariate analysis.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Cognitive impairment

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Tinetti 1995	*Adjusted OR (95%CI)* Serious injurious fall (entire cohort) MMSE<26 = 2.2(1.5-3.2) Serious injurious fall (those who fell at least once MMSE<26 =2.4(1.6-3.4).	High	Pooled logistic regression adjusted for housing stratum, moth of follow-up, history of fall, at least two chronic conditions, Balance and gait scores female gender, body mass index.
van Schoor 2002	*Adjusted OR (95%CI)* *RCPM and adjusted variable Age and education=1.03(1.00-1.07) **CT Age and education=1.02(1.00-1.04).	Medium	Logistic regression with adjustment for age, sex, depression, education level and stroke.

Extended care: statistically significant results

Bueno-Cavanillas 2000	*DR (95%CI)* Intrinsic fall / dementia 6.2(1.7-23.3).	Low - small sample	Cox regression analysis no adjustment variables reported.

***** RCPM = non-verbal, visual test to measure a persons ability of nonverbal and abstract reasoning.
** CT= coding task

Appendix E: Evidence table 2 risk factors: multivariate analysis

Community dwelling and extended care: statistically non-significant results (ns)

Study	Comments
Tinetti 1995	MMSE <20 ns in multivariate analysis.
Northridge 1996	Mental status test ns in multivariate analysis.
Tromp 1998	Cognitive impairment ns in multivariate analysis.
Cesari 2002	Cognitive performance scale ns in multivariate analysis.
Stalenhoef 2002	MMSE<24 ns in multivariate analysis.
van Schoor 2002	RCPM and adjusted variable Age= 1.02(0.98-1.05) Age and depression and education= 1.03(0.99-1.07) MMSE and adjusted variable Age= 1.03(0.99-1.07) Age and depression= 1.02(0.97-1.06) Age and depression and education= 1.03(0.99-1.08) CT and adjusted variable Age= 1.00(0.99-1.02) Age and depression and education= 1.02(0.99-1.04).
Thapa 1996	*Adjusted IDR(95%CI)* Cognitive impairment / moderate 1.49(0.89-2.50) Cognitive impairment / severe 1.59(0.78-3.26) Adjusted for all other variables.
Kallin 2002	MMSE ns in multivariate analysis.
Wood 2002	MMSE ns in multivariate analysis.

MMSE= mini mental state examination

Appendix E: Evidence table 2 risk factors: multivariate analysis

Urinary incontinence

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Tromp 1998	*Adjusted OR(95%CI)* 1.8(1.2-2.7).	High	Logistic regression adjusted for age, gender recurrent falls
Brown 2000	*Adjusted OR(95%CI)* Urge incontinence 1.26(1.14-1.40).	High	Multivariate model with adjustment for all factors.

Statistically non-significant results

Study	Comments
Tinetti 1995	Ns in multivariate analysis.
Koski 1998	Urinary incontinence ns in multivariate analysis.
Brown 2000	*Adjusted OR(95%CI)* Stress incontinence 1.06(0.95-1.19).
Cesari 2002	*Adjusted OR(95%CI)* 1.06(0.93-1.20) Adjusted for age and gender.
Thapa 1996	Ns in multivariate analysis.

Appendix E: Evidence table 2 risk factors: multivariate analysis

Home hazards

Community dwelling: statistically significant results

Study	Results	Quality	Comments
Cesari 2002	*Adjusted OR(95%CI)* 1.51(1.43-1.69).	Medium	Logistic regression with adjustment for age and gender.
Gill 2000	*Proportional Hazards ratio (95%CI)* Loose rugs, mats etc= 5.87(1.42-24.2) Carpet fold or tripping hazard= 3.45(1.29-9.27).	High	Adjusted for age, gender and housing type. Many potential hazards were assessed in this study. Only significant in adjusted results reported here.

Appendix E: Evidence table 3 Profile of Tools

Turn 180
Developers: Simpson et al 2002.
Setting: For use in hospitals and the community.
Populations: Older people, particularly those around 75 years with complex problems.
Objective: To assess dynamic postural stability.
Procedure: Older people are prepared with comfortable and suitable clothing and footwear. Stable handholds are made available. A suitable chair that requires minimal effort to stand up by the older person is provided. For comparability, all future tests need to be conducted in similar conditions – for example, time of day, same observer and setting. Instructions for the older person may need to be repeated to ensure they have understood. Instructions could be written on a card so that they may be read. The older person needs to stand up and, on request, turn to face the opposite direction, without holding onto chairs, if possible. They must try not to use objects to support their body weight, as this would invalidate the test. They can choose the direction in which they turn. An observer behind the older person counts the steps taken.
Length of time to carry out test: The test is not timed and the subject may take as long as they require.
Special equipment needed: None.
Training required: Not specified, however the practice of standardising this test is attempting to eliminate errors of judgement on the part of the assessors.
Burden/acceptability to patients: Devised for the frail older person, the development of the standardised procedure evaluated fear where the majority (87.3%) did not experience fear of falling during the test.
Measure type. Describe: Observation and counting of steps taken to turn 180°.
Cut off points for level of risk. How were these derived? More than fours steps are associated with an increased fall risk (Nevitt *et al*, 1989).
Further testing of tool: Nevitt et al (1989) – the aim of this study was to ascertain risk factors for recurrent falls. This study included a test for the number of steps taken to turn 180°. No procedure is given for the test. This was a single sample prospective cohort of N=325 community dwelling older people above 60 years, with a history of one previous fall in the last 12 months. Syncopal falls were excluded. Outcome measurement was taken of the number of steps to complete a 180° turn. The mean number of steps taken was 4±2. The unadjusted RR 1.9 (1.2-3.2) for greater than five steps to make the turn was associated with an increased risk of multiple falls - two or more. Simpson et al (2002) – the aim of this study was to describe the development of a standardised procedure for the 180° turn. Patients admitted to acute geriatric wards were screened for eligibility as soon as their discharge date was set. N=142 patients with a mean age of 81years completed the tests (two tests turning clockwise or anti-clockwise). Turn 180 step counts correlated positively with number of falls recalled in the last 6 months. (rho = 0.35, P=0.001).
Conclusions: Retest reliability and between operator reliability of the turn 180 version are being examined. No other evaluations of the 180° have been identified.

Berg balance scale
Developers: Berg Katherine O et al 1989.
Setting: All settings. Previous testing includes elderly care home, acute care settings and laboratory.
Populations: Ambulatory elderly.
Objective: To identify those at risk □ To identify those at highest risk □ Both.

Appendix E: Evidence table 3 Profile of Tools

To rate the ability of an individual to maintain balance while performing ADL related tasks. Components include balance, lower and upper extremity strength.

Procedure:
Assessment by professional and (0-4) grading ability to perform 14 common everyday movements:

- Ability to maintain positions of decreasing stability
- To change positions
- Perform tasks in unstable positions
- Perform movements with increasing speed.

Components include balance, lower and upper extremity strength.
Aspects of balance measured:
Sit to stand
Stand to sit
Stand and sit unsupported
Transfer bed to chair
Stand eyes closed
Stand feet together
Standing one foot in front of other
Reach forward
Pick up object from floor
Single leg stance
Look over shoulders
Turn 360º
Alternate foot on stool.

Length of time to carry out test: 15 minutes.

Special equipment needed:
Stopwatch
Chair
Bed
Ruler
Stool.

Training required: Yes

Burden/acceptability to patients: Not reported.

Measurement type. Describe:
Scale 0- 56 points, divided into sub-scales. Ordinal level of measurement.

Cut off points for level of risk. How were these derived?
Clinical experience and judgement. 45 is stated as a cut off point.

Further testing of tool:
1. Berg (1992) Extended setting n=113 participants
Inter rater reliability
Caregiver and participants gave a global rating scale score of their balance ability (good, fair, poor). Four data points: initial assessment, 3, 6 and 9 months.
Results (Pearson product moment correlation coefficient)
Caregiver ratings and BBS: r= 0.47 to 0.61
Self-rating and BBS: r=0.39 to 0.41
Concurrent validity
Researchers assessed participants with Berg balance scale (BBS) and functional independence with the Barthel index (Mahoney et al 1965).
BBS cut-off point of 45 or greater determined those who are safe in independent ambulation based on clinical experience.
Results (Pearson product moment correlation coefficient)
BBS and Barthel index: r=0.87 to 0.93
Predictive validity
At one year follow-up participants were classified according to fall status.
Results (Relative risk 95%CI)
Score of less than 45: RR 2.7 (1.5-4.9)

Reviews (narrative):

Appendix E: Evidence table 3 Profile of Tools

1. Whitney SL et al (1998) A review of balance instruments for older adults, *American Journal of Occupational Therapy,* 52;8:666-671.

Reliability
Interrater ICC= 0.98
Interrater rs= 0.88
Internal consistency/ Cronbach's alpha= 0.96
Validity
Concurrent
Barthel Index: r=0.67
Timed up and Go: r=0.76
Tinetti: r=0.91
Predictive
<45 predicted falls
All settings
Quality of review
Specific questions guided the review:

- Aspects of balance
- Administration time
- Tools needed
- Reliability
- Validity
- Population.

2. Thorbahn LD (1998) Value and limitations of the Berg balance test to predict risk of falls in nursing home residents, *Annals of Long Term Care,* 6;2:49-53.

As above
Predictive validity: Cut off point of 45 described for one study, other not stated. Both studies participants were community dwelling and sample size less than 70.
Sensitivity: range= 53% to 91%
Specificity: range= 82% to 96%
Suggests that further research is needed on individuals who score between 31 and 45.
Quality of review
Mainly descriptive and discussion.

3. Zwick D et al (2000) Evaluation and treatment of balance in the elderly: A review of the efficacy of the Berg balance test and Tai Chi Quan, *Neuro Rehabilitation,*15: 49-56.

Refers to the following study not included in the above:

- Harada et al (1995)

N= 53 extended care participants.
Cut off point of 48
Sensitivity=84%
Specificity=78%

4. Perell KL (2001) Fall risk assessment measures: an analytic review, *Journal of Gerontology,* 56A;12:M761-M766.

Refers to Berg (1989)
Outpatient and CVA patients.
Cut off point of 49
Sensitivity = 77%
Specificity = 86%

Appendix E: Evidence table 3 Profile of Tools

Comments on reviews: Generally these were narrative reviews with a clear emphasis on specific tests and scales. Limited information is given regarding the quality of studies, demographic information, which provided the data source for the review.
Other comments: Other studies exist that have tested this scale with inpatients and stroke patients, assessing general aspects of balance not related to falls, but perhaps stroke disability severity. Most of the reliability and validity studies are with small sampled populations and have therefore been excluded.
Conclusions: Detailed assessment of balance. Has been extensively tested with different populations but does take 15 minutes to administer.

Dynamic gait index
Developers: Shumway-Cook(1997).
Setting: All settings.
Populations: Ambulatory elderly.
Objective: To identify those at risk. To rate the ability of an individual to modify gait in response to changing task demands.
Procedure: Assessment by professional on a 4 point scale (0-3) grading ability to perform the following: • Walk on level surface • Change gait speed • Perform head turns while walking • Stepping over and around objects • Pivoting during walking • Stair climbing.
Length of time to carry out test: 15 minutes.
Special equipment needed: Stairs.
Training required: Yes.
Burden/acceptability to patients: Not reported.
Measurement type: Ordinal. 0-3 point rating scale of observers judgement (0= severe impairment, 3=normal) Total score 24.
Cut off points for level of risk: Initial development by the authors using a small sample (n=44) of community dwelling participants. Using a cut off value of <19 the DGI identified 64% of the non fallers from previous history of falls. No further data extracted due to sample size.
Further testing of tool: 1. Whitney et al (2000) USA N= 247 outpatients referred for treatment of vestibular dysfunction. Falls history obtained from participants. DGI scores of 19 or lower/ falls =OR 2.58 (1.47-4.53).
Reviews (narrative): 1. Perell KL (2001) Fall risk assessment measures: an analytic review, *Journal of Gerontology,* 56A;12:M761-M766. Refers to Whitney et al (2000) as above.
Other comments: Other studies were referred to but have been excluded based on either not enough information or small sample size.
Conclusions: Assesses all aspects of gait but longer to administer.

Appendix E: Evidence table 3 Profile of Tools

Functional reach test
Developers: Duncan P et al (1990).
Setting: All settings.
Populations: Ambulatory elderly.
Objective: To assess balance that may contribute to risk of falling.
Procedure: • Measurement in inches/cm of the distance between arm's length and maximal forward reach using a fixed base of support.
Length of time to carry out test: One to two minutes.
Special equipment needed: Force platform/ electronic system for measuring functional reach or 'yardstick'.
Training required: Yes.
Burden/acceptability to patients: Not reported.
Measurement type: Inches/cm.
Cut off points for level of risk: Developmental study by the authors indicate that a reach of less than or equal to six inches (15cms) predicted a fall. Inter rater reliability on reach measurement reported as 0.98.
Further testing of tool 1. Eagle et al (1999) Inpatients therefore excluded. 2. Dite et al (2002) Australia N=81 community dwelling participants Concurrent validity FR/TUGT: rs = -0.47 FR/Step test: rs=0.50 FR/FSST: rs = -0.47 3. Behrman et al (2002) USA Case control study, in patients therefore excluded.
Conclusions: Only assesses ability to reach forward and no other balance or performance.

Performance-oriented assessment of mobility problems
Developers: Tinetti ME et al 1986.
Setting: Aimed at all settings.
Populations: Ambulatory elderly.
**Objective: To identify those at risk To identify those at highest risk ** Both. To rate the ability of an individual to maintain balance while performing ADL related tasks. Components include balance, lower and upper extremity strength.
Procedure: Assessment by professional. Short form = (0-2) grading ability to perform nine common everyday movements: 0 = most impairment, 2 =independence. Long form as above. **Aspects of balance measured** 13 balance items, nine gait items including: Standing and sitting balance Stand to sit, sit to stand Turn 360º Nudge on sternum Turn head

Appendix E: Evidence table 3 Profile of Tools

Lean back Unilateral stance Reach object from high shelf Pick up object from the floor.
Length of time to carry out test: 10 minutes.
Special equipment needed: Stopwatch Chair 5lb object 15ft walkway.
Training required: Yes.
Burden/acceptability to patients: Not reported.
Measurement type: Short form scale 0 - 28. Long form scale 0 - 40 Ordinal level of measurement.
Cut off points for level of risk. How were these derived? Clinical experience and judgement. >18 (short form) is stated as a cut off point that predicts falls (Tinetti 1986).
Further testing of tool: 1. Raiche et al (2000) N=225 community dwelling participants (Canada) Cut off score = 36 or less: Sensitivity = 70% Specificity = 52%.
Reviews (narrative): 1. Whitney SL et al (1998) A review of balance instruments for older adults, *American Journal of Occupational Therapy,* 52;8:666-671. **Reliability** Interrater 85% ±10% **Validity** Concurrent Berg balance scale: r=0.91 Predictive (short form) >18 predicted falls All settings. 2. Perell KL (2001) Fall risk assessment measures: an analytic review, *Journal of Gerontology,* 56A;12:M761-M766. Refers to Tinetti (1986) In and out patients. Cut off point of 10 (short form) Sensitivity = 80% Specificity = 74%.
Comments on reviews: Generally these were narrative reviews with a clear emphasis on specific tests and scales. Limited information is given regarding the quality of studies, demographic information, which provided the data source for the review.
Conclusions: Most aspects of balance and performance assessed. Longer to administer and burden to patients.

Appendix E: Evidence table 3 Profile of Tools

Timed 'up and go' test
Developers:
Setting: All settings.
Populations: Ambulatory elderly.
Objective: To identify those with balance deficits.
Procedure: Client stands from a chair with an armrest, walks 3m and turns around, returns to chair and sits down.
Length of time to carry out test: One to three minutes reported.
Special equipment needed: Stop watch Chair 3m walkway.
Training required: Yes.
Burden/acceptability to patients: Not reported.
Measurement type: • Measurement of time to complete the test. • Ordinal. 5 point rating scale of observer's perception of patient's risk of falling (1 = normal, not at risk of falling; 5= severely abnormal).
Cut off points for level of risk: 10-14 seconds.
Further testing of tool: 1. Podsiadlo & Richardson (1991) N=60 Community dwelling participants attending day hospital (Canada) Interrater/ intrarater reliability = ICC 0.99 Concurrent validity TUGT/ Berg balance test: r= -0.81 TUGT/ Gait speed: r= -0.61 TUGT/ Barthel: r= -0.78. 2. Dite eta al (2002) N=81 community dwelling participants Concurrent validity TUGT/ FSST: rs= 0.88 TUGT/ Step test: rs = -0.79 TUGT/ FR: rs = -0.47. 3. Rose et al (2002) N= 134 community dwelling participants (USA) Cut off time =10 seconds: Sensitivity = 71% Specificity = 89%.
Reviews (narrative): 1. Whitney SL et al (1998) A review of balance Instruments for older adults, *American Journal of Occupational Therapy,* 52;8:666-671. Refers to: • Podsiadlo & Richardson 1991 as above. • Okumiya et al (1998) Japan Community dwelling Cut off time = 16 seconds: Sensitivity = 54% Specificity = 74% PPV 44%.

Appendix E: Evidence table 3 Profile of Tools

2. Perell KL (2001) Fall risk assessment measures: an analytic review, *Journal of Gerontology,* 56A;12:M761-M766. Refers to Shumway-Cook (2000). Outpatient setting N=30 Inter-rater reliability 0.98 Cut off time = 14 seconds Sensitivity and specificity 87%.
Comments on reviews: Generally these were narrative reviews with a clear emphasis on specific tests and scales. Limited information is given regarding the quality of studies, and demographic information, which provided the data source for the review.
Conclusions: This assessment appears to have clinical utility demonstrated by time to administer and little burden to patients. Specified cut-off points vary between studies.

Multi factorial assessment instruments for community dwelling settings
1. Caledonia home health care fall risk assessment tool, Laferriere RH (1998) USA
Nine itemed tool with intrinsic and extrinsic factors. Assessment and intervention strategy.
Laferriere RH (1998) Rural research: piloting a tool to identify home care clients risk of falling, *Home Care Provider, 3 (3), 162-169.*

2. Elderly fall screening test (EFST), Cwikel JG et al (1998)
Five item test including: fall in last year, injurious fall in last year, frequent falls, slow walking speed, unsteady gait. 17 minutes to administer, sensitivity 93%, specificity 78%.
Cwikel J, Fried AV, Galinsky D, Ring H Gait and activity in the elderly: implications for community falls-prevention and treatment programmes, *Disability Rehabilitation*,1995;17:277-80.

3. Home assessment profile, Chandler JM, Prescott B, Duncan PW (1991) USA
Identifies frequency of hazards present and scores patient difficulty. Total score with cut off for risk.
Chandler JM, Prescott B, Duncan PW (2001) Special feature: the home assessment profile - a reliable and valid assessment tool, *Top Geriatric Rehabilitation* 16(3) 77-88.

4. HOME FAST: home falls and accidents screening tool, Mackenzie L, Byles J, Higginbotham N (2000) Australia
Contains information to identify hazards associated with the physical environment, assessment of functioning and personal behaviour factors. Identification prompts further assessment and prevention/modification strategy. Total items =25.
Mackenzie L, Byles J, Higginbotham N (2000) Designing the home falls and accidents screening tool (HOME FAST): selecting the items, *British Journal of Occupational Therapy,* 63(6), 260-269.

5. Objective safe at home, Anemaet WK, Motta-Trotter E (1997) USA
Ordinal scale tool that evaluates major areas of the home environment and rates both the assistance required and difficulty demonstrated by patients.
Anemaet WK, Motta-Trotter E (1997) *The user-friendly home care handbook*, USA: Learn Publications.

6. WeHSA: Westmead home safety assessment, Clemson L (1997) Australia
Four-page list of potential hazards in 72 categories. Uses a summed score of nominal data.

Appendix E: Evidence table 3 Profile of Tools

Clemson L (1997) *Home fall hazards and the Westmead home safety assessment,* West Brunswick: Coordinates publications.

7. Elderly fall screening test (EFST), Cwikel JG et al (1998) Israel
Five item test including: fall in last year, injurious fall in last year, frequent falls, slow walking speed, unsteady gait. 17 minutes to administer, sensitivity 93%, specificity 78%.
Cwikel J, Fried AV, Galinsky D, Ring H Gait and activity in the elderly: implications for community falls prevention and treatment programmes, *Disability Rehabilitation, 1995;17:277-80.*

Appendix E: Evidence table 4 minimum data set - home care, minimum data set - residential assessment instrument

Study	Aim/objective of study	Population/ setting	Methods	Results	Quality & comments
Fries 1997 US	To evaluate the effect of the implementation of the National RAI System on selected conditions representing outcomes for nursing home residents.	Before: Implementation N=2188 from 268 homes. After: Implementation 2088 from 254 of the same nursing homes. Mean age=79.6.	Simple pre & post at six month interval. Measures at baseline: dehydration, falls, decubitus, vision, stasis ulcer, pain, dental status, malnutrition at baseline then again at follow-up. Outcomes: decline or improvement. Prevalence falls, observation and recording on records.	Decline Improvement OR (adj.) Falls 0.79 NS 1.20NS (N=3005) (N=382) N=no. of falls Prevalence falls 30 days prior to admission. Falls before N=6,597 and after N=6,178 non-significant P.0.97. Though the prevalence in falls suggests a decrease post RAI, the adjusted OR for pre vs post is not statistically significant. OR was adjusted for additional variables – age, gender, length of stay or facility characteristics and did not demonstrate any consistent effect.	Medium The sample pre and post were different individuals.

Appendix E: Evidence table 4 minimum data set - home care, minimum data set - residential assessment instrument

Study	Aim/objective of study	Population/ setting	Methods	Results	Quality & comments
Morris 1997 Australia, Canada, the Czech Republic, Japan, US	To describe the results of an international trial of the home care version of the MDS instrument.	A sample of N=781 randomly selected volunteered clients of home care agencies in five countries. (But does not constitute a random sample of all older people served in those countries). Mean age=79.6 Female=59.5% Married=37.9% Did not go out of house one week prior to assessment =26% Live alone=32.1%.	Cross national field trial (A multi-centre study, centres volunteered). To examine the frequency with which CAPs were triggered in the 780 sample in the presence or absence of cognitive impairment, which is measured by the cognitive performance scale(CPS) identifying those that are cognitively intact, have mild to moderate impairment or are severely impaired. CPS measured on the Folstein mini mental examination. CAP triggers-from MDS items.	N=780. Total potential CAPS=30 Mean caps triggered for 780 participants = 11.8 (5.5% triggered <5 or 2.1% triggered>20) Most prevalent triggered: Preventative health measures 87% IADL rehabilitation 83% Falls 79% Social function 77% Health promotion 74% % triggered on CAPs within categories of CPS (falls reported only) CPS Scale Total Intact Mild Severe Sig N=780 N=451 N=190 N=117 Across CAPS 78.8 % 82.5% 78.4% 65 % .001 The prevalence of the falls CAP being triggered is 78.8% for all subjects and is higher for those cognitively intact (82.5%) than those with severe cognitive impairment (65%).	Medium These results are descriptive and the sample is not internationally representative. The suggestion is made that the results indicate a consistency across countries. CAP areas where the cognitively intact clients are more likely to trigger include IADL rehabilitation, social function, cardio-respiratory, falls and pain.

Appendix E: Evidence table 4 minimum data set - home care, minimum data set - residential assessment instrument

Study	Aim/objective of study	Population/ setting	Methods	Results	Quality & comments
Ritchie 2002 US	To institute a co-ordinated care approach to address needs in a systematic fashion for at risk rural elders to receive assessments that leads to effective treatment/referral/care plans.	Pop: screening of 2600 rural elder (>75) community dwelling residents to locate at risk group Setting: 2 southern counties N=238 (84.3% participant rate) (ave. over both counties) Mean age=78.75 Male=99.6% African Am.=21.8% Education ≤ 8th grade=41.7% Income <$900/month =20.8% Married=83.65%.	Longitudinal study with Intervention of a co-ordinated advocacy for rural elders program utilising MDS-HC (10a) for initial and subsequent assessments. Baseline measurements - multiple instruments used to obtain demographic, ADL, cognitive etc. measurements. Falls was not specifically measured. Outcomes - first assessment: prevalence of triggered CAPS-MDS-HC measure. Subsequent assessments: typical initial CARE activities in response to triggers. Measured on visits and interviews on telephone and reassessment.	First assessment Prevalence of initial triggered CAPS Falls reported only County 1 County 2 Georgia S. Carolina N=108* N=118* 63%(68) 76.3 (90) Subsequent assessment Typical Initial CARE activities in response to triggers Falls reported only Initial visit No. with prob. N=159** Selected care Pts, receiving Activity Service Fall prevention ed. 38.4% Prosthetics 5.0% Exercise/rehab referral 3.8% Adult protective serv. 1.3% Although the CAP for falls had been triggered in well over half the original sample, the response of initiating services was given to approximately 50% of those identified as at risk of falling.	Medium *Discrepancy in numbers not explained. **Does not match expected of 158. The sample was community dwelling elders who were mainly white married males, which are not typical of this review's target population and therefore extrapolation is difficult.

Appendix E: Evidence table 5: fear as a risk factor

Study	Population/setting	Method	Results	Quality & comments
Cumming 2000 Australia	Community dwelling aged 65 and over.N=418 (79%) able to participate for falls efficacy scale. Other data excluded (see excluded studies). N=169 fell during follow-up.	Risk factors – socio-demographic, falls efficacy scale (o=low 100=high), falls history ADL from self-report during interview-administered questionnaire. Outcome measurement - daily falls calendar posted monthly to researchers for a period of one year.	*Adjusted hazard ratio (95%CI)* Falls efficacy scale ≤ 75 (n= 88) =2.09 (1.31-3.33).	Medium Statistical methods - subjects divided into sub categories based on scores and previous reported categorisation.
Tromp 2001 Netherlands	Community dwelling aged 65 and over. N=1374 (94% agreed to participate) N=1285 (93%) completed all four data points. Single falls n= 281 (22%) Recurrent fallers n=146 (11%).	Risk factors - baseline interview with questionnaire component including socio-demographic, physical function, ADL, functional performance, falls history and fear of falling. Outcome measurement - participants completed a falls diary weekly that was posted to researchers every three months for a period of one year.	*Odds ratio (95%CI)* Fear of falling/fall at follow up= Single fall=2.6(2.0-3.3) Recurrent falls=3.1(2.2-4.4)	High Statistical methods - bivariate analysis Fear ns in multivariate analysis.
Friedman 2002 USA	Community dwelling aged 65 to 86 years. N=2520 at baseline, 88.9% at follow-up with n=2212 that had completed follow-up information. Follow-up period 20 months. N=615 with a history of falling at baseline. N=459 expressed fear of falling at baseline, n=212 had reduced activities because of fear. No details of number of falls at follow-up.	Risk factors - baseline data measurement by a home administered questionnaire and clinical examination, including demographic, vision assessment, comorbidities, neuropsychiatric status, medications, physical performance based testing and fear of falling. Fear of falling included falls history. Fear was assessed asking if participants are afraid of falling and if they limit their activities because of the fear of falling. Outcome measurement - fear of falling status and falls incidence.	Results *OR (95%CI)* Shared risk factors between fall predictors and fear of falling predictors: Female/ falls=1.53(1.24-1.89) Female/fear= 2.0 (1.56-2.57) Stroke/falls=1.61-1.15-2.25) Stroke/ fear= 1.54(1.06-2.24). Fear of falling at baseline/ fall at follow-up: 1.78(1.41-2.24) Fear at baseline/ fear at follow-up: 5.40(4.23-6.91) Falls at baseline/ fear at follow-up: 1.58(1.24-2.01).	High Statistical methods: stepwise logistical regression. Outcomes of falls and fear of falls modelled separately. Adjusted for other variables in the model. Further analysis of those expressing fear at baseline and had reduced their activities OR=2.10(p=<0.0001).

Appendix E: Evidence table 5: fear as a risk factor

Study	Population/setting	Method	Results	Quality & comments
Arfken 1994 USA	N=890 community dwelling participants stratified in age groups ranging from 66 to 81+years. <u>Falls</u> At least one fall No fear n=26 Moderately fearful n=36 Very fearful n=48 p=<0.0001. Recurrent falls No fear n=8 Moderately fearful n=13 Very fearful n=22 p=<0.0001.	Falls surveillance following recruitment with participants reporting falls to a hotline, plus monthly postcards reporting the incidence of falls. At one year follow-up the participants received a structured in-home assessment including demographics, health status, activity level, satisfaction with life, depressed mood and a brief physical assessment. Fear was determined with a 3-point verbal rating scale and dichotomised to summarise outcome as odds ratios. A=moderately fearful and not fearful; B= very fearful.	*OR (95%CI)* One fall: A= 1.52 (1.06-2.17) B= 2.49(1.48-4.20) Recurrent falls: A=1.71(1.01-2.89) B=3.12(1.61-6.06).	High Statistical methods - logistic regression adjusted for age, gender.

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Armstrong 1996	Randomised controlled trial. Randomised by phone using 'computer generated pseudo-random numbers'. Blocked, stratified randomisation. Partial blinding. Analysis by intention to treat.	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 or 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.	a. HRT (Prempak C 0.625 mg or Premarin 0.625 mg) and calcium (Sandocal 1,000 mg). b. Control: calcium (Sandocal 1,000 mg). For part of the study, an HRT placebo was also given to this group.	Length of follow-up 48 weeks. Losses: eight of 116 (7%). <u>Outcome</u> Falls data collected at 12 weekly intervals. 1. Number of participants falling during the study. <u>Results:</u> HRT plus calcium n=24/53 vs calcium alone n=16/55, number of participants falling, community dwelling post fracture RR 1.56 [0.94, 2.59].		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Becker 2003	Randomised controlled trial. Cluster randomised by city government official using sealed envelopes. Intention to treat analysis.	Setting: nursing homes, Germany. N=981. Sample: men and women requiring long-term care in six 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.	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, five 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 two months exercise and use of hip protectors; group exercise programme (balance and progressive resistance exercises	Length of follow-up 365 days from a specified date. Losses: none reported. <u>Outcomes</u> Falls and fall sheets completed daily by nursing staff and supervised regularly by study nurse. 1. Number of participants falling. 2. Number with two or more falls. 3. Fall rate per 1,000 person years. 4. Time to first fall. 5. Number of hip fractures. 6. Number of non-hip fractures. <u>Results:</u> Cluster N=6 =981 participants. Multifaceted intervention vs control. Number of fallers RR 0.75 [0.57, 0.98]. Incidence density rate of falls per 1,000 resident years RR 0.55 [0.41, 0.73] (trialists' analysis).		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

			using ankle weights and dumbbells, 75 minutes two x per week).			

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Bischoff 2003	Randomised controlled trial. Double blind. Randomised by an independent statistician in groups of four. Analysis by intention to treat.	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 three 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 three months.	a. Vitamin D plus calcium carbonate (4000IU cholecalciferol per tablet), for 12 weeks. b. Control: two tablets of 600mg calcium carbonate per tablet. Tablets looked identical in both groups. Administered twice a day with breakfast and dinner.	Length of follow-up 12 weeks (duration of intervention) or until discharge to nursing home. Losses: 33 of 122 (27%). <u>Outcome</u> Falls recorded by staff using a falls protocol (date, time, circumstances, injuries). 1. Number of participants falling. 2. Number of falls. <u>Results:</u> Vitamin D n=14/45 vs control n=18/44, number of participants falling, long stay geriatric care RR 0.76 [0.43, 1.33].	Also measured but not considered in the review were multiple serum biochemical values, overall musculoskeletal function using a summed score on various measures – for example, strength, timed up and go test.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Buchner 1997a	Randomised controlled trial. Randomised by 'variation of randomly permuted blocks'. Randomised to seven groups: six intervention groups (three FICSIT, three MoveIT), and one control group. Only FICSIT and control groups reported in this paper. Intention to treat analysis.	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 eight step tandem gait test without errors; below 50th 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.	Supervised exercise classes one hour x three 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 six months'. Exercise sessions started with a 10 to 15 minute warm up and ended with a five to 10 minute cool down.	Length of follow-up: variable, from randomisation to the end of study funding (0-25 months, median 18 months). Losses: 15 of 105 (14%) (14 from intervention groups). <u>Outcomes</u> Fall outcomes reported for any exercise (all three 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. <u>Results</u> Exercise/physical therapy alone n=32/75 vs control n=18/30, number of participants falling community dwelling untargeted RR 0.71 [0.48, 1.05].	Seattle FICSIT trial [Province 1995] Only 1.3% of original sample randomised. Falls not primary outcome. Other outcomes assessed at end of intervention (six months) then 'control group allowed to exercise after 6 months'. Seven of 30 subjects did.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Campbell 1997	Randomised controlled trial. Allocation schedule developed using computer generated numbers. Assignment by independent person off site. Intention to treat analysis.	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.	Baseline health and physical assessment for both groups. a. One hour visits by physiotherapist x four in first two months to prescribe home-based individualised exercise and walking programme. Exercise 30 minutes x three per week plus walk outside home x three per week. Encouraged to continue for one year. Regular phone contact to maintain motivation after first two months. b. Control: social visit by research nurse x four in first two months. Regular phone contact.	Length of follow-up: 12 months and 24 months. Losses: 20 of 233 (9%). <u>Outcomes</u> Falls recorded daily on postcard calendars, mail registration monthly by postcard, telephone follow-up. 1. Number of participants falling at one year and two years. 2. Number with injury fall at one and two years. 3. Number with two or more falls. 4. Mean rate of falls (falls/per year). 5. Fall rate per 100 person years. 6. Number complying with intervention. <u>Results</u> Exercise/physical therapy alone n=53/116 vs control 62/117 number of participants falling, community dwelling (strength, balance, walking)-individually targeted RR 0.86 [0.66, 1.12]. Exercise/physical therapy alone n=27/103 vs control n=43/110 1.Number of participants sustaining injury fall, community dwelling – individually targeted RR 0.67 [0.45, 1.00].		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				2.Number sustaining two or more falls n=22/116 vs 34/117 RR 0.65 [0.41, 1.05].		
Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation concealment)**
Campbell 1999	Randomised controlled trial, two by two factorial design. Allocation schedule developed using computer generated numbers. Assignment by independent person off site. Intention to treat analysis.	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.	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 and no exercise programme. Exercise programme: one hour physiotherapist visits x four in first two months to prescribe home-based individualised exercises (muscle strengthening and balance retraining exercises 30 min x three per week) and walking x two 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.	Length of follow-up: 44 weeks. Losses: 21 of 93 (23%). <u>Outcomes</u> 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 two or more falls. 6. Number sustaining one or more falls indoors. 7. Fall rate per 100 person years. 8. Number sustaining an adverse effect. 9. Number who complied with intervention. <u>Results</u> Exercise/physical therapy alone vs control. Community dwelling-individually targeted 1.Number of participants falling community dwelling (strength, balance,	Only 19% randomised. Psychotropic medications recorded one month after completion of study. Eight of the 17 who taken placebo only for 30 weeks had restarted one month after end of study.	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Campbell 1999 cont.				walking)-individually targeted: N=12/45 vs n=16/48 RR 0.80 [0.43, 1.50]. 2.Number sustaining medical fall: N=3/45 vs 4/48 RR 0.80 [0.19, 3.38]. 3.Number. sustaining fracture fall: N=1/45 vs n=0/48 RR 3.20 [0.13, 76.48]. 4.Number sustaining injury fall, n=5/45 vs 8/48 RR 0.67 [0.24, 1.89]. 5.Number sustaining two or more falls: n=5/45 vs 7/48 RR 0.76 [0.26, 2.23]. Exercise plus medication withdrawal vs control community dwelling individually targeted 1.Number of participants falling: n=6/24 vs 11/24 RR 0.55 [0.24, 1.24]. 2.Number sustaining medical care fall: n=2/24 vs 3/24 RR 0.67 [0.12, 3.64]. 3.Number sustaining fracture fall: n=1/24 vs 0/24 RR 3.00 [0.13, 70.16]. 4.Number sustaining injury fall: n=2/24 vs 3/24 RR 0.67 [0.12, 3.64]. 5.Number sustaining two or more falls: n=3/24 vs 6/24 RR 0.50 [0.14, 1.77]. Medication withdrawal vs control community dwelling individually targeted 1.Number of participants falling: n=11/48 vs 17/45		

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				RR 0.61 [0.32, 1.15]. 2.Numbersustaining medical care fall: n=3/48 vs 4/45 RR 0.70 [0.17, 2.97]. 3.Number sustaining a fracture fall: n=1/48 vs 0/45 RR 2.82 [0.12, 67.40] 4.Number sustaining injury fall: n=7/48 vs 6/45 RR 1.09 [0.40, 3.01]. 5.Number sustaining two or more falls: n=4/48 vs 8/45 RR 0.47 [0.15, 1.45].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Carpenter 1990	Prospective randomised controlled trial. Women randomised by random number tables and husbands allocated to same group. Analysis by intention to treat.	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 above. 23 men and 49 women were over 85 years. Inclusion criteria: aged 75 years and above; living in Andover area. Exclusion criteria: living in residential care.	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 five or more. B. Control: no disability surveillance between initial and final evaluation.	Measured at three years Losses: 172 of 539 (32%). <u>Outcomes</u> 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 six months; death during the study period. <u>Results</u> The trailists reported significantly fewer falls in the experimental group during the month before the final interview, but insufficient data were		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				available to calculate an effect size		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (Allocation concealment)
Carter 1997	Randomised controlled trial. Analysis by intention to treat not possible.	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.	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.	Length of follow-up 1 year. Losses: 200 of 658 (30%). <u>Outcomes</u> 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. <u>Results</u> Home safety intervention. High density and low density intervention plus medication withdrawal vs control. 1.No of participants falling: High density n=19/133 vs 29/161 RR 0.79 [0.47, 1.35] Low density N=19/163 vs 29/161 RR 0.65 [0.38, 1.11]	Unpublished study.	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				2.Number sustaining two or more falls: High density N=2/133 vs n=11/161 RR 0.22 [0.05, 0.98] Low density N=3/163 vs n=11/161 RR 0.27 [0.08, 0.95]		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Carter 2002	Randomised controlled trial. Randomised by computer generated programme. Intention to treat not possible.	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 > eight hours / week moderate to hard exercise; planning to be out of city > four weeks during 20 week programme.	a. Exercise class (Osteofit) for 40 minutes, two x per week, for 20 weeks in community centres. Classes of 12 per instructor. Eight 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.	Length of follow-up 20 weeks (duration of intervention). Losses: 13 of 93 (14%). <u>Outcomes</u> 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. <u>Results</u> Report no difference between groups in the number of people falling. No summary statistic for falls reported and insufficient data presented to calculate one.		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Cerny 1998	Randomised controlled trial. Randomised by coin toss but some clusters, for example couples or two ladies dependent on another for transport. Intention to treat analysis not possible.	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.	a. Exercise programme of progressive resistance, stretching, aerobic and balance exercises and brisk walking over various terrains for 1½ hours, x weekly, for six months. b. Control: no intervention.	Follow-up at three and six months Losses: none described. <u>Outcome</u> 1. Number of participants falling. <u>Results</u> Exercise/physical therapy alone vs control community dwelling untargeted. Number of participants falling n=3/15 vs n=3/13 RR 0.87 [0.21, 3.58].	Other outcomes analysed as pre-post intervention: strength, range of motion, balance and gait.	B*

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Close 1999	Randomised controlled trial. Randomised by random numbers table and list held independently of the investigators. Intention to treat analysis not possible	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.	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.	Follow-up every four months for one year. Losses: 93 of 397 (23%). <u>Outcomes</u> Falls diary 1. Number of participants falling. 2. Number with injury fall. 3. Number sustaining three or more falls. 4. Number of falls. Also measured but not considered in this review: doctor and hospital visits, and admissions; function. <u>Results</u> Assessment followed by multifactorial intervention vs control community dwelling		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				targeting known fallers or fall risk factors only. 1.Number participants falling n=59/141 vs 111/163 RR 0.61 [0.49, 0.77]. 2.Number sustaining injury fall n=8/141 vs 16/163 RR 0.58 [0.26, 1.31].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Coleman 1999	Randomised controlled trial. Cluster randomisation by physician practice. Intention to treat analysis.	Setting: HMO members, Washington, USA. N=169. Sample: community dwelling men and women in nine 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).	a. Half-day chronic care clinics every three-four months in five 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 (four practices).	Follow-up 24 months. Losses: 56 of 169 (33%). <u>Outcomes</u> Falls recorded retrospectively by questionnaire at 12 and 24 months. 1. Percentage of participants falling. <u>Results</u> Reported that screening and intervention in a chronic care clinic provided no improvement in the incidence of falls at 12 or 24 months. No summary statistic provided.		C*
Cornillon 2002	Randomised controlled trial. Randomised by random number tables. Intention to treat analysis possible.	Setting: community, St Étienne, France. N=303. Subjects: community dwelling and independent in ADL (83% female).	a. Information on fall risk, and balance and sensory training in groups of 10-16. One session per week for eight weeks. Session started with foot and ankle warm-up (walking on tip	Follow-up 12 months. Falls and fall related injuries recorded on six monthly falls calendars. Losses: five of 303 (1.7%). <u>Outcomes</u>		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		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.	toe and on heals 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.	1. Number of participants falling. 2. Mean number of falls (no standard deviation). 3. Mean number of medical care falls (no standard deviation). Results Exercise/physical therapy alone vs control community dwelling untargeted, number of participants falling N=39/148 vs 48/153 RR 0.84 [0.59, 1.20].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Cumming 1999	Randomised controlled trial. Stratified block randomisation. Intention to treat analysis.	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.	a. One home visit by experienced occupational therapist assessing environmental hazards (standardised form) and supervision of home modifications. Telephone follow-up after two weeks. b. Control: usual care.	12-month follow-up with monthly falls calendar. Losses: 142 of 530 (27%). Outcomes 1. Number of fallers (by location of fall, home or away). 2. Compliance with recommendations. Results Home safety intervention alone vs control, community dwelling, number of participants falling: 1.Number of falls in year prior to randomisation, n=53/161 vs 52/163 RR 1.03 [0.75, 1.41].		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				2.Falling history in year prior to randomisation, n=43/103 vs 67/103 RR 0.64 [0.49, 0.84]. 3.Fallers and non fallers in year prior to randomisation, n=96/264 vs n=119/266 RR 0.81 [0.66, 1.00].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Dawson-Hughes 1997	Randomised controlled trial. Stratified block randomisation using random numbers tables. Intention to treat analysis.	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 five years; renal disease; bilateral hip surgery; therapy with a bisphosphonate, calcitonin, oestrogen, tamoxifen, or testosterone in past six months, or fluoride in past two years; femoral neck bone	a. Calcium citrate malate (500 mg elemental calcium) and cholecalciferol (700 IU vitamin D) orally, daily at bedtime for three years. b. Control: double placebo tablets.	Length of follow-up three years. Postcard sent in after any fall. Telephone call to verify circumstances. Subjects reported any additional falls at six monthly follow-up visit. Non-vertebral fractures reported at six monthly follow-up visit and verified by review of x-ray reports or hospital records. Losses: 56 of 445 (13%). Outcomes 1. Number of participants falling during study. 2. Number of falls per subject. 3. Fall related non-vertebral fractures.		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		mineral density more than 2 SD below the mean for subjects of the same age and sex; dietary calcium intake exceeding 1,500 mg per day; laboratory evidence of kidney disease.		Also measured at six-month intervals, but not considered in this review, were bone mineral density, biochemical assays, and other measures. Results The number of participants falling did not differ significantly between intervention and control groups. Data were not presented.		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Day 2002	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). Intention to treat analysis.	Setting: community, Melbourne, Australia. N=1,107. 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 two years (except for short absences); had participated in regular to moderate physical activity with a balance component in previous two	a. Exercise: weekly class of one 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	Length of follow-up 18 months. Falls reported using monthly postcard to record daily falls. Telephone follow-up if calendar not returned within five working days of the end of each month, or reporting a fall. Losses: 17 of 1,107 (1.5%). Outcomes 1. Time to first fall. 2. Number of fallers. Results Exercise/physical therapy alone vs control community dwelling untargeted, number of participants		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Day 2002 cont.		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.	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.	falling n=76/135 vs n=87/137 RR 0.89 [0.73, 1.08]. Home safety intervention alone vs control, fallers and non-fallers prior to year of randomisation number of participants falling, n=78/136 vs 87/137 RR 0.90 [0.74, 1.10]. Vision assessment and referral vs control, number of participants falling, n=84/139 vs 87/137 RR 0.95 [0.79, 1.14]. Exercise visual correction and home safety intervention (community dwelling). Number of participants falling 1.Exercise, visual correction and home safety n= 65/135 vs control n=87/137 RR 0.76 [0.61, 0.94]. 2.Exercise and visual correction n=66/136 vs control n=87/137 RR 0.76 [0.62, 0.95]. 3.Exercise and home safety intervention n=72/135 vs control n=87/137 RR 0.84 [0.69, 1.03].		

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Donald 2000	Randomised controlled trial, two by two factorial design. Stratified by fall risk and randomised by 'randomised envelopes'. Analysis by intention to treat.	Setting: hospital, Gloucester, United Kingdom. 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.	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 dorsiflexors). c. Assigned to ward area with carpet and conventional physiotherapy. d. As above © plus seated leg strengthening exercises (hip flexors ankle dorsiflexors).	Length of follow-up variable depending on length of hospital admission. Losses: 9 of 54 (17%). <u>Outcome</u> 1. Number of participants falling during admission. 2. Number of fracture falls. <u>Results:</u> 1.Exercise/physical therapy alone n=2/30 vs control n=6/24, number of participants falling, institutional care-individually targeted RR 0.27 [0.06, 1.20]. 2. Vinyl n=1/26 vs carpet flooring n=7/28 in rehabilitation ward, number of participants falling RR 0.15 [0.02, 1.17].	Also measured at admission and discharge, but not considered in the review: Barthel scores, hip and ankle strength, timed walk and functional reach test.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Ebrahim 1997	Randomised controlled trial. Randomly assigned using prepared envelopes containing computer generated allocation. Intention to treat analysis not possible.	Setting: UK. N=165. Sample: post-menopausal women identified from A&E and orthopaedic fracture clinic records. Inclusion criteria: fractured upper limb in last two years. Exclusion criteria: on bisphosphonates for osteoporosis; life expectancy <1 year; cognitive impairment; too frail for brisk walking or to travel for measurements.	a. Initial advice on general health/diet. Encouraged to build up to brisk walking 40 minutes x three per week. B. Control: initial advice on general health/diet. Upper limb exercises to improve post-fracture function.	Length of follow-up two years. Results reported for one and two year follow-up. Falls monitored by monthly telephone calls. Losses: 68 of 165 (41%). Outcomes 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. Results Exercise/physical therapy alone vs control community dwelling untargeted. 1.Number of participants falling, n=52/81 vs n=50/84 RR 1.08 [0.85, 1.37]. 2.Number sustaining fracture fall, n=2/81 vs 3/84 RR 0.69 [0.12, 4.03].		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Fabacher 1994	Randomised controlled trial. Randomised with randomly generated assignment cards in sealed envelopes. Intention to treat analysis not possible.	Setting: community, California, USA. N=254. Sample: men (N=248) and women (N=6) aged above 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.	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.	Measured at four monthly intervals for one year, by structured interview for active arm and by telephone for controls. Losses: 59 of 254 (23%). <u>Outcome</u> 1. Number of individuals falling. <u>Results</u> Assessment followed by multifactorial intervention vs control community dwelling-geriatric screening (fallers and non fallers), number of participants falling n=14/100 vs 22/95 RR 0.60 [0.33, 1.11].		A*

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Fiatarone 1997	Randomised controlled trial. Method of randomisation not described. No intention to treat analysis.	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.	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, three days per week for 16 weeks. b. Control: wait list control. Weekly phone calls.	Length of follow-up 16 weeks (duration of intervention). Falls identified weekly by phone (assumed). Losses: four of 34 (11%). <u>Outcomes</u> 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		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				care visits. Results No difference between groups was observed in the frequency of falls in this study. No summary statistic and no data provided.		
Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation concealment)**
Gallagher 1996	Randomised controlled trial. Method of randomisation not described. Observers unblinded at six months. Intention to treat analysis not possible	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 more; sustained a fall in previous three months. Exclusion criteria: none described.	a. Two risk assessment interviews of 45 minutes each. One counselling interview of 60 minutes showing video and booklet and results of risk assessment. b. Control: baseline interview and follow-up only. No intervention.	Length of follow-up six 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. Results The intervention had no statistically significant impact on the main outcome measures. Comparisons between intervention and control groups controlling for pre-programme differences.		B*
Gray-Donald 1995	Randomised controlled trial. Method of randomisation not described. Stratified by gender and nutritional risk criteria. Intention to treat analysis.	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 above 60 years; requiring community	a. 12 week intervention of high-energy nutrient dense supplements provided by dietician. Two 235 ml cans per day (1045-1480 kj per can) for 12 weeks. b. Control: visits only (encouragement and suggestions about improving	Retrospectively monitored at six and 12 weeks. Losses: four of 50 (8%). Outcomes 1. Number of participants falling. Results Nutritional supplementation		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		services; elevated risk of under-nutrition (excessive weight loss or BMI <24 kg/m2). Exclusion criteria: alcoholic; terminal illness.	diets).	vs control, community dwelling targeted, number of participants, n=0/22 vs 5/24 RR 0.10 [0.01, 1.69].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Hogan 2001	Randomised controlled trial. Computer generated sequence concealed in locked cabinet prior to randomisation. Stratified by number of falls in previous year: 1 or >1. Intention to treat analysis.	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 three months; living in the community; age 65 years and above; 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.	a. One in-home assessment by a geriatric specialist (doctor, nurse, physiotherapist or OT) lasting one-two hours. Intrinsic and environmental risk factors assessed. Multidisciplinary case conference (20 minutes). 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 instructed about exercises to do at home. b. Control: one home visit by recreational therapist.	Length of follow-up: 12 months. Falls recorded on monthly calendars (47.8% returned). Also retrospective recall at three, six months (at visit) and 12 months (by phone). Losses: 24 of 163 (15%). <u>Outcomes</u> 1. Number of participants falling. 2. Number sustaining medical care fall. 3. Number sustaining injury fall. 4. Number sustaining three 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. <u>Results</u> Assessment followed by multifactorial intervention vs control, community dwelling targeting known fallers or fall risk factors only:		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				1.Number of participants falling, n=54/79 vs 61/84 RR 0.94 [0.77, 1.15]. 2.Number sustaining medical care fall, n=9/79 vs 8/84 RR 1.20 [0.49, 2.95].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Hornbrook 1994	Cluster randomised controlled trial. Intention to treat analysis not possible.	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: above 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.	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.	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 1,000 person years. Losses: 156 of 3,182 (5%) in the intervention group. Outcomes 1. Number of participants falling. 2. Number sustaining medical care fall. 3. Number sustaining fracture fall. 4. Number sustaining injury fall. 5. Number sustaining two or more falls. 6. Number sustaining near fall. 7. Fall rate per 1,000 person years. 8. Number complying with treatment programme. 4. Fracture falls.		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				5. Hospitalised falls. Results Unadjusted rates for all falls were significantly lower among intervention participants; for other categories of fall (injury falls, medical care falls). There were no statistically significant differences between groups OR 0.85 p<.05, no confidence intervals.		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Jensen 2002	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. Intention to treat analysis not possible.	Setting: institutions, Umeå, 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 above. Exclusion criteria: none listed.	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: four 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,	Follow-up 34 weeks. Falls registered by nurses and aides, if witnessed or reported, using structured report designed for study. Losses: 78 of 402 (19%). Outcomes 1. Number of people falling. 2. Number of falls. 3. Time to first fall. 4. Number sustaining injury fall. Results Incidence of falls in the intervention group. Adjusted Incidence rate ratio 0.60 [0.50, 0.73.		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

			staff guidance. b. Control: usual care.			

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Jitapunkul 1998	Randomised controlled trial. Method of randomisation not described.	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.	a. Home visit from non-health professional with structured questionnaire. Three monthly visits for three years. Referred to nurse/geriatrician (community based) if Barthel ADL index and/or Chula ADL index declined two or more points, or subject fell more than once during previous three 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 three years.	Measured at the end of three years. Falls during last three months only. Losses: 44 of 160 (28%). <u>Outcomes</u> 1. Number of participants falling. <u>Results</u> Assessment followed by multifactorial intervention vs control Community dwelling-geriatric screening (fallers and non-fallers), number of participants falling, n=3/57 vs n=6/59 RR 0.52 [0.14, 1.97].		B*
Kenny 2001	Randomised controlled trial. Randomised in blocks of eight, method of randomisation not described. Intention to treat analysis not possible	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 more, history of a fall, diagnosed as having cardioinhibitory CSH by carotid	a. Pacemaker (rate drop response physiologic dual-chamber pacemaker: Thera RDR, Medtronic, Minneapolis, Minnesota). b. Control: no pacemaker.	Follow-up one year after randomisation. Losses: 16 of 175 (9%). <u>Outcomes</u> 1. Number of falls. 2. Number of injurious falls. Also measured but not considered in this review were number of episodes of syncope.	Out of 71,299 A&E attendees screened, 1,624 received carotid sinus massage and 175 agreed to be randomised.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		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.		Results Cardiac pacing vs control 1.Number of participants with syncope, n=22/84 vs n=47/87. RR 0.48 [0.32, 0.73] 2.Number sustaining fracture fall, n=3/84 vs n=4/87 RR 0.78 [0.18, 3.37] 3.Mean number of falls 4.10 vs 9.3 WMD –5.20 [-9.40, -1.00].		

Study	Methods	Population/setting	Interventions	Results	Comments	Allocation concealment
Kingston 2001	Randomised controlled trial. Method of randomisation not described. Intention to treat analysis not possible	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.	a. Rapid health visitor intervention within five 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.	Follow-up 12 weeks. No description of how falls monitored, presumably retrospective at day four and week 12. Losses: 17 of 109 (16%). Outcomes 1. Number of participants falling. Also measured but not considered for this review, SF36 assessment at day four and 12 weeks. Results Assessment followed by multifactorial intervention vs control, community dwelling-targeting known fallers or fall risk factors only, number of participants falling, n=4/60 vs n=5/49 RR 0.065 [0.19, 2.30].		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Latham 2003	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. Intention to treat analysis.	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 six 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.	a. Exercise: quadriceps exercises using adjustable ankle cuff weights three x per week for 10 weeks. First two 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.	Follow-up six 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 three and six month visits. Reminder phone call between visits. Losses: 43 of 243 (17%). <u>Outcomes</u> 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. <u>Results</u> Exercise/physical therapy alone vs control, community dwelling (strength training)-individually targeted, 1.Number of participants falling, n=60/112 vs n=64/110 RR 0.92 [0.73, 1.16]. 2.Number sustaining muscoskeletal injury during study, n=18/112 vs n=5/110	Detailed description of exercise regimen given in paper.	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				RR 3.54 [1.36, 9.19]. Vitamin vs control, community dwelling targeted, number of participants falling, n=64/121 vs n=60/114 RR 1.00 [0.79, 1.28].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Lightbody 2002	Randomised controlled trial. Method of randomisation not described. 'Block-randomised consecutively into groups'. Intention to treat analysis not possible.	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.	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.	Length of follow-up six months. Falls, injury and treatment recorded in diary. Postal questionnaire at six months to collect data. GP records and hospital databases searched. Losses: 34 of 348 (10%). <u>Outcomes</u> 1. Number of people falling. 2. Number of falls. 3. Number sustaining injury fall. <u>Results</u> Assessment followed by multifactorial intervention vs control, community dwelling targeting known fallers or fall risk factors, number of participants falling, n=43/171 vs n=44/177 RR 1.01 [0.70, 1.46].	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.	B*

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Lord 1995	Randomised controlled trial. Pre-randomisation prior to consent, from a schedule of participants	Setting: community, Australia. N=194. Sample: women, recruited from	a. Twice weekly exercise programme (warm up, conditioning, stretching,	Measured over 12 months. Fall ascertainment questionnaires sent out		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Lord continued	in a previous study. All from intervention group. Inadequate data for intention to treat analysis.	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.	relaxation) lasting one hour, over a 12-month period. b. Control: no intervention.	every two months. Telephone call if questionnaire not returned. Losses: 19 of 194 (10%). <u>Outcomes</u> 1. Number of participants falling. 2. Number of participants sustaining two or more falls. 3. Number of participants sustaining one or more falls indoors. 4. Number sustaining non-accidental falls. 5. Number sustaining 'balance falls'. <u>Results</u> Exercise/physical therapy alone vs control, community dwelling untargeted, 1.Number of participants falling, n=26/75 vs 33/94 RR 0.99 [0.65, 1.50]. 2.Numbersustaining two or more falls, n=8/75 vs n=12/94 RR 0.84 [0.36, 1.94].		

McMurdo 1997	Randomised controlled trial. States 'randomly allocated'. Intention to treat analysis not possible.	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.	45 minute exercise programme of weight bearing exercise to music, three x weekly, 30 weeks per year, over two years, with 1,000 mg calcium carbonate daily. b. Control: 1,000 mg calcium carbonate daily.	Length of follow-up two years. Losses: 26 of 118 (22%) over two years. <u>Outcomes</u> 1. Number of women falling. Also measured, but not considered in this review: bone mineral density. <u>Results</u>		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				Exercise/physical therapy, community dwelling untargeted, number of participants falling, n-13/44 vs n=21/48 RR 0.68 [0.39, 1.18].		
Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation concealment)**
McMurdo 2000	Randomised controlled trial. Cluster randomisation of nine residential homes. Intention to treat analysis not possible.	Setting: institutional care, Dundee, United Kingdom. N=133. Sample: men and women in nine 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 more; resident in participant nursing home. Exclusion criteria: MMSE score <12.	a. Falls risk factor assessment and modification x two (at start and six months) blood pressure, medication review, visual acuity, ambient lighting levels; seated exercise sessions for balance, strength and flexibility 30 minutes x two weekly for six months. b. Control: reminiscence sessions 30 minutes x two per week for six months.	Length of follow-up one year. Staff recorded falls daily on a calendar from seven-12 months. Losses: 49 of 133 (37%). <u>Outcomes</u> 1. Number of participants falling. 2. Mean number of falls (no SD). 3. Number complying with treatment. 4. Falls per person week. <u>Results</u> Reported no difference between intervention and control groups in the percentage of participants falling in the six-month period after completion of the intervention. There was no difference between the groups in the number of falls sustained, the risk of falling: OR 0.45 [0.19, 1.14].		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				The risk of recurrent falling: OR 1.07 [0.40, 2.97].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Means 1996	Randomised trial nested within a pre-test post-test experimental design. Inadequate data for intention to treat analysis.	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 above; ambulatory for at least 30 feet; community dwelling; able to comprehend instructions and give informed consent; history of one or more falls in previous year.	a. Exercise programme including obstacle course training. b. Control: exercise programme without obstacle course training.	Length of follow-up six months. Losses: 34 of 99 (33%). Outcomes 1. Mean number of falls per participant in each group, with standard deviation. Results Exercise/physical therapy alone vs control, community dwelling, untargeted, mean number of falls, n=31 mean 1.50 vs n=34 mean 1.90, WMD –0.40 [-1.61, 0.81].		C*

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Mulrow 1994	Randomised controlled trial. Randomisation blocked and stratified by nursing home. Inadequate data for intention to treat analysis.	Setting: one academic nursing home and eight community nursing homes, USA. N=194. Sample: elderly residents dependent in at least two	a. 30-45 minute one on one physiotherapy session x three weekly for four months. b. Control: 30-45 minute one on one friendly visit x three weekly for four months.	Length of follow-up one year but only results at four months reported. Falls identified from patient charts and/or incident reports. Losses: 14 of 194	San Antonio FICSIT trial [Province 1995]	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		activities of daily living. Falling status on entry not defined. Age: mean (SD) 79 (8) years. Inclusion criteria: age above 60 years; resident in a nursing home for at least three months; dependent in at least two activities of daily living. Exclusion criteria: terminal illness; severe dementia; known assaultive behaviour pattern; currently or recently having physiotherapy.		(7%). Outcomes 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. Results Exercise/physical therapy, institutional, care, individually targeted. 1.Number of participants falling, n=44/97 vs n=38/97 RR 1.16 [0.83, 1.61]. 2.Number sustaining medical fall, n=13/97 vs n=7/97 RR 1.86 [0.77, 4.45]. 3.Number sustaining injury fall, n=7/97 vs n=2/97 RR 3.50 [0.75, 16.43].		
Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation concealment)**
Newbury 2001	Randomised controlled trial. Randomisation by random numbers in sequentially numbered sealed envelopes. Intention to treat analysis.	Setting: community, Adelaide, Australia. N=100. Sample: every 20th name in an age-sex register of community dwelling patients registered with six general practices (63% female). Age: range 75 - 91 years;	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	Falls identified retrospectively when 75+HA repeated at 12 months. Losses: 11 of 100 (11%). Outcomes 1. Number of participants falling. Numerous other outcome	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	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		median age in intervention group 78.5, control group 80 years. Inclusion criteria: aged 75 years and above; living independently in the community. Exclusion criteria: none.		measures recorded but not included in this review. Results Assessment followed by multifactorial intervention, community dwelling, geriatric screening (fallers and non fallers), number of participants falling, n=12/48 vs n=17/50 RR 0.74 [0.39, 1.37]	Kingdom.	

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Nikolaus 2003	Randomised controlled trial. Randomised by 'sealed envelopes containing group assignments using a random number sequence'. Intention to treat analysis.	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 (SR) 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;	a. Comprehensive geriatric assessment + at least two 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 post discharge management by GPs.	Length of follow-up one year. Falls recorded in falls diary and by monthly telephone calls. Losses: 81 of 360 (23%). Outcomes 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. Results Home safety intervention alone vs control, community dwelling,	Home intervention team consisted of three 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.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		living >15 km from clinic.		number of participants falling. 1.Falling history in year prior to randomisation, n=21/53 vs n=36/55 RR 0.61 [0.41, 0.89]. 2.Fallers and non-fallers in year prior to randomisation, n=51/181 vs n= 61/179 RR 0.83 [0.61, 1.31].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Nowalk 2001	Randomised controlled trial, stratified by age gender. Randomised by permuted blocks (block size = nine). Performed separately for each site. Intention to treat analysis not possible.	Setting: senior housing facilities (independent living to skilled nursing care), USA. N=112. Sample: residents of two long-term care facilities (87% female). Age: mean 84 years. Inclusion criteria: resident of facility; age 65 years or more; 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.	a. 'Fit NB free' individualised progressive strength training and conditioning (treadmill, walking, bicycling, weight lifting) three 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 one x per month) and Tai Chi three 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	Length of follow-up variable depending on time of enrolment (mean (SD) 21.9 (4.6) months, range 13 -28 months. Losses: 32 of 112 (29%). Falls identified from incident reports. <u>Outcomes</u> 1. Number of participants falling. 2. Time to first fall. 3. Number who complied with programme. 4. Death during study. <u>Results</u> Reported no significant difference in number of falls between a control group and two exercise groups.		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

			residents while walking (one 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).	No summary statistic and insufficient data to calculate one.		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Pardessus 2002	Randomised controlled trial. Randomised using random numbers table. Intention to treat analysis.	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.	a. Comprehensive two-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.	Length of follow-up one year. Falls identified by monthly telephone calls. Losses: 9 of 60 (15%). <u>Outcomes</u> 1. Number of participants falling. 2. Mean number of falls per participant. <u>Results</u> Home safety intervention alone vs control, community dwelling, falling history in year prior to randomisation, number of participants falling n=13/30 vs n=15/30 RR 0.87 [0.50, 1.49].		B*
Pereira 1998	Randomised controlled trial 1982-85. Reporting 10-year follow-up. Intention to treat analysis not	Setting: community, Pittsburgh, USA N=229 randomised – 198 available for 10-year follow-up.	a. Eight week training period with organised group walking scheme x two weekly. Also encouraged to walk x once	Reporting 10-year follow-up. Falls in the previous 12 months ascertained by telephone interview. Losses:		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

	possible.	Sample: healthy volunteers. Age: mean 57 years at randomisation. Mean (SD) at follow-up 70 (4) years. Inclusion criteria: one year post-menopause; aged between 50 and 65 years. Exclusion criteria: on HRT; unable to walk.	weekly on their own. Building up to seven miles per week total. B. Control: no intervention.	31 of 229 (14%). Outcomes 1. Number of participants falling. 2. Number sustaining two 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. Results Exercise/physical therapy alone vs control, community dwelling untargeted, 1.Number of participants falling, n=26/96 vs n=33/100 RR 0.82 [0.53, 1.26]. 2.Number sustaining two or more falls, n=22/96 vs n=30/100 RR 0.76 [0.48, 1.23].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Pfeifer 2000	Double blind randomised controlled trial. Method of randomisation not described. Intention to treat analysis not possible.	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,	An eight 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.	Length of follow-up one year. Falls and fractures monitored retrospectively by questionnaire at one year. Losses: 11 of 148 (7%). Outcomes 1. Number of participants falling. 2. Number of sustaining fracture fall. Also measured, but not considered in this review were body sway		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		calcitonin, vitamin D or metabolites, oestrogen, tamoxifen in past six months; fluoride in last two 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.		parameters, and biochemical measures. Results Vitamin D vs control, community dwelling, targeted. 1.Number of participants falling, n=11/70 vs n=19/67 RR 0.55 [0.29, 1.08]. 2.Number sustaining fracture fall, n=3/70 vs n=6/67 RR 0.48 [0.12, 1.84].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Ray 1997	Randomised controlled trial of seven pairs of nursing homes matched by number of beds and randomised within pairs. Statistician generated sealed envelope, random assignments for each pair. Intention to treat analysis.	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):	a. Multidisciplinary patient safety assessment (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; in-service education for nurses. b. Control: usual care. Offered in-services on fall prevention after follow-up period.	Follow-up 365 days in home from time of assessment. Falls recorded from incident reports and medical records. Losses: 25 of 499 (5%). Outcomes 1. Number of recurrent fallers (two 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.		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		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-co-ordinator for two-four 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 six months; with possible safety domain problem. Exclusion criteria: bed bound.		Results The mean recurrent faller proportion in intervention facilities: 43.8% [2%, 36%] vs control 54% p=.03. The mean rate of injurious falls in intervention facilities (13.7 falls per 100 person years): 31.2% [24.6%, 86.4%] vs control facilities (19.9 per 100 person years) p=.22.		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Reinsch 1992	Randomised controlled trial. Randomisation by senior centre rather than by individual participant. Intention to treat analysis not possible.	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.	a. 'Stand up/ step up' exercise programme, with preliminary stretching exercise. One hour, x three days per week, for one year. b. Cognitive-behavioural intervention, consisting of relaxation training, reaction time training and health and safety curriculum. One hour, x one day per week, for one year. c. Exercise (two meetings per week) and cognitive intervention (x one meeting per week) for one year. d. Discussion control group. One hour, x one day per week, for one year.	Length of follow-up one year. Falling ascertained by recall, at weekly intervals. Losses: 46 of 230 (20%). Outcomes 1. Number of participants falling. 2. Number sustaining injury fall. 3. Number sustaining medical care fall. 4. Number sustaining fracture fall. 5. Number sustaining two or more falls. Results		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				Survival analysis used. The number of fallers during the first year of the intervention did not differ significantly among groups. Log rank $\chi 2$ (3, n=229) =2.21, p=.53].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Robertson 2001a	Randomised controlled trial. Allocation schedule developed using computer generated numbers. Assignment by independent person off site. Intention to treat analysis.	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	3. Home exercise programme, individually prescribed by district nurse in conjunction with her district nursing duties (see notes). Visit from nurse at one week (one hour) and at two, four and eight weeks and six months (half hour) plus monthly telephone call to maintain motivation. Progressively difficult strength and balance retraining exercises plus walking plan. Participants expected to exercise three x	Length of follow-up one year. Active fall registration with daily calendars returned monthly + telephone calls. Losses: 29 of 240 (12%). <u>Outcomes</u> 1. Number of participants falling. 2. Number sustaining two or more falls. 3. Number sustaining fracture fall. 4. Number sustaining	District nurse had no previous experience in exercise prescription. Received one week's training from research group's physiotherapist, who also made site visits and phone calls to monitor quality.	A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Robertson 2001a cont.		time of recruitment; not able to understand trial requirements.	weekly and walk two x weekly for one year. b. Control: usual care.	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. <u>Results</u> Exercise/physical therapy alone vs control, community dwelling (strength, balance, walking)-individually targeted. 1.Number of participants falling, n=38/121 vs n=51/119 RR 0.73 [0.52, 1.02]. 2.Number sustaining fracture fall, n=2/121 vs 7/119 RR 028 [0.06, 1.33]. 3.Number sustaining injury fall, 27/121 vs n=39/119 RR 0.68 [0.45, 1.04]. 4.Number sustaining two or more falls, n=22/121 vs n=24/119 RR 0.90 [0.54, 1.52]. 5. Mean number of falls n= 121 mean (SD) 0.67(1.29) vs n=119 Mean (SD) 0.92 (1.80) WMD –0.25 [-0.65, 0.15].		
Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation**

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

						concealment)
Rubenstein 1990	Randomised controlled trial. Randomised with computer generated, randomly sequenced cards in sealed envelopes. Analysis appears to be by intention to treat.	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.	a. Nurse practitioner assessment within seven days of a fall, followed by physician recommendations for action, and referral for intervention if appropriate. B. Control group: usual care.	Falls recorded in daily log. Length of follow-up two years. Losses: none described. <u>Outcomes</u> 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. <u>Results</u> Assessment followed by multifactorial intervention vs control, institutional care, targeting known fallers or fall risk factors only. 1.Number. of participants falling, n=64/79 vs n=68/81 RR 0.97 [0.84, 1.11]. 2.Number sustaining fracture fall, n=7/79 vs 5/81 RR 1.44 [0.48, 4.33]. 3.Number sustaining injury fall, n=9/79 vs n=7/81 RR 1.32 [0.52, 3.37].		A*

Study	**Methods**	**Population/setting**	**Interventions**	**Results**	**Comments**	**Quality (allocation concealment)**
Rubenstein 2000	Randomised controlled trial Randomised in blocks of 16-20 at three-six month intervals, using randomly generated sequence cards in sealed envelopes. Intention to treat analysis.	Setting: community, California, USA. N=59. Sample: men recruited from veterans administration ambulatory care centre (volunteers). Age: mean 74 years.	a. Exercise sessions (strength, endurance and balance training) in groups of 16-20, three x 90 minute sessions per week for 12 weeks. b. Control: usual activities.	Follow-up for three months from randomisation. No active fall registration. Fall ascertainment for intervention group at weekly classes. Controls phoned every two weeks. Losses: 4 of 59 (7%).		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

		Inclusion criteria: aged 70 years and older; ambulatory; with at least one fall risk factor: lower limb weakness, impaired gait, impaired balance, more than one fall in previous six months. Exclusion criteria: exercised regularly; severe cardiac or pulmonary disease; terminal illness; severe joint pain; dementia; medically unresponsive depression; progressive neurological disease.		Outcomes 1. Number of fallers. 2. Number of falls. 3. Number sustaining injury falls. 4. Fall rate per 1,000 person years. Results Exercise/physical therapy, community dwelling, untargeted, 1.Number of participants falling, n=12/31 vs 9/28 RR 1.20 [0.60, 2.42]. 2.Number sustaining injury fall, n=0/31 vs 0.28 RR not estimable.		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Ryan 1996	Randomised controlled trial. Method of randomisation not described. Assume intention to treat analysis.	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.	Interview and physical assessment by nurse prior to randomisation. a. One hour fall prevention education programme discussing personal (intrinsic) and environmental (extrinsic) risk modification in small groups of seven-eight women (nurse-led).	Follow-up monthly for three months Losses: none described. Outcomes 1. Number of fallers. 2. Number of falls. 3. Number of fall related injuries. 4. Number of fall prevention changes made.	Pilot research. Primarily to test methodology of a fall prevention education programme and resulting changes in fall prevention behaviour.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

			b. Same educational programme but individual sessions with nurse c. Controls received health promotion presentation (no fall prevention component) in small groups of seven-eight.	<u>Results</u> Home safety intervention plus fall prevention classes vs control, number of participants falling. 1.Group instruction vs control, n=1/16 vs n=3/15 RR 0.31 [0.04, 2.68]. 2. One on one instruction vs control, n=2/14 vs 3/15 RR 0.71 [0.14, 3.66].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Sato 1999	Double-blind randomised study. Randomisation by computer generated random numbers. Intention to treat not possible.	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 three months or longer during the previous 18 months, or at any time in the previous two months.	a. One alpha (OH) Vitamin D3 1.0 mcg daily for 18 months. b. Control: identical placebo.	Length of follow-up 18 months. Number of falls per subject 'recorded' during 18 months. Losses: none described. <u>Outcomes</u> 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. <u>Results</u> Vitamin D vs control Community dwelling targeted. 1.Mean number of falls, n=40, mean (SD), 1.40 (1.80) vs n=40 mean (SD) 1.30 (1.90)		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				WMD 0.10 [-0.71, 0.91]. 2.Number sustaining a fracture fall, n=1/40 vs n=8/40, RR 0.13 [0.02, 0.95].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Schnelle 2003	Randomised controlled trial. Randomised within nursing homes by 'computerized programs'. Intention to treat not possible.	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 post-acute skilled care or terminal illness.	a. FIT intervention (low intensity, functionally oriented exercise and incontinence care) provided every two hours from 8.00 am and 4.00 pm for five days a week, for eight months (see notes for further details). Controls: usual care.	Length of follow-up eight months. Falls identified from patient records weekly. Losses: 18 of 190 (9%). <u>Outcomes</u> 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 1,000 resident weeks. 10. Number of fall related skin injuries per 1,000 resident weeks. 11. Number of fall related fractures per 1,000 resident	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 eight 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	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Schnelle 2003 cont.				weeks. 12. Number of other fall related injuries per 1,000 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. <u>Results</u> Exercise plus incontinence management vs control. 1.Number of participants falling, n=17/92 vs n=29/98 RR 0.62 [0.37, 1.06]. 2.Number sustaining fracture fall, n=4/92 vs 1/98 RR 4.26 [0.49, 37.42] 3.Number sustaining injury fall, n=8/92 vs n=11/98 RR 0.77 [0.33, 1.84].	goals for exercise adjusted weekly.	

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Shaw 2003	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). Intention to treat analysis.	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 above; 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 four 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 two x per week.	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.	Length of follow-up one year. Falls identified by weekly diary mailed as a postcard, and telephone contact if no card for two weeks. Losses: 92 of 308 (30%). <u>Outcomes</u> 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. <u>Results</u> Assessment followed by multifactorial intervention vs control, cognitively impaired, any residence, number of participants falling, n=96/130 vs n=115/144 RR 0.92 [0.81, 1.05].		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Steinberg 2000	Randomised controlled trial. Cluster randomisation. Four groups with approximately equal numbers formed from two or three national seniors branches. Groups randomly allocated to one of four interventions. Method of randomisation not described. Intention to treat analysis.	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.	Cumulative intervention a. Intervention d. plus exercise classes designed to improve strength and balance, one 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.	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. Losses: 9 of 252 (4%). <u>Outcomes</u> 1.Time to first fall. 2. Fallers per 100 person months. 3. Falls per 100 person months. <u>Results</u> Cox's proportional hazards regression model used, adjusted hazard ratios comparing intervention with control ranged: For slips HR 0.35 [0.17, 0.73] to 0.48 [0.25, 0.91] For trips HR 0.29 [0.16, 0.51] to o.45 [0.27, 0.74] For falls 0.60 [0.36, 1.01] to 0.82 [0.51, 1.31.]	Younger, healthier and more active sample than elderly population as a whole.	C*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Stevens 2001	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. Co-inhabitants assigned to same group as index recruit. Intention to treat analysis.	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 above; 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 two other older people.	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.	Follow-up one year. Falls recorded on daily calendar. No raw data. Results presented as adjusted and unadjusted odds ratios and incident rate ratios. Losses: 264 of 1879 (14%). <u>Outcomes</u> 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). <u>Results</u> Participants falling: 1.Involving environmental hazards in the home Adjusted rate ratio 1.11 [0.82, 1.50]. 2. Fell because of hazards in the home Adjusted OR 0.97 [0.74, 1.28]. 3. Rate of all falls Adjusted rate ratio 1.02 [0.83, 1.27].	Hazard list designed with OT input to include factors identified from literature and existing checklists. 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 two weeks of visit.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

				4. Rate of falls inside the home Adjusted rate ratio 1.17 [0.85, 1.60]. 5. Rate of injurious falls Adjusted rate ratio 0.92 [0.73, 1.14].		

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Tinetti 1994	Randomised controlled trial. Randomisation of 16 treating physicians, matched in four groups of four, into two control and two intervention in each group; enrolled subjects assigned to same group as their physician. Analysis by intention to treat not possible due to missing data. Outcome assessors blinded to assignment.	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 >four 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.	a. Interventions targeted to individual risk factors, according to decision rules and priority lists. Three month programme duration. b. Control visits by social work students over same period.	Measured at one year. Falls ascertained by monthly postal survey, followed by personal or telephone contact. Losses: 10 of 301 (3%). <u>Outcomes</u> 1. Number falling. 2. Number sustaining medical care fall. 3. Number sustaining serious injury fall. 4. Death during study. <u>Results</u> Participants falling n=304 in the intervention group Adjusted Incidence ratio 0.69 [0.52, 0.90]. Units of randomisation and analysis appear to be different, this may have resulted in a narrower confidence.	Yale (New Haven) FICSIT trial [Province 1995] Risk factors screened for included: postural hypotension; sedative/hypnotic drugs e.g. benzodiazepine; four or more medications; impaired transfer skills; environmental hazards for falls; impaired gait; leg/arm muscle strength; range of movement.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
van Haastregt 2000	Randomised controlled trial. Randomisation by computer generated random numbers. Inadequate data for intention to treat analysis.	Setting: community, Hoensbroek, Netherlands. N=316. Sample: community dwelling men and women registered with six general medical practices. Age: mean (SD) 77.2 (5.1) years. Inclusion criteria: aged 70 years and above; living in the community; two or more falls in previous six months or score three 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.	a. Five home visits from community nurse over one year. Screened for medical, environmental and behavioural risk factors for falls and mobility impairment; advice, referrals and 'other actions'. b. Control: usual care.	Follow-up 12 months and 18 months. Falls recorded in weekly diary. Losses 81 of 316 (26%). <u>Outcomes</u> 1. Number falling. 2. Number sustaining medical care fall. 3. Number sustaining injury fall. 4. Number sustaining two or more falls. 5. Number complying with recommendations. 6. Death during study. <u>Results</u> Assessment followed by multifactorial intervention vs control, community dwelling, targeting known fallers or fall risk factors only. 1.Number of participants falling, n=63/129 vs 53/123 RR 1.13 [0.87, 1.48]. 2.Numbersustaining medical care fall, n=15/129 vs 11/123 RR 1.30 [0.62, 2.72]. 3.Number sustaining injury fall,n=26/129 vs 21/123 RR 1.18 [0.70, 1.98]. 4.Number sustaining two or more falls, n=34/129 vs 29/123 RR 1.12 [0.73, 1.72].		B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
van Rossum 1993	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. Intention to treat analysis.	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.	a. Preventive home visits by public health nurse x four per year for three years. Extra visits/ telephone contact as required. Checklist of health topics to discuss. Gave advice and referrals to other services. b. Control: received no home visits.	Follow-up at 1½ years and three years by postal survey and interview. Falls in previous six months recorded. Losses 102 of 580 (18%). <u>Outcomes</u> 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. <u>Results</u> Found no difference in the incidence of falls between the control and intervention groups. No data provided.		A*
Vassallo 2001	Cluster randomised controlled trial. Method of randomisation not described. Inadequate data for intention to treat analysis.	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.	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: two wards, usual care.	Length of follow-up not stated. Losses: none described. <u>Outcomes</u> 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.	Abstract only	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Vellas 1991	Randomised controlled trial. Randomised seven days after a fall. Inadequate data for intention to treat analysis.	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 seven days previously. Exclusion criteria: hospitalised for more than seven days after the fall; demented; sustaining major trauma e.g. hip fracture or other fracture; unable to mobilise or be evaluated within seven days of the fall.	a. Iskédyl® (combination of raubasine and dihydroergocristine) two droppers morning and evening for 180 days. b. Placebo for 180 days	Follow-up 180 days. Losses 6 out of 95 (6%). <u>Outcome</u> 1. Number of fallers. <u>Results</u> Pharmacological therapies vs control, number of participants falling, n=14/45 vs n=28/43 RR 0.48 [0.29, 0.78].		B*
Vetter 1992	Randomised controlled trial. Randomisation by household. Inadequate data for intention to treat analysis.	Setting: community, Wales, UK. N=674. Sample: men and women aged abouve 70 years on the list of a general practice in a market town. No exclusion criteria listed.	a. Health visitor visits, minimum yearly, for four years, with advice on nutrition, environmental modification, concomitant medical conditions, and availability of physiotherapy classes if desired. b. Control: usual care.	Length of follow-up four years. Falling status ascertained by interview at end of study period. Losses: 224 of 674 (33%). <u>Outcomes</u> 1. Number of participants sustaining a fall. 2. Number of participants sustaining fracture fall. 3. Deaths during study. <u>Results</u> Participants falling, intervention vs control 95/240 (40%) vs 65/210 (31%) 9% difference; -5% to 21%. Incidence of fractures was 5% (16/350 vs 4% (14/324)- difference not significant.		A*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Wagner 1994	Randomised controlled but method of randomisation not described. Inadequate data for intention to treat analysis.	Setting: community, Seattle, USA. N=1,559. Sample: 'healthy elderly' men and women, HMO enrollees. Age: mean 72 years. Inclusion criteria: aged 65 years or more; HMO members; ambulatory and independent. Exclusion criteria: too ill to participate as defined by primary care physician.	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.	Measured at one and two years. Losses: 89 of 1559 (6%). <u>Outcomes</u> 1. Number of participants falling. 2. Number sustaining medical care fall. 3. Number sustaining injury fall. 4. Death during the study. <u>Results</u> Assessment followed by multifactorial intervention vs control, community dwelling, geriatric screening (fallers and non fallers). 1.Number of participants falling, n=175/635 vs n=223/607 RR 0.75 [0.64, 0.88]. 2.Number sustaining medical care fall, n=42/635 vs n=57/607 RR 0.70 [0.48, 1.03]. 3.Number sustaining injury fall, n=63/635 vs n=88/607 RR 0.68 [0.51, 0.93].	Risk factors identified: inadequate exercise, high risk alcohol use, environmental hazards if increased fall risk, high risk prescription drug use, impaired vision, impaired hearing.	B*

Appendix E: Evidence table 6: Interventions for the prevention of falls (reproduced from Gillespie et al, 2003)

Study	Methods	Population/setting	Interventions	Results	Comments	Quality (allocation concealment)
Wolf 1996	Randomised controlled trial. Randomised using computer generated procedure. Inadequate data for intention to treat analysis.	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: above 70 years old; ambulatory; living in unsupervised environment; agreeing to participate on a weekly basis for 15 weeks with four month follow-up. Exclusion criteria: debilitating conditions e.g. cognitive impairment, metastatic cancer, crippling arthritis, Parkinson's disease, major stroke, profound visual defects.	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, one hour once weekly for 15 weeks.	Length of follow-up seven - 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. Losses: 40 of 200 (20%). <u>Outcomes</u> 1. Number of falls. 2. Time to one or more falls. 3. Time to one or more injurious falls. <u>Results</u> 15 week Tai Chi intervention vs control, participants falling RR 0.51 [0.36, 0.73]. When using a narrower definition of falling excluding stumbling RR 0.67 [0.41, 1.09].	Atlanta FICSIT trial [Province 1995]. Published data is not in a useable form. 1997 paper included under this study reports on a sub-group of the trial, reporting on outcomes other than falls.	B*

*Quality gradings for concealment of allocation from Cochrane review for interventions for preventing falls in elderly people (Gillespe, et al 2003)
A= Assigned treatment adequately concealed prior to allocation
B= Information inadequate to judge concealment
C= Assigned treatment clearly not concealed prior to treatment

Appendix E: Evidence table 7a: Patient views and experiences of falls prevention strategies: Qualitative studies

Study	Aim	Method	Sample characteristics	Setting	Results	Conclusions
Aminzedah & Edwards 1998 Canada	To ascertain views on use of assistive devices to prevent falling.	Four focus group interviews (tape-recorded) with each subject participating in one.	n=30 from Italian and British Canadian backgrounds; n=21 female; mean age 72.2 (61-86); n=16 lived alone; n=18 primary school education. No information on fall status.	Community	Falls associated with injury, psychological trauma, loss of independent and death. Consensus on advantages of mobility aids but majority believed they did not require them, even among those who reported fear of falling and a history of falls.	Social stigmas attached to ageing, disability and device use may influence older people's decisions to accept or reject mobility aids. However, participants had favourably evaluated bathroom aids. Those from non-English speaking background (NESB) have greater need for targeted health promotion education.
Ballinger & Payne 2000 UK	To explore perspectives on falls/falling among older people with hip fracture.	Semi-structured interviews (analysis involved discourse analysis).	n=8 Consecutive patients (>65 years) admitted to an orthopaedic trauma elderly care ward with hip #; n=7 females; mean age 81.	Orthopaedic trauma elderly care ward	Patients attributed falls to bad luck or incompetence of others. Therapists and patients do not share the same agendas and perspectives about falls.	Older people distance themselves from the possibility of a fall and involvement in prevention initiatives, through fear of stigma and stereotyping.
C'wealth Australia 2000	To investigate fall prevention strategies most likely to be accepted. To examine information needs and perceptions of older people concerning falls and their prevention.	Seven group discussions and 10 individual in-depth interviews (taped and transcribed for content and thematic analysis).	n=59 (included those who had and hadn't experienced a fall; carers). 'Culturally and linguistically diverse' - no details given; age=65 and over; females dominated.	Rural and metropolitan community dwellers	*Most readily accepted strategies:* • Walking aids • Home modification. *Strategies accepted with some reservations* • Speaking with GP about preventing falls • Participation in a falls prevention program - concept unfamiliar and some consider themselves past the stage of learning. *Strategies less readily accepted* • Eyesight checks • Feet check and footwear • Medication review • Home help • Improving balance and exercise levels.	The term 'fall prevention' is unfamiliar and the concept difficult to grasp. Perceived relevance of falls prevention strategies is low until a fall has been experienced. Falls interventions need to be communicated as a life-style enhancing measure and as a means to staying independent for longer in order to gain the full support of older people.

Appendix E: Evidence table 7a: Patient views and experiences of falls prevention strategies: Qualitative studies

					Barriers to adopting fall prevention strategies • Disbelief that the risk of falling can be reduced • If a person has not had any falls or near misses or already has a walking aid because of a pre-existing health condition • Signifies admission of being 'old, old' • Inaccessible and unappealing information.	
Study	**Aim**	**Method**	**Sample characteristics**	**Setting**	**Results**	**Conclusions**
Kong 2002 Hong Kong	To explore the psychosocial consequences of falling.	Explorative approach with semi-structured interviews.	n=20 Chinese; aged 65 and above; recent fall either in community or hospital setting (within 48 hours of interview); n=15 females; degree of injury ranged from no injury to fractured ribs.	Elder care wards	Informants perceived falls as unpredictable and not preventable. Older Chinese people take a passive role in seeking help and information.	Falls interventions should promote a sense of mastery and facilitate supportive social interactions with others.
Health Education Board 1999 Scotland	To examine how elderly people perceive and constructs risks of falling.	Five group and nine in-depth individual interviews.	n= 50 (fallers and non-fallers) recruited via established group and organisations working with older people. Included Asians but proportion not given. n=58 aged less than 75; n=40 female.	Community (rural and urban)	Respondents distinguished between trips (experienced by self) and falls (experienced by others). Those who had experienced falls that they regarded as condition-linked could see no scope for falls prevention. Non-fallers felt there were environmental and personal changes that might prevent or minimise falling, but advocated change for others rather than self.	The word 'falls' is contentious - its use is likely to inhibit engagement with any preventive programme. Targeting 'older people' is also likely to provide a negative or non-response among people who do not relate to portrayals with which they do not identify. People may be more receptive to messages around prevention when they have actually had a fall or near fall.

Appendix E: Evidence table 7a: Patient views and experiences of falls prevention strategies: Qualitative studies

					Formal exercise seen as something only 'exceptional' people do. Participants in exercise classes found the value in social rather than physical benefits.	
Porter 1999 USA	To explore the experience of falling and trying to get up while at home alone.	Descriptive (Husserlian) phenomenological study.	n=25 women aged 80 or more who had reported at least one fall, lived alone.	Community	Older women who have fallen assess their abilities and opportunities to control their environments to prevent further falls.	There is a need to build relationships with key health professionals before problem-solving and offering falls prevention strategies with an emphasis on finding out what characteristics the person is willing to modify and what changes they are prepared to make.

Study	Aim	Method	Sample characteristics	Setting	Results	Conclusions
Resnick 1999 USA	To explore what motivates older people in nursing homes to perform functional activities (with reference to falls).	Semi-structured interviews using naturalistic/ constructivist inquiry.	n=44 (n=37 females); average age: 88 yrs; length of stay in nursing home: 2.8 yrs.	Nursing home	Fear of falling had a major impact on function. Many participants had been admitted to the nursing home following a fall. There was a reluctance to walk and inappropriate use of wheelchairs to avoid walking.	Beliefs held by the participants influenced motivation to participate in falls prevention strategies. Reminders by nursing home staff that they were able to perform an activity, rather than warning them to avoid performing an activity that put them at risk of falling, helped increase motivation and strengthen willingness to be more active, thus preventing further falls
Simpson 2003 UK	To examine the precautions older people are prepared to take to prevent falls (with an emphasis on exercise).	'Qualitative'. Semi-structured interview.	n=32 inpatients (reasons for admission not reported) n=26 women; mean age 83 (sd 5.3).	Acute elderly care medical wards	Most respondents were unaware of the benefits of exercise in general or the positive effect of specific exercises on balance and muscle strength. Neither hospital doctors nor GPs were mentioned as a source of encouragement to exercise. Clients reported concern about health professional's personal manner of assessing and intervening and this affected	Professionals should be alert to and counter the belief among some older people that nothing can be done for falls attributed to chance. The strategy with the strongest evidence (balance and strengthening) is much less likely to be adopted. The benefits of strategies such as exercise and home modification should be promoted and clients should be reassured that pain and fatigue are not inevitable when exercising. Professionals who advise on hazard reduction strategies

Appendix E: Evidence table 7a: Patient views and experiences of falls prevention strategies: Qualitative studies

					their response to safety recommendations. Perceived barriers to exercises were pain, effort and age.	in older people's homes should take account of client's views.
Stead 1997 Scotland	To investigate the factors which influence participation in physical activity.	Focus group discussions.	Aged 55-75+ (n=not reported). Nine focus groups. No further information.	Community dwelling	There are two distinct groups: those who already incorporate exercise into their lifestyle and those who do not. The non-active group are more likely to regard exercise as potentially harmful and as using up finite energy resources. There is a discrepancy between the benefits that health professionals and older people attach to exercise, with the former highlighting the physiological and health benefits and the latter the social and psychological rewards.	Confirms findings that older people prefer exercise of a moderate intensity that includes a strong social and recreational component. For the non-active group there is a low health expectation and low confidence in their physical abilities. Again, the social benefits needs to be emphasised and incorporation of physical activity in everyday routines should be encouraged. Failure to take proper account of the relevance of exercise to lifestyle and the meanings that people attach to it, can result in the provision of services that do not adequately reflect need and may alienate their intended audience.
Study	**Aim**	**Method**	**Sample characteristics**	**Setting**	**Results**	**Conclusions**
Grossman 2003	To investigate physical activity perceptions, motivations and barriers.	In-depth qualitative interviews using open-ended questions.	Aged 75 years and above. n=33 under-active adults (defined as participating in < 20 minutes of endurance-type physical activity of moderate intensity, three times/wk for minimum three months).	Community dwelling	Misperception that physical activity levels relatively high. Knowledge of physical activity benefits expressed in terms of dangers of a sedentary lifestyle. Encouragement from family/friends important. Quality of life and independence more important than longevity. Lack of time, ageing process, adverse environment were all cited as barriers.	Misconceptions and gaps in knowledge exist. However, under-active people continue to be interested in learning about physical activity despite cited barriers. Recommendations for practice include giving specific advice to older patients, engaging family in the motivation process, addressing unique incentives for this age group and improving self-efficacy in patients who face multiple barriers. The presence of multiple barriers suggests that physical activity prescription and counselling should be ongoing and included in every visit.

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

Author	Study design Objective	Setting	Population Characteristics	Methods Interventions Outcomes measured	Results	Comments Quality issues
Specific falls prevention programs or general behaviour change interventions						
Culos-Reed 2000	Narrative review of predictors of adherence to behaviour change interventions.	All settings.	"Elderly" - no ages specified.	Physical activity, pharmacological and dietary interventions. Outcomes measured listed in Results column.	No quantitative data presented. Predictors of increased exercise compliance include past exercise history, home-based program location. Dietary compliance may be adversely effected by lack of nutritional knowledge, changed living situations.	Non-systematic literature review.
Lambert 2001	Before/after study designed to determine if participants in falls prevention programs make the required changes, and to identify factors affecting compliance with the program.	5 USA seniors centres. USA	84 health, community-dwelling adults, aged 65-97 years.	2 session falls prevention education program including risk modification advice, risk screening and balance confidence assessment. Outcomes: changes in health habits 1-2 weeks after program, anecdotal statements regarding perceived barriers and cost implications.	Positive stage change for doing regular exercise and some home modifications. Statement that program involved minimal cost but no data given.	Only descriptive statistics given for outcome measures, no statistical differences assessed. Author recommendations were reasonable based on literature review provided, but not on data provided by the study.
Yardley 2002	Before/after study of random sub-sample of larger randomised trial. This study aimed to identify commonly feared consequences of falling and how these affect activity avoidance.	Community living adults in UK.	224 healthy, community-dwelling adults, mean age 81 years.	Measured falls history and fear of falling at baseline. Measured these outcomes again 6 months later plus consequences of fear of falling and activity avoidance. Mostly used validated scales to assess outcomes.	No relationship found over time. Cross sectional analysis showed that previous fall, increasing age, being female, and increased anticipation of loss of function and identity were all independently associated with activity avoidance.	No data tables provided for the cross-sectional analyses, results reported narratively in text only. Decreased activity due to fear of falling presumed to decrease participation in falls prevention programs, although actual participation was not measured directly.

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

Author	Study design Objective	Setting	Population Characteristics	Methods Interventions Outcomes measured	Results	Comments Quality issues
Specific falls prevention programs or general behaviour change interventions						
Simpson 1995	Cross sectional observational study examining the reactions of elderly people at risk of falling to being taught how to get up from the floor.	Rehabilitation wards in London hospitals. Subjects could be inpatients or day unit patients. UK	105 rehab patients at risk of falling but capable of getting up off the floor and expected to return to own home after discharge. Mean age 83.5 years.	Assessed ability and confidence in getting up alone after a fall, before a teaching session was given. Some qualitative assessment of reasons for refusal to be taught.	87% agreed to be taught how to get up after a fall. 51% quite or very confident of being able to get up again after a fall before the teaching session. No significant relationship between practical session performance and before session confidence measures. Reasons given for refusal to be taught were that most people were not facing up to their risk of falling (no data provided).	No results given regarding any change in ability to get up off the floor after the teaching session compared with pre-session ability. Conclusions drawn difficult to substantiate with evidence provided from the study.
Cheal 2001	Before/after study design using qualitative methods to explore the perception of activity change and to evaluate efficacy of a falls prevention program to enhance self-efficacy.	Community setting Australia.	8 community dwelling adults identified by health workers as at risk of falling.	Self-efficacy assessed 2 weeks before and 4 weeks after participation in 'Steady As You Go' falls prevention program. Qualitative in-depth interviews and Modified Falls Efficacy Scales (MRES) were conducted / administered.	MFES scores increased by an average of 15 points after the program. Main theme the authors concluded from the qualitative results was that activity participation and mastery experiences should be included in falls prevention programs.	Qualitative findings may be useful to supplement other quantitative data.

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

Author	Study design Objective	Setting	Population Characteristics	Methods Interventions Outcomes measured	Results	Comments Quality issues
Exercise behaviour programs						
King 1998	Narrative review of 'recent' (years not specified) randomised or quasi-randomised trials to assess interventions designed to promote physical activity in older adults.	Community based settings.	Searched for trials which assessed general exercise promotion activities in adults over 50 years. Studies including people with coronary heart disease were excluded.	Trials assessing participation rates and activity level outcomes were included in the review selection criteria.	29 studies were included in the review, 13 of which contained results relevant to this review. Suggested home based, telephone supervised, low intensity programs had the greatest compliance. Potential barriers to participation included: transportation problems, fear of injury, lack of perceived ability, and illness.	Did not specify years when trials were selected, no assessment of data quality. Appropriately, did not pool results as main outcomes were measured very differently.
Hillsdon 1995	Systematic review of 10 randomised trials assessing effective promotion of physical activity.	Community settings.	Adults (no age limits), but included older adults in 3 of the 10 trials.	Included randomised trials assessing single factors interventions to increase exercise activity and where exercise behaviour outcomes were measured.	Common features in the trials involving older adults which showed high exercise participation rates: home-based; informal, unsupervised exercise; frequent professional contact, moderate intensity exercise (e.g. walking); moderate frequency of sessions (2-3/week).	High quality: specific search strategy and inclusion criteria; quality assessment undertaken. Appropriately, did not pool results as outcomes measured very differently between studies.
Rejeski 1997	3 arm randomised trials designed to assess the effect of 2 types of exercise programs on self reported disability.	Sedentary volunteers. Method of recruitment not stated. All study arms had a 3 month clinic-based phase followed by 15 months home-based training, telephone support and follow-up.	439 ambulant subjects (mean age 67 years) who had radiographic evidence of knee osteoarthritis and self reported difficulty with activities of daily living due to knee pain.	Control group: education sessions for 3 months, then phone follow-up for 15 months. Intervention 1: aerobic exercise program (walking), 1 hr sessions, 3 times / week. Intervention 2: resistance exercise	Only consistent predictor of compliance across time was prior exercise behaviour ($p<0.01$). Demographic, psychosocial, fitness and disability-related measures did not predict compliance.	Approx half of the subjects in both treatment arms had 'dropped out' by 16 months follow-up point. Results presented as changes in R^2 values over time: difficult to interpret these in real terms e.g. the reduction in time

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

		Canada		program (exercises with weights), 1 hr sessions, 3 times / week. Multiple regression used to	Frequent exercise (3 times / week) for moderate duration (35 mins) produced the greatest	spent exercising or the decrease in attendance.
Author	**Study design Objective**	**Setting**	**Population Characteristics**	**Methods Interventions Outcomes measured**	**Results**	**Comments Quality issues**
Exercise behaviour programs						
Rejeski 1997 cont.				examine factors predictive of level of attendance and time spent exercising (compliance measures) at 3 follow-up time points (3, 9, 16 months). Also examined dose-response effects of compliance.	reduction in disability.	
King 1995 (main trial) Oman 1998 (subset of main trial)	4 arm randomised trial comparing different exercise program formats and intensities.	Community setting in California USA.	269 healthy 50-65 years olds, mostly white and well-educated. Recruited by random digit dialling and community media campaign.	Gp1: high intensity home based program (60min session x3/wk); Gp2: high intensity group based program (60 min class session x3/wk); Gp3: lower intensity home based program: (30min walk x5/wk); control gp: choice of above programs after one year waitlist. Outcomes relevant to this review: exercise adherence and self-efficacy measures with logs, treadmill data, self reported exertion perception, validated self-efficacy scale (in a subset of 63).	At 1 year: group based program had significantly lower participation rates compared with home based programs ($p<0.0005$). By 2 years there was a drop in the participation rates for the moderate intensity group (authors speculate difficulty in maintaining frequency of 5 times/wk for long periods). Past exercise history was the best predictor of current exercise adherence.	Almost 90% follow-up rate at 2 years strengthens results. No sample size calculations.

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

Author	Study design Objective	Setting	Population Characteristics	Methods Interventions Outcomes measured	Results	Comments Quality issues
Exercise behaviour programs						
Resnick 2002	Randomised trial designed to assess the effect of the WALC intervention on self-efficacy, exercise activity, falls and fall-related injuries.	USA community care retirement community.	20 randomly selected individuals from a list of 120 eligible people. Participants were sedentary, older women (mean age 88 years). Prognostic baseline characteristics well balanced between groups.	WALC intervention (W=walk, A=address pain, fear, fatigue; L=learn about exercise and overcoming barriers; C=visual cues e.g. reminder calendars. Control group: routine care, assessment and treatment when necessary. Outcomes: exercise self-efficacy, health status, exercise behaviour and activity.	Treatment group had higher exercise self-efficacy and activity at 6 months follow-up. Authors concluded that WALC intervention is effective in initiating exercise in sedentary older adults and increasing adherence to the program.	No sample size calculations, but did post hoc power calculations. Excluded 15% patients after randomisation and only had relatively short follow-up time (6 months). Unclear whether these results can be maintained in the long-term.
Resnick 2000 Resnick 2001	Qualitative and quantitative (cross sectional observational study) to explore factors influencing adherence to an exercise program in older adults. Descriptive cross-sectional survey to assess the same factors.	USA continuing care retirement village.	23 of original 24 volunteer members of a walking group. Mean age 81 years. Mostly white, well-educated women. 201 adults from the same setting, mean age 85 years.	Qualitative component: open-ended interviews, audio-taped and transcribed; coded and categorised into main themes. Quantitative component: assessed self-efficacy, motivation, fear of falling and health status using validated scores then assessed association between these factors and exercise adherence (measured by session attendance).	Participants who exercised more regularly (i.e. had greater program adherence) had higher self-efficacy expectations related to exercise, better functional performance and fewer functional limitations attributable to health. Adherence to the program was influenced positively by beliefs in exercise benefits, goal identification, positive peer role models and past exercise experience.	Direction of effect unclear. Not a randomised trial thus causal association cannot be determined.

Appendix E: Evidence table 7b Patients' views and experiences of falls prevention strategies: Quantitative studies

Author	Study design Objective	Setting	Population Characteristics	Methods Interventions Outcomes measured	Results	Comments Quality issues
Exercise behaviour programs						
Bruce 2003	Cross sectional analysis of baseline data from longitudinal study to determine whether fear of falling was associated with the level of recreational activity in independently functioning women.	West Australian community setting.	Random selection of 1,500 women, 70 years and older from the electoral role. Primary aim was to enrol them in a randomised trial of oral calcium supplements to prevent osteoporitic fractures. Mean age 75.2 years, 24% were obese (BMI >30m^2/kg).	Measured fear of falling using simple questions (said to correlate well with other validated scores) and physical activity (also via questioning). Performed multiple regression and linear modelling to assess associations between these factors.	Fear of falling was independently associated with lower physical activity (p=0.003) and obesity (p=0.001). Conclusion that the common fear of falling even in healthy, high-functioning adults is an important psychological barrier that may need to be overcome in programs attempting to improve activity levels in older women.	Only associations can be drawn from this cross sectional data. No cause and effect link can be demonstrated using this study design.
Wielandt 2000	Narrative literature review to assess compliance with prescribed adaptive equipment.	No specific settings stated, but the review covered a wide range practice settings.	The age of the participants in the included studies ranged from 2.5-93 years. There were 31 included studies.	Medline and Cinahl database were searched for the years 1963-1996. The types of studies or interventions included in the review were not specifically stated. There was a wide variety of adaptive equipment reviewed, although no studies specifically included hip protectors.	Factors which generally increased compliance with the use of adaptive equipment included: living alone; made-to-measure devices; perceived benefit of the equipment; home visits to fit, provide training in the device's use and assess ongoing use. Factors which decreased compliance with use of adaptive equipment included: physical deterioration; loss of self confidence; lack of aesthetic appeal; embarrassment regarding needing to use the device.	Although many of the studies included in the review did not pertain to the age group under consideration, the results seemed generalisable to the guideline population.

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Close 1999 UK	Randomised by random numbers table and list held independently of the investigators. Intention to treat analysis not possible.	Community dwelling individuals presenting at A/E after a fall, recruited on discharge. Mean age: 78.2 (>65). History of falling.	Medical and occupational therapy assessments and interventions. Medical assessments to identify primary cause of fall and other risk factors present (general examination and visual acuity, balance, cognition, affect, medications). Interventions and referral as required. Home visit by occupational therapist (functional assessment and environmental hazards). Advice, equipment and referrals as required. N=141. Comparison: usual care. N=163.	Follow-up every four months for one year. Falls diary. Losses: 93/397=(23%). <u>Outcomes</u> 1. Number of participants falling. 2. Number with injury fall. 3. Number sustaining three or more falls. 4. Number of falls. Also measured but not considered in this review were doctor and hospital visits, admissions, function. <u>Results</u> Multi-factorial intervention n=59 vs. control n=111, number of participants falling-targeting known fallers or fall risk factors RR 0.61 [0.49, 0.77]. Multi-factorial intervention n=8 vs. control n=16, number sustaining injury fall-RR 0.58 [0.26, 1.31].	B*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Crotty 2002 Australia (excluded in Cochrane)	Randomisation computer generated and performed by hospital pharmacist blinded to study and medical status of patient. Intention to treat.	Admission for fall related to hip fracture for surgical treatment >65 expected to return to suitable home environment.	Accelerated discharge and home based rehabilitation. Home modifications. N=34. Comparison: conventional treatment. N=32.	Follow up four months. Losses to follow-up none stated. Adverse events. <u>Outcome</u> 1. Number of falls. 2. Falls requiring hospital treatment. Also measured but not considered in this review were physical and social independence, balance confidence, quality of life, carer strain, patient and carer satisfaction, use of community service. <u>Results</u> Home care intervention n=6 vs. control n=4 Number participants falling untargeted RR 0.71 [0.60, 0.82]. Home care intervention n=1 vs. control n=1 number of participants with falls requiring hospitalisation untargeted RR 0.94 [0.88, 1.0].	A*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Ebrahim 1997 UK	Randomly assigned using prepared envelopes containing computer generated allocation. Intention to treat analysis not possible.	Post-menopausal women identified from A&E and orthopaedic fracture clinic records. With a fractured upper limb in last two years.	Initial advice on general health/diet. Encouraged to build up to brisk walking 40 minutes x three per week. N= 81. Comparison: initial advice on general health/diet. Upper limb exercises to improve post-fracture function. N=84.	Follow-up two years. Losses: 68 of 165 (41%). <u>Outcomes</u> 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. <u>Results</u> Exercise/physical therapy alone n=52 vs control n=50 Number of participants falling, community dwelling untargeted. RR 1.08 [0.85, 1.37]. Exercise/physical therapy alone n=2 vs control n=3 Number of participants sustaining fracture fall, community dwelling untargeted. RR 0.69 [0.12, 4.03].	A*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Kingston 2001 UK	Method of randomisation not described. Intention to treat analysis not possible.	Community dwelling women attending A&E with a fall. Mean Age 71.9 years, history of a fall, discharged directly to own home.	Rapid health visitor intervention within five 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. N=60. Comparison: usual post fall treatment i.e. letter to GP from A&E detailing the clinical event, any interventions carried out in hospital and recommendations about follow-up. N=49.	Follow-up 12 weeks. Losses: 17 of 109 (16%). Outcomes No description of how falls monitored, presumably retrospective at day four and week 12. 1. Number of participants falling. Also measured but not considered for this review were SF36 assessment at day four and 12 weeks. Results Multi-factorial intervention n=4 vs. control n=5, number of participants falling-targeting known fallers or fall risk factors RR 0.65 [0.19, 2.30].	B*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Lightbody 2002 UK	Method of randomisation not described. 'Block-randomised consecutively into groups'. Intention to treat analysis not possible.	Consecutive patients attending A&E with a fall (74.4% women). Age: median (IQR) 75 (70-81). > 65 years.	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. N=171. Comparison: usual care .N=177.	Follow-up six months. Losses: 34/348 (10%). Outcomes Falls, injury and treatment recorded in diary. Postal questionnaire at six months to collect data. GP records and hospital databases searched. 1. Number of people falling. 2. Number of falls. 3. Number sustaining injury fall. Results Multi-factorial intervention n=43 vs. control n=44, number of participants falling-targeting known fallers or fall risk factors RR 1.01 [0.07, 1.46].	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. B*
Pardessus 2002 France	Randomised using random numbers table. Intention to treat analysis.	Individuals hospitalised for a 'mechanical' fall and recruited in hospital, but community dwelling, Age: mean 83.2.	Comprehensive two 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. N=30. Comparison: usual care. N=15.	Follow-up one year. Losses: 9 of 60 (15%). Outcomes Falls identified by monthly telephone calls. 1. Number of participants falling. 2. Mean number of falls per participant. Results Home safety intervention n=13 vs control n=15 Falling history in year prior to randomisation RR 0.87 [0.50, 1.49].	B*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Rubinstein 1990 USA	Randomised with computer generated, randomly sequenced cards in sealed envelopes. Analysis appears to be by intention to treat.	Men and women in long-term residential care who have sustained a fall within previous seven days. Age: mean 87years.	Nurse practitioner assessment within seven days of a fall, followed by physician recommendations for action, and referral for intervention if appropriate. N=79. Comparison: usual care. N=81.	Follow up two years. Losses: none described. Outcomes Falls recorded in daily log. 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. Results Multi-factorial intervention n=64 vs. control n=68, number of participants falling Institutional care-targeting known fallers or fall risk factors RR 0.97 [0.84, 1.11]. Assessment followed by multi-factorial intervention n=7 vs control n=5, institutional care-targeting known fallers RR 1.44 [0.48, 4.33]. Assessment followed by multi-factorial intervention n=9 vs control n=7 institutional care-targeting known fallers or fall risk factors RR 1.32 [0.52, 3.37].	A*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

Study	Methods	Participants and setting	Intervention	Results	Quality (allocation concealment) & comments
Shaw 2003 UK	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). Intention to treat analysis.	Older people with cognitive impairment or dementia attending A&E after a fall. Community dwelling or in institutions). Age 65 years or over; cognitive impairment and dementia (MMSE <24; consent from three people (patient, immediate carer, and next of kin). Age: mean 84, range 71-97 years.	Multifactorial, multidisciplinary clinical assessment (medical, physiotherapy, occupational therapy, cardiovascular) and intervention for all identified risk factors for falls. N=130. Comparison: clinical assessment but no intervention. N=115.	Follow-up one year. Losses: 92 of 308 (30%). <u>Outcomes</u> Length of falls identified by weekly diary mailed as a postcard, and telephone contact if no card for two 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 attendance. 7. Number of fall related hospital admissions. <u>Results</u> Assessment followed by multi-factorial intervention n=96 vs control n=115 - cognitively impaired any residence RR 0.92 [0.81, 1.05].	A*
Tinnetti 1999 US (Excluded in Cochrane)	Randomised at hospital discharge, stratified by pre-fracture functional level and by initial discharge location. Appears to be intention to treat analysis.	Non-demented persons > 65 years who underwent surgical repair of a hip fracture and return home within 100 days.	Systematic multi-component rehabilitation strategy-includes ADL strategy. N=148. Comparison: usual care (rehabilitation care with limited ADL activities). N=156.	Follow up six months and one year. Losses to follow up 31/304 (10%). <u>Outcomes</u> Adverse events: 1. falls or injuries 2. hospitalisation. Also measured but not relevant for this review were a battery of self-report and performance based measures of physical and social function. <u>Results</u> Multifactorial intervention n=28 vs. control n=27 number of participants falling untargeted RR 1.1 [1.06, 1.14]. Multifactorial intervention n=16 vs. control n=20 number of participants hospitalised untargeted RR 0.84 [0.8, 0.88].	B*

Appendix E: Evidence table 8: Interventions of rehabilitation programmes (Reproduced from Gillespie et al, 2003)

*Quality gradings for concealment of allocation from Cochrane review for interventions for preventing falls in elderly people (Gillespie, et al 2003)
A= Assigned treatment adequately concealed prior to allocation.
B= Information inadequate to judge concealment.
C= Assigned treatment clearly not concealed prior to treatment.

Appendix E: Evidence table 9 rehabilitation: other key documents

1. Cameron et al (2000) Geriatric rehabilitation following fractures in older people: a systematic review, *Health Technology Assessment,* 2000; 4 (2).

Summary of methods

Aim of the review

To assess the clinical and cost effectiveness of programmes of care following the acute management of fractures in older people. The principle focus was on rehabilitative care after proximal femoral fracture.

Selection criteria:

Study design

- Systematic reviews
- RCTs, quasi-randomised
- Controlled cohort
- Published UK audit data in the last five years.

Participants

Patients aged 65 years and above with any fracture of the lower limbs, pelvis, upper limbs or spine that required hospital care either as an inpatient or in ambulatory care.

Interventions

Interventions included were those designed to improve function (mobility and self-care) and/or reduced hospital care. Primary outcome of reducing the incidence of further falls was not considered.

The interventions fell into three broad categories:

1. Packages of care: geriatric orthopaedic rehabilitation unit (GORU), geriatric hip fracture programme (GHFP), early supported discharge (ESD), application of a clinical pathway.
2. The consequences of the introduction of prospective payment systems (PPS).
3. Specific multidisciplinary intervention designed to improve particular aspects of mobility or self care.

Outcomes

- Length of hospital stay
- Readmission to hospital
- Residence following discharge
- All cause mortality
- Morbidity
- Mobility
- Activities of daily living

- Health related quality of life.

Primary outcome of reducing the incidence of further falls was not considered.

Main results

Forty-one comparative studies (of which 14 were RCTs) and seven audit studies were included. The studies were heterogeneous. The very limited data that were available suggest that:

- GHFP, ESD and clinical pathways reduce total length of stay in hospital
- There is no evidence that length of stay in a GORU is less than in a conventional orthopaedic unit
- Length of stay may be reduced by the introduction of a PPS
- Readmission rate after ESD shows a statistically non-significant increase
- Significantly higher rates of return to previous residential status are achieved by GHFP and by ESD
- PPSs have led to increased use of nursing homes in the USA
- There is no evidence that any of the programmes evaluated, nor the introduction of PPSs, are associated with changes in mortality
- There are insufficient data to assess the impact of any programme on level function, morbidity, quality of life or impact on carers.
- From a health and social services perspective, GHFP and ESD are likely to be cost saving. The economic implications of GORU are less clear.

Quality

The quality criteria met by this systematic review (NHMRC 2001) was high.

2. Scottish Intercollegiate Guidelines Network (2002) *Prevention and management of hip fracture on older people*,

The evidence base for this guideline was synthesised in accordance with SIGN methodology.

The guideline refers to recommendations for the following:

- Prevention of hip fracture
- Pre-hospital management
- Management in A&E
- Preoperative care
- Anaesthetic management
- Surgical management
- Early postoperative management
- Rehabilitation and discharge.

The following is a summary of the recommendations relating to rehabilitation following a fracture.

Rehabilitation and discharge

- **Early assessment: [B]**

Within 48 hours of admission, a corroborated history should be obtained, which should include:

- premorbid function and mobility
- available social support
- current relevant clinical conditions mental state.

Patients with co-morbidity, poor functional ability and low mental test scores prior to admission should undergo rehabilitation in a geriatric orthopaedic rehabilitation unit (GORU). [B]

- **Rehabilitation:**

NUTRITION AND REHABILITATION

Supplementing the diet of hip fracture patients in rehabilitation with high-energy protein preparations containing minerals and vitamins should be considered. [A]

MEDICAL MANAGEMENT AND REHABILITATION

Multidisciplinary team working facilitates the rehabilitation process. [B]

- **Discharge**

SUPPORTED DISCHARGE

Supported discharge schemes should be used to facilitate the safe discharge of elderly hip fracture patients and reduce acute hospital stay. [B]

Discharge management

- The patient should be central to discharge planning and, where realistic, their needs and wishes taken into consideration. The views of a carer are also important.
- Liaison between hospital and community - including social work department - facilitates the discharge process.
- Occupational therapy home assessments assist in preparing patients for discharge.
- Patient, carer, GP, and other community services should be given as much notice as possible of the date of discharge.
- Discharge should not take place until arrangements for post-discharge support are in place and the patient is fit for discharge.
- Written information on medication, mobility, expected progress, pain control and sources of help and advice should be available to patient and carer.
- General practitioners have an important role to play in post discharge rehabilitation and should receive early and comprehensive information on hospital stay, services arranged

and future follow-up arrangements. Complicated discharges that may have considerable impact on the primary care team should be discussed in advance with the GP.

- Consideration should be given to the prevention of falls with particular attention being paid to potential household hazards, footwear, and provision of adaptive equipment/walking aids and alarm systems.

Quality

The quality of this guideline was evaluated with the AGREE (Appraisal of guidelines for research and evaluation) instrument. The following scores for the specified six domains are given below. The quality of the result is represented by a higher percentage.

1. Scope and purpose 66%
2. Stakeholder involvement 75%
3. Rigour of development 100%
4. Clarity of expression 92%
5. Applicability 55%
6. Editorial independence 100%

3. The Chartered Society of Physiotherapy and the College of Occupational Therapists (June 2000) *Guidelines for the collaborative rehabilitative management of elderly people who have fallen.*

There were no clear methods described in this document and results with recommendations are summarised here. The guideline is intended to assist physiotherapists, occupational therapists and nurses working in the community, acute care or long-term care in making decisions about appropriate treatment for elderly people who have fallen.

To improve elderly people's ability to withstand threats to their balance

- **Assess** to identify the impairments, likely to respond to rehabilitative intervention, which probably contributed to the person's previous falls or might lead to further falls.
- **Intervene** to increase the elderly person's stability, transferring, walking and other functional movement by:
  -balance training
  -strengthening the muscles around the knee, hip and ankle
  -increasing the flexibility of the trunk and lower limbs
  -providing mobility aids and appliances if really necessary.

To improve the safety of the elderly person's surroundings

- **Assess** to identify any environmental hazards that contributed to previous falls and that might lead to further falls.
- **Intervene** by:

-removing, replacing or modifying any hazards with the person's consent
-teaching the person to be aware of hazards and how to avoid them.

To prevent elderly people suffering from the consequences of a long lie

- **Assess** to establish how the elderly person (and their carer) coped following previous fall and if they have any strategies for coping following a fall in the future.
- **Intervene** by teaching the person how to:
  -get up from the floor
  -summon help
  -move about, keep warm etc while on the floor.

To optimise elderly people's confidence and, whenever relevant, their carer's confidence, in their ability to move about as safely and as independently as possible

- **Assess** to identify any psychological consequences of the fall that might lead to self-imposed restrictions of activity.
- **Intervene** to help the elderly person regain confidence in their balance ability and functional competence, by encouraging the person to cope successfully with increasingly severe threats to their balance and increasingly demanding functional tasks.

Good practice points

- A physician should examine a faller to identify any underlying medical reasons.
- A plan of intervention is agreed with the elderly person and, where relevant, their carer.
- Establish baselines of appropriate measurements about the elderly person's pre intervention state against which their post-intervention state can be compared.
- Establish the extent to which the elderly people (and their carer) are likely to be able to co-operate with an intervention programme in terms of memory ability and willingness to participate.
- Note any relevant signs or symptoms of contributory factors that may have led to the fall, that need to be brought to the attention of the elderly person's doctor.

Quality

The quality of this guideline was evaluated with the AGREE (Appraisal of guidelines for research and evaluation) instrument. The following scores for the specified six domains are given below. The quality of the result is represented by a higher percentage.

1. Scope and purpose 66%
2. Stakeholder involvement 33%
3. Rigour of development 33%
4. Clarity of expression 83%
5. Applicability 33%
6. Editorial independence 50%

Systematic reviews identified were:

Parker et al (2002) Mobilisation strategies after hip fracture surgery in adults (Cochrane Review), in *The Cochrane Library,* issue 4, 2002, Oxford.

Summary of methods

Aim of the review

To evaluate the effects of different mobilisation strategies and programmes after hip fracture surgery.

Study design

RCTs, quasi-randomised.

Participants

Skeletally mature patients with a hip fracture.

Interventions

Post-operative care programmes such as immediate or delayed weight bearing after surgery.

Outcomes

These are described within the following broad categories:

- Fracture healing complications
- Post-operative course and complications
- Anatomical restoration
- Other: mortality, pain, return to living at home, return of mobility, functional outcomes, health related quality of life.

Primary outcome of reducing the incidence of further falls was not considered.

Main results

There is insufficient evidence from RCTs to determine the effects of more frequent physiotherapy, quadriceps strengthening exercises, treadmill gait training, or neuromuscular stimulation after hip fracture surgery. There is also insufficient evidence to determine the effects of early weight bearing after the internal fixation of an intracapsular proximal femoral fracture.

Quality

The quality criteria met by this systematic review (NHMRC 2001) was high.

Cameron et al (2002) Co-ordinated multidisciplinary approaches for in patient rehabilitation of older patients with proximal femoral fractures (Cochrane Review), in *The Cochrane Library,* issue 3, 2002, Oxford.

Aim of the review

To examine the effects of co-ordinated multidisciplinary inpatient rehabilitation, compared with usual (orthopaedic) care for older patients with hip fracture.

Study design

RCTs, quasi-randomised.

Participants

Older patients with any type of fracture of the proximal femur, which had been surgically fixed prior to entry on the care programme.

Interventions

Treatment in a geriatric orthopaedic rehabilitation unit (GORH) or other types of specialised multidisciplinary inpatient rehabilitation.

Outcomes

- Mortality
- Morbidity
- Post-operative functional status
- Length of hospital stay
- Level of care and extent of support required on discharge
- Patient's perceived quality of life on discharge
- Carer burden and stress
- Direct, indirect and hidden costs.

Primary outcome of reducing the incidence of further falls was not considered.

Main results

There is no conclusive evidence of the effectiveness of co-ordinated post-surgical care typified by the GORU model following proximal femoral fracture. However there is a trend towards effectiveness in all main outcome measures.

Quality

The quality criteria met by this systematic review (NHMRC 2001) was high.

Ward et al (2003) Care home versus hospital and own home environments for rehabilitation of older people (Cochrane Review), in *The Cochrane Library,* issue 3.

Aim of the review

To compare the effects of home care environments versus hospital environments in the rehabilitation of older people.

Study design

- RCTs, quasi-randomised
- CCTs
- CBAs
- ITS.

Participants

Persons aged 60 years or older who are in receipt of rehabilitation. The following population subgroups were included:

-Persons aged 60 or above with stroke

-Persons aged 60 or above with fracture of neck of femur.

Interventions

Home care environments.

Outcomes

- ADL
- Health status, quality of life
- Mortality
- Adverse effects
- Readmission to an acute facility
- Patient and carer satisfaction
- Number of days receiving rehabilitation.

Primary outcome of reducing the incidence of further falls was not considered.

Main results

There is insufficient evidence to compare the effects of home care environments, hospital environments and own home environments on an older person's rehabilitation outcomes.

Quality

The quality criteria met by this systematic review (NHMRC 2001) was high.

National service framework for older people (2001): standard six: falls

Improving care and treatment following a fall: key messages/ principles of care

Primary care

Minor falls or injuries, and the subsequent loss of confidence, may seriously restrict an older person's ability to carry out their normal activities at home. Some older people will seek treatment from, or be referred to their GP.

Older people who fall should, with their consent, be referred to a specialist falls service particularly those who:

- have had previous fragility fractures
- attend A&E having fallen
- called an emergency ambulance having fallen
- have two or more intrinsic risk factors in the context of any fall
- have frequent unexplained falls
- fall in hospital or in a nursing or residential care home
- live in unsafe housing conditions
- are very afraid of falling.

In hospital

- Older people who are taken to hospital following a fall should have their needs assessed as soon as possible after arrival in A&E to determine whether they are safe to return home, or should be admitted to intermediate care or to hospital for further assessment and management.

- All older people taken to hospital with a fall should be reviewed by a member of the specialist falls service and the need (or otherwise) for a fuller assessment determined. For older people returning home from A&E, this initial review can be undertaken either on-site or subsequently on an outpatient, day patient or domicilliary basis. Comprehensive specialist assessment, if indicated, will need to take place in outpatient or day hospital settings, with access to full diagnostic and multidisciplinary facilities.

- Older people exhibiting high risk for osteoporotic fracture but without any injury to their bones should be referred for assessment of bone mineral density (BMD). Those with results consistent with osteoporosis should be offered appropriate therapeutic interventions. This is currently being addressed by the NICE in *The assessment of fracture risk and prevention of osteoporotic fractures in individuals at high risk.*

- If the older person does not need admission to hospital, or referral to intermediate care services, other options are available that offer more than discharge, while awaiting review at home by a member of the specialist falls service. These include:
    - discharge home accompanied by occupational therapist to assess risks in the home and provide immediate advice or plan equipment provision or home repair services
    - discharge home accompanied by, and with low key support from, a voluntary agency or good neighbour scheme
    - discharge home with care from statutory agencies
    - discharge home with safety or mobility equipment.

- Older people with suspected hip fracture or other serious injury should be admitted to hospital as soon as possible after arrival in A&E. Potentially serious injuries may present in a complex fashion. For example, an older person may complain of a pain in the knee, which is in fact due to a hip fracture (referred pain). Examinations and investigations of apparently minor injuries should also determine whether a more serious injury has occurred.

- Discharge from hospital needs careful and early planning by a multidisciplinary team fully involving older people and their carers. The specialist falls service will be responsible for co-ordinating the assessment and individual care plan for discharge and for ensuring that arrangements for support are in place prior to discharge. This assessment should build on any assessment information already held on the older person.

Rehabilitation

Many older people will need rehabilitation after a fall whether they have been treated in hospital or remain at home. The aim is to maximise an older person's independence and enable them to carry out their normal activities of daily living and social participation. Effective rehabilitation will be responsive to the wishes of older people, involve a number of agencies and disciplines, and be available when required and work towards identified outcomes. A combination of clinical, therapeutic and social interventions may be needed to address an older person's health and social care needs and to reduce the risk of further falls.

Rehabilitation strategies should aim to:

- increase the older person's stability during standing, transferring, walking and other functional movement by:
    - balance training
    - strengthening the muscles around the hip, knee and ankle
    - increasing the flexibility of the trunk and lower limbs
    - providing appropriate mobility and safety equipment

- help older people regain their independence and confidence to relearn and practise their previous skills in every day living, and to cope successfully with increasing threats to their balance and increasingly demanding functional tasks
- improve the safety of the older person's environment by, with their consent, removing, replacing or modifying any hazards
- teach awareness of hazards and how to avoid them
- teach the older person strategies to cope with any further fall and prevent a long lie. If possible the person should be trained how to get up from the floor. Otherwise methods for summoning help, including use of community alarms, should be rehearsed. Strategies for preventing hypothermia and pressure sores should also be discussed
- establish a network of community support and supervision if this is needed, including the voluntary sector and organisations such as the National Osteoporosis Society, many of whom have befriending services to relieve isolation and support rehabilitation of older people.

Long-term support

Longer-term support may be required. Care practices should not aim to restrict mobility, but explore how older people can manage safely in their own home, or in a residential or nursing home. The least invasive methods of intervention and management of care should be used. The use of community alarm systems - including pendants and phone-based systems - for people who have fallen to summon help can increase the security and confidence of an older person. But they are only valuable if the person is conscious or within reach of a pull cord. The community equipment services initiative (standard 2) includes proposals to extend the use of 'tele-care' or environmental control technologies - including passive alarms - capable of providing added safety for those who are particularly vulnerable.

- Older people who have fallen should be assessed and reviewed regularly to monitor their needs. Longer-term social and emotional support may be required to minimise any loss of independence caused by the effects of the fall. This may include provision of personal or domestic care services or introduction to social activities to prevent social isolation and depression.

Falls clinics and assessment

Specialist assessment should be carried out by the falls service in collaboration with primary and social care professionals. This should build on the single assessment process. It should identify risk factors associated with an older person's health and their environment and should:

- identify and diagnose any risk factors for falls associated with an older person's health (including any physical impairment) and environment, particularly those likely to respond to intervention
- establish how the older person (and their carer) coped following any previous fall and if they have any strategies for coping with a fall in the future
- identify any psychological consequences of the fall that might lead to self-imposed restriction of activity
- lead to an investigation and treatment for osteoporotic risk.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Birks 2003	Randomisation of individual participants by a telephone randomisation service.	366 community residents recruited as patients recovering from a hip fracture on orthopaedic wards of York District Hospital, England, or from the general population who had sustained a hip fracture in the past. Mean age: 80.0/80.2 years[1] Proportion male: 12.6%. Inclusion criteria: aged over 70 years; have sustained one hip fracture; had to have one hip intact; able to give informed consent. Exclusion criteria: bed or chair-bound; had bilateral hip replacement; a clothing size of 18 or above.	Allocation to wear hip protectors or not (control group). Hip protectors from Robinson Healthcare Ltd that are equivalent to those of Safehip, Denmark.	Length of follow-up: mean of 14 months (range 6-41 months). <u>Outcomes</u> Number of hip fractures. Number of other fractures. Compliance of wearing the protectors. Adverse effects of the protectors. <u>Results</u> 1.Incidence of hip fractures, randomised by individual patient, hip pads n=6/182 vs n=2/184 control. RR 3.03 [0.62, 14,83]. 2.Incidence of pelvic fractures Hip pads n= 3/182 vs n=0/184 control. RR 7.08 [0.37, 136.04]. 3.Incidence of other fractures, hip pads n=15/182 vs 17/184 control. RR 0.89 [0.46, 1.73].	A* Unpublished information made available from authors.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Cameron 2001	Method of randomisation by numbered sealed opaque envelopes.	174 living in residential care facilities in Sydney, Australia. Mean age: 85.6/84.0 years. All female. Inclusion criteria: aged 75 years and older; have had two or more falls in the last three months or one fall requiring hospital admission; at least one hip without prior surgery; able to understand English; have sufficient cognitive function to give informed consent; likely to continue to live at home for three months and to survive for at least one year; confirmation that the facility staff would assist with encouraging the participant to wear the protector.	Allocation to wear hip protectors or not (control). Hip protectors equivalent to those of Safehip, Denmark.	Length of follow-up: two years. <u>Outcomes</u> Number of hip fractures. Number of pelvic fractures. Number of other fractures. Compliance of wearing the protectors. Adverse effects of the protectors. Mortality. Falls. <u>Results</u> 1.Incidence of hip fractures, randomised by individual patient, hip pads n=8/86 vs n=7/88 control. RR 1.17 [0.44, 3.08]. 2.Incidence of pelvic fractures Hip pads n= 2/86 vs n=2/88 control. RR 1.02 [0.15, 7.10]. 3.Incidence of other fractures, hip pads n=4/86 vs 4/88 control. RR 1.02 [0.26, 3.96]. 4. Mortality, hip pads n=28/86 vs n=28/88 control. RR 1.02 [0.66, 1.58].	A*

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Cameron 2003	Method of randomisation by numbered sealed opaque envelopes.	600 living in their own homes in Sydney, Australia. Mean age: 83.2/83.0 years. All female. Inclusion criteria: aged 74 years and over; in contact with aged care health services; at least two falls in the last three months or one fall requiring hospital admission; at least one hip without prior surgery; sufficient cognitive function to give informed consent; likely to continue to live at home for three months; likely to survive for at least one year; able to understand English.	Allocation to wear hip protectors or not (control). Two adherence nurses fitted protectors and encouraged adherence with three visits, followed by two telephone contacts. Further visits or telephone contact if not adhering. Hip protectors equivalent to those of Safehip, Denmark.	Length of follow-up: two years. Outcomes Number of hip fractures. Number of pelvic fractures. Number of other fractures. Compliance of wearing the protectors. Adverse effects of the protectors. Mortality. Number of falls. Results 1.Incidence of hip fractures, randomised by individual patient, hip pads n=21/302 vs n=22/298 control. RR 0.94 [0.53, 1.68]. 2.Incidence of pelvic fractures Hip pads n= 8/302 vs n=6/298 control. RR 1.32 [0.46, 3.75]. 3.Incidence of other fractures, hip pads n=23/302 vs n=21/298 control. RR 1.08 [0.61, 1.91]. 4. Mortality, hip pads 33/302 vs n=46/298 control. RR 0.17 [0.47, 1.07].	A*

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Chan 2000	The method or randomisation was stated as 'taking draws literally'	71 residents of nine nursing homes in Randwick, New South Wales, Australia. Mean age: not stated. Proportion male: not stated.	Allocation to wear hip protectors or not (control group). Type of protector was locally made pads and pants.	Length of follow-up: nine months. Outcomes Number of hip fractures. Falls. Compliance of wearing the protectors. Results 1.Incidence of hip fractures, randomised by individual patient, hip pads n=3/40 vs n=6/31 control. RR 0.39 [0.11, 1.43].	B* Additional information supplied by authors via email.
Ekman 1997	The selection of one nursing home for study was stated as being 'randomised'. This home's residents were offered external hip protectors and the incidence of hip fracture compared with three 'control' homes.	744 residents of four nursing homes in Uppsala, Sweden. Mean age: 84 years. Proportion male: not stated.	Allocation to wear hip protectors or not (control group). Type of protector was JOFA AB, Malung, Sweden. No special fixation method was used.	Length of follow-up: 11 months. Outcomes Number of hip fractures. Mortality. Falls. Compliance of wearing the protectors. Results 1.Incidence of hip fractures, randomised by unit or nursing home, hip pads n=4/302 vs n=17/442 control. RR 0.34 [0.12, 1.01].	C*

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Harada 2001	Randomised by the room or ward number.	164 residents of a nursing home in Japan. Mean age: 83.2 years. All female.	Allocation to wear hip protectors or not (control). Hip protectors - Safehip, Denmark.	Length of follow-up: 19 months. Outcomes Number of hip fractures. Number of other fractures. Number of falls. Compliance with wearing the protectors. Results 1.Incidence of hip fractures, randomised by unit or nursing home, hip pads n=1/88 vs n=8/76 control. RR 0.11 [0.01, 0.84]. 2.Incidence of pelvic fractures Hip pads n= 0/88 vs n=0/76 control. 3.Incidence of other fractures, hip pads n=2/88 vs n=0/79 control. RR 4.33 [0.21, 88.74].	C* Bone density was measured in all patients by ultrasonic evaluation of the calcaneal bone. Additional information supplied by the authors on method of randomisation and that no patients were excluded after allocation.
Hubacher 2001	Randomised trial of 20 nursing homes. For half of these homes randomisation of each participant was by 'computer'; for the other half the head of the nursing home randomised fall prone residents in 'random order'. New patients to the home were assigned in order of their entry	548 residents of 20 nursing homes in Zurich, Switzerland. Mean age: 85.5 years. Proportion male: 22%.	Allocation to wear hip protectors or not (control group). Type of protector was Safehip, Denmark.	Length of follow-up: 10 months. Outcomes Number of hip fractures Number of pelvic fractures. Number of other fractures. Falls. Compliance of wearing the protectors. Adverse effects of the protectors. Results 1.Incidence of hip fractures, randomised by individual	Additional information supplied by trialists.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

	(even to the hip protector group, odd to the control group).			patient, hip pads n=7/384 vs n=2/164 control. RR 1.49 [0.31, 7.12]. 2.Incidence of pelvic fractures Hip pads n= 1/384 vs n=0/164.	
Study	**Methods**	**Participants**	**Interventions**	**Results**	**Quality (allocation concealment) & Comments**
Hubacher 2001 cont.				control. RR 1.29 [0.05, 31.40] 3.Incidence of other fractures, hip pads n=7/384 vs n=3/164 control. RR 1.00 [0.26, 3.81]	C*
Jantti 1996	Randomised trial by the opening of sealed envelopes for each patient in the study.	72 residents of a municipal old people's home in Tampere, Finland. Mean age: groups 85.5/84 years (range 71-96). Proportion male: 11%.	Allocation to wear hip protectors or not (control group) Hip protectors used were designed by first named author of study. Consisted of pants with pockets which contain a 2 cm thick pad of closed-cell polyethylene foam measuring 20 cm by 15 cm.	Length of follow-up: 12 months. <u>Outcomes</u> Number of hip fractures. Compliance of wearing the protectors <u>Results</u> 1.Incidence of hip fractures, randomised by individual patient, hip pads n=1/36 vs n=5/36 control. RR 0.20 [0.02, 1.63]. 2.Incidence of pelvic fractures Hip pads n= 0/36 vs n=2/36 control. RR 0.20 [0.01, 4.03]. 3.Incidence of other fractures, hip pads n=0/36 vs n=0/36 control. 4. Mortality, hip pads n=6/36 vs n=8/36 control. RR 0.75 [0.29, 1.94].	B* By the end of the one-year observation period, 33 participants had been lost through death or permanent hospitalisation.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Kannus 2000	Treatment units (number not reported) within 22 community based health care centres were randomised by an independent physician using sealed envelopes to either receive the protectors or to act as a control group. Ratio of protector to control group 1:2.	1,801 users of 22 community based health care centres in southern and central Finland. Each centre had treatment units consisting of long-stay facilities or outpatient care units for supporting living at home. Mean age: 81/82 years. Proportion male: 23/21%. Inclusion criteria: ambulatory; aged 70 years or above; at least one identifiable risk factor for hip fracture (previous fall or fracture, impaired balance or mobility, use of walking aids; cognitive impairment; impaired vision; poor nutrition; or a disease or medication known to predispose people to falls and hip fractures). The patients in the protector group were, on average, one year younger (81 versus 82 years, p=0.006), of lower weight (63.1kg versus 65.5 kg, p<001), lower body mass index (24.3 versus 25.1, p<0.001), more likely to have dementia (33% versus 26%, p=0.001), more likely to have a previous stroke, bleeding, or related central nervous system condition (21% versus 15%, p=0.002), more likely to have impaired mental status (p<0.001) and were more likely to have a history of previous falls (p<0.001).	Allocation to wear hip protectors or not (control group) Type of protector was KPH hip protector, Respecta, Helsinki. Hip protectors were fixed in pockets in special underwear.	Length of follow-up: 611 person-years (mean 0.94 years per individual) in the protector group and 1,458 person-years (mean 1.27 years per individual) in the control group. <u>Outcomes</u> Number of hip fractures. Number of pelvic fractures. Number of other leg fractures. Number of other fractures. Falls. Compliance of wearing the protectors. Adverse effects of the protectors. <u>Results</u> 1.Incidence of hip fractures, randomised by unit or nursing home, hip pads n=13/653 vs n=67/1148 control. RR 0.34 [0.19, 0.61]. 2.Incidence of pelvic fractures Hip pads n=2/653 vs n=12/1148 control. RR 0.29 [0.07, 1.31]. 3.Incidence of other fractures, hip pads n=23/653 vs n=59/1148 control. RR 0.69 [0.43, 1.10].	C* 1,725 elderly adults were eligible for the trial. 204 out of the 650 randomised to the protector group and 94 out of 1,075 randomised to the control refused to participate. Further dropouts in the protector group were deaths (51 cases), became unable to walk (58), had a hip fracture (13), refused to continue (71) or other reasons (26). In the control group drop outs were deaths (137 cases), became unable to walk (108), had a hip fracture (67), refused to continue (90) or other reason (36). To replace the dropouts, eligible adults were recruited from the waiting list over the study period (207 in the protector group and 167 in the control group). Additional information supplied by trialists.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

Study	Methods	Participants	Interventions	Results	Quality (allocation concealment) & Comments
Lauritzen 1993	Randomised trial by drawing a number to allocate 10 out of 28 wards of a nursing home to receive protectors.	665 residents of a nursing home in Copenhagen, Denmark. All aged above 69 years. Proportion male: 30%.	Allocation to wear hip protectors or not (control group). Hip protectors used consisted of a outer shield of polypropylene and an inner part of Plastazote. Hip protectors were fixed in special underwear (Safehip, Denmark).	Length of follow-up: 11 months. <u>Outcomes</u> Number of hip fractures. Number of other fractures. Falls (subgroup). Compliance of wearing the protectors (subgroup). <u>Results</u> 1.Incidence of hip fractures, randomised by unit or nursing home, hip pads n=8/247 vs n=31/418 control. RR 0.44 [0.20, 0.93]. 2.Incidence of pelvic fractures Hip pads n=0/247 vs n=2/418 control. RR 0.34 [0.02, 7.01]. 3.Incidence of other fractures, hip pads n=15/247 vs n=25/418 control. RR 1.02 [0.55, 1.89].	B* Additional information supplied by trialists.
Meyer 2003 Meyer 2003	Randomised 49 clusters, each with more than 70 residents. Nursing homes, or "independently working" wards of a large nursing home randomised using computer generated lists using random permuted blocks of four, six and 10 using external, central telephone.	942 residents of 42 nursing homes with 49 clusters in Hamburg, Germany. Age: 70 or more. Proportion male: 14%. Inclusion criteria: aged 70 or more; not bedridden; living in the nursing home for more than three months.	Allocation of 25 clusters to receive structured education of staff based on social learning theory, 60-90 minute session in small groups, (covered effectiveness of hip protectors, factors known to reduce use, strategies for successful implementation); educational material for residents, relatives and physicians; one nurse from each intervention cluster delivered same education programme to residents individually or in small groups. Nursing staff encouraged to wear hip protectors for these sessions. Free hip protectors provided to intervention groups.	Length of follow-up: 18 months. <u>Outcomes</u> Number of hip fractures. Number of other fractures. Falls. Mortality. Compliance of wearing the hip protectors. <u>Reasons for non-compliance:</u> Hospital admissions. Fall related medical consultations. Quality of life. Costs.	A*

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

cont.			Control: nominated study co-ordinator for each control cluster (n=24) received 10 minute session with information and demonstration of hip protector and	Results 1.Incidence of hip fractures, randomised by unit or nursing home, hip pads n=21/459 vs	
			provided with two free hip protectors for demonstration purposes. Hip protectors (Safehip, Denmark).	n=42/483 control. RR 0.53 [0.32, 0.87]. 2.Incidence of pelvic fractures Hip pads n=1/459 vs n=3/483 control. RR 0.35 [0.04, 3.36]. 3.Incidence of other fractures, hip pads n=38/459 vs n=35/483 control. RR 1.14 [0.74, 1.78].	
van Schoor 2003	Randomised in blocks of four after stratification for sex and age using computer generated random lists.	561 residents of apartment homes, homes for the elderly and nursing homes in Amsterdam, Holland. Mean age: 84.8/85.7 years. Proportion male: 11%. Inclusion criteria: 70 years and over; low bone density and/or high risk for falling (BUA 40 dB/MHz or less; or BUA 40-60 dB/MHz and at least two risk factors for falling; or BUA 60-70 dB/MHz and at least three risk factors for falling). Risk factors for falling were one or more falls in the previous six months; dizziness on standing up from a chair in the last two weeks; sustained a stroke with neurological impairment; urinary incontinence; low physical activity; impaired mobility; cognitive impairment. Exclusion criteria: completely immobile; previous hip fracture; or with a hip prosthesis on both sides.	Allocation to wear hip protectors or not (control). Hip protectors were Safehip, Denmark.	Mean length of follow-up: 69.6 weeks. Outcomes Number of hip fractures. Number of pelvic fractures. Number of other fractures. Compliance of wearing the protectors. Adverse effects of the protectors. Mortality. Falls. Results 1.Incidence of hip fractures, randomised by individual patient, hip pads n=18/276 vs n=20/285 control. RR 0.93 [0.50, 1.72]. 2.Incidence of pelvic fractures Hip pads n=2/276 vs n=3/285 control. RR 0.69 [0.12, 4.09]. 3.Incidence of other fractures, hip pads n=14/276 vs n=11/285 control. RR 1.31 [0.61, 2.84] 4. Mortality, hip pads n=83/276	A* 6.8% of the participants lived in apartment houses for the elderly, often with access to facilities in a home for the elderly nearby.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

				vs n=79/285 control. RR 1.08 [0.84, 1.41].	
Study	**Methods**	**Participants**	**Interventions**	**Results**	**Quality (allocation concealment) & Comments**
Villar 1998	'Randomised' – no details of method given.	141 residents in 31 rest homes in Dorset, UK. Age: range 64 – 98 years. All female. Exclusion criteria: dementia; communication problems; previous pressure sores; general practitioner unwilling to involve participant; dress size 18 or above (no suitable undergarment available).	Allocation to wear hip protectors or not (control). Hip protectors (Safehip, Denmark) made of an outer layer of polypropylene with an inner Plastazote lining were sewn into special underwear.	Length of follow-up: 12 weeks. Outcomes Number of hip fractures. Number of falls on hip. Compliance of wearing the hip protectors. Results Incidence of hip fracture nil.	B* This was a feasibility study set up as a pilot for a randomised trial of hip protectors. The primary aim was to evaluate compliance and reasons for non-compliance.

Other additional studies on compliance with hip protectors

Study	**Methods**	**Settings**	**Participants**	**Intervention**	**Results**	**Quality (allocation concealment) & Comments**
Cameron 2000	Randomised controlled trial that assessed the effect of hip protectors on fear of falling.	Community-dwelling Australian setting.	131 women aged 75 years or more who had two or more falls or one fall requiring hospital admission in the previous year.	The intervention group were issued with hip protectors and were encouraged to use them for two years by a home visiting adherence nurse (approximately monthly visits). Outcomes: fear of falling and falls efficacy. Adherence with the use of the hip protectors was reported, but there was no description of how adherence was measured.	Adherence with the use of hip protectors was described as 'not complete' but only 8% of subjects were completely non-adherent. This adherence rate was reported as being 'higher than reported by others' but there was concern that assessing this outcome only four months into a wear period of two years might not reflect long-term maintenance rates.	The lack of description regarding how adherence was defined and measured is a weakness of the study with regard to the assessment of this outcome. Also, cost was not a consideration for these trial participants, as the hip protector equipment was provided free of charge. This may be a potential barrier to use in non-trial populations.
Pakkari 1998	Before and after study designed to assess the acceptability and	Finnish nursing homes.	19 ambulatory nursing home residents at high risk of fracture. All eligible residents were approached and	Participants were fitted with the hip protectors and staff were given instruction on their use. Caregivers recorded wearing	12/19 (63%) of the eligible residents agreed to use the protector for six months. There were worn on 93% of	No real data was provided to support the conclusions drawn as this observational study

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

	compliance with hip protectors in ambulatory, institutionalised elderly people.		invited to participate.	hours and waking time in research diaries. Attitudes of the study subjects and caregivers were noted.	the subjects' active days, and for 91% of the waking time on those active days (=11 hours/day ± 4). There were mostly positive comments regarding their use by both staff and subjects. The main concern was that the required tight fit reduced the ability for independent toileting. The authors concluded that attitude, education and staff motivation may be factors in achieving good compliance.	had no control group against which the effect of lack of staff motivation or support could be assessed. Hence these conclusions should be considered with caution.
van Schoor 2002	Systematic review of the published literature to assess the determinants of compliance with hip protectors.	No settings specifically stated, presumably all settings included.	Included all types of studies that assessed the use of hip protectors in adults aged 65 years and over. 14 studies were included in the review.	Searched three electronic databases: PubMed, Embase and the Cochrane Library for studies which measured compliance or primary acceptance of hip protectors.	Primary acceptance of hip protectors was low to moderate (37-72%) and compliance with their use ranged from 20-92% in the included studies. Measurement of compliance was often unclear and many difference definitions were used. Most of the included studies were in nursing home settings. Unclear if these compliance results would thus be generalisable to community dwelling populations.	No specific search of Medline. Also did not note which parts of the Cochrane Library were searched, but presumably both the CENTRAL trials register and the Cochrane database of systematic reviews. Two reviewers, but no description of quality assessment or data extraction methods.
Villar 1998	Prevalence study that aimed to assess compliance with the use of hip protectors. It was undertaken as a feasibility study for a planned randomised trial of the efficacy of hip protectors.	31 rest homes in the UK.	101 participants allocated to the intervention arm of the pilot randomised trial. The ages of the participants ranged from 64-98 years. All were women.	Each of the participants was fitted with three pairs of protector pads sewn into specially designed undergarments. Randomly timed fortnightly visits were made to assess compliance for 12 weeks.	27/101 (27%) wore the hip protectors for the full 12 week period. 54/101 women worn the device for less than a week. The reasons for non-compliance were usually poor fit or discomfort. The authors concluded that compliance could be increased with modification	No practical suggestions made to how the comfort and ease of use issues could be overcome whilst still ensuring the necessary firm fit.

Appendix E: Evidence table 10: Hip protectors for the prevention of fracture in older people (reproduced from Parker et al, 2003)

					of the pads and garment to enhance fit, comfort and ease of use.	

Appendix E: Evidence table 11: Hip protectors for the prevention of hip fracture (Reproduced from Parker et al, 2003). Other outcomes were reported in this systematic review and details are given as follows:

1. Incidence of falls
It is unclear whether the use of hip protectors has any impact on the frequency of falls amongst those randomised to their use. Eight studies reported a similar proportion of falls in the protector and control group.
• Cameron (2001) reported 365 falls for 80 individuals in the protector group versus 384 for 80 individuals in the control group. • Cameron (2003) reported 365 falls for 80 individuals in the protector group versus 384 for 80 individuals in the control group. • Ekman (1997) reported 294 for 302 individuals in the protector group versus 531 for 442 individuals in the control group. • Jantti (1996) noted 197 falls for 36 individuals in the intervention group versus 158 for 36 individuals in the control group. • Lauritzen (1993) reported on a subgroup of 116 residents with 45 falls for 45 individuals in the intervention group versus 90 for 71 individuals in the control group. • Harada (2001) reported 131 falls (or 1.37) falls per person for those allocated to protectors against 90 falls (1.09 per person) in the control group. • Chan (2000) reported 191 falls in the 40 allocated to protectors against 101 falls in the 31 controls. • Hubacher (2001) reported a fall rate of 1.16 per person per year in the protector group and 1.21 in the control group. • Meyer (2003) reported no significant difference in the proportion of fallers (mean difference between groups -0.06, 95% CI -0.16 to 0.05) or in the number of falls per resident in each group (mean difference -0.80, 95% CI -1.85 to 0.24). • van Schoor (2003) reported 727 falls in 276 participants in the protector group against 1,075 in the control group. One hundred participants in the protector group had recurrent falls against 114 in the control group.

- Villar (1998) reported a greater but not statistically significant number of individuals suffering falls on the hip in those allocated to hip protectors (8/101 versus 1/40; RR 3.17, 95% CI 0.41 to 24.52).
- Kannus (2000) only reported on falls in the protector group with 1,404 falls occurring in the 653 individuals

2. Mortality

There was no evidence that the use of hip protectors had any effect on mortality.

- Jantti (1996) reported on mortality and morbidity expressed in terms of permanent hospitalisation for both groups. By one-year follow-up, the mortality (6/36 versus 8/36) and incidence of permanent hospitalisation (10/36 versus 9/36) were similar in the two groups.
- Cameron (2001) reported on mortality at 18 months.
- Meyer (2003) reported 157/459 deaths during the study in the protector group against 183/483 in the control group.
- van Schoor (2003) gave the number of deaths during the study period (mean of 69.6 weeks).
- Results for the four individual randomised studies are 150/700 (21.4%) versus 161/707 (22.8%) (RR 0.95, 95% CI 0.78 to 1.15).

3. Compliance

Amongst those who were assigned to their use, compliance with wearing of hip protectors was limited. It is not clear in some trials how compliance was measured but for those that stated the method of measurement, the length of time wearing them was calculated.

- Chan (2000) reported a compliance of 50.3 per cent with dementia given as a reason for non-compliance.
- Ekman (1997) reported an average compliance of 44 per cent, although it is not clear how this was calculated.
- Harada (2001) reported that 17/88 (19%) of those allocated to the protectors refused to wear them. Complete compliance estimated by hours worn was 70 per cent and partial compliance 17 per cent.
- Jantti (1996) stated that, of the 19 participants available at one year, 13 (68%) were still using hip protectors.
- Of the subgroup of 45 individuals allocated to hip pads monitored in Lauritzen (1993), only 11 (24%) wore the protectors regularly.
- In Kannus (2000), 31 per cent of those eligible declined to participate in the study, and a further 71 out of 446 patients discontinued use during the study. Compliance in those who agreed to participate in the study (assessed as the number of days the protector was worn as a percentage of all available follow-up days) was 48 per cent (±29%, range <1 to 100%).
- van Schoor (2003) used random visits to assess compliance. At one month 39 per cent were not compliant with wearing the protectors. This figure had risen to 55 per cent at six months and 63 per cent at one year.
- Hubacher (2001) reported that for 384 allocated to the protector group, 138 were regular wearers, 124 discontinued wearing them and 122 refused to wear them. Even the 138 'regular wearers' only wore the pads 49.1 per cent of the time.
- Birks (2003) gave an overall compliance figure of 34 per cent.
- Cameron (2001) stated total compliance was 57 per cent. At the end of the study only 37 per cent were still regular wearers of the protectors.

- Meyer (2003) reported that the hip protectors were worn by 34 per cent of the intervention group participants.
- Cameron (2003) approached 1,807 potential subjects living in their own homes and 34 per cent of these agreed to participate. By two years, the end of this study, only 33-38 per cent of participants were wearing the protectors all the time.
- In Villar (1998), of the 288 individuals approached only 141 consented to participate. Of the 101 who received the protectors only 27 (27%) wore them throughout the 12 week study period. In a breakdown of the reasons for non-compliance presented by Villar (1998), discomfort and poor fit were the most common reasons for discontinued use.

4. Complications (including skin damage/breakdown)

- Ekman (1997) mentioned that the occurrence of skin irritation was used as a reason for non-compliance.
- Villar (1998) reported three individuals who were unable to tolerate the special undergarments during a heat wave and also mentioned discomfort as the prime reason for non-compliance.
- Kannus (2000) reported skin irritation or abrasion in 15 cases. In addition one person reported the protector caused swelling of the legs and another that it caused bowel irritation.
- Hubacher (2001) reported that aches and pains and an uncomfortable feeling with wearing the protectors was given as a reason for non-compliance.
- Minor skin irritation was reported in Cameron (2001), and Cameron (2003) reported minor skin irritation or infection caused by hip protectors in 16 users (5%).
- Meyer (2003) reported five cases of skin irritation. In addition some of the care homes reported increased dependency of some of the residents at toileting, more difficulty in dressing and discomfort from wearing the protectors.

Appendix F: Quality checklist for qualitative studies on older people's views on falls prevention, willingness and barriers to participation

Article	Clearly focused question	Type of qualitative study	Author's position clearly stated	Sampling strategy described and justified	Adequate description of method of data collection	Procedures for data analysis/ interpretation given	Respondent validation	Claims made for generalisability of findings?	Relevance
Aminzedah & Edwards 1998	Yes	Focus groups	Yes	Yes	Yes	Yes	Yes	Suggest further research	Yes
Ballinger & Payne 2000	Yes	Discourse analysis	Yes	Yes	Yes	Yes	Yes	No	Yes
C'wealth Australia 2000	Yes	'Qualitative approach'	Yes	Unclear	Yes	No	Yes	Yes	Yes
Health Education Board 1999	Yes	Group and in depth interviews	Yes	Yes	Yes	Yes	Unclear	No	Yes
Grossman 2003	Yes	In-depth qualitative interviews	No	Yes	Yes	No	No	No	Relevant to physical activity in general rather than specific to falls.
Kong 2002	Yes	Content analysis	No	Yes	Yes	Yes	Unclear	No	Yes
Porter 1999	Yes	Husserlian phenomenology	No	Yes	Yes	Yes	No	No	Yes
Resnick 1999	Yes	Naturalistic/ constructivist inquiry	Yes	Yes	Yes	Yes	Yes	No	Yes (nursing home residents)
Simpson 2003	Yes	'Qualitative'	No	Yes	Yes	Yes	No	No	Yes
Stead Scotland 1997	Yes	Focus groups	Yes	Unclear	Yes	Yes	No	No	Relevant to exercise in general rather than specific to falls.

Appendix F: Quality assessment results for hip protectors review

1 2 3 4 5 6 7 8 9 10	Total	Study
3 1 1 1 1 0 1 0 1 1	10	Birks 2003
3 1 1 1 1 0 1 1 1 1	11	Cameron 2001
3 1 1 1 1 1 1 1 1 1	12	Cameron 2003
1 0 1 0 1 0 0 1 1 1	6	Chan 2000
0 1 1 1 0 0 0 1 1 0	5	Ekman 1997
0 1 1 1 1 0 1 1 1 1	8	Harada 2001
2 1 1 1 1 0 1 0 1 0	8	Heikinheimo 1996
0 1 1 1 1 0 0 0 1 0	5	Hubacher 2001
0 1 1 1 0 0 1 0 1 1	6	Kannus 2000
0 1 1 0 0 0 0 1 1 0	4	Lauritzen 1993
3 1 1 0 1 0 1 1 1 0	9	Meyer 2003
3 1 1 1 1 0 1 1 1 1	11	van Schoor 2003
1 1 1 0 1 0 0 1 1 1	7	Villar 1998

Appendix F: Interventions for prevention of falls; quality assessment of trial items and possible scores (Gillespie et al, 2003)

Study id	Item A	Item B	Item C	Item D	Item E	Item F
Armstrong 1996	3	3	2	2	1	1
Becker 2003	3	3	1	2	1	1
Buchner 1997	1	3	1	2	1	1
Bischoff 2003	2	3	3	3	3	3
Campbell 1997	3	3	3	3	1	1
Campbell 1999	3	3	3	3	2	2
Carpenter 1990	1	2	1	1	1	1
Carter 1997	3	2	2	2	1	1
Carter 2002	2	2	1	3	1	1
Cerny 1998	2	3	1	1	1	1
Close 1999	2	2	1	3	1	1
Coleman 1999	1	3	1	3	1	1
Cornillon 2002	2	3	1	3	1	1
Cumming 1999	3	3	1	3	1	1
Dawson-Hughes 1997	2	3	3	1	3	3
Day 2002	3	3	1	3	1	1
Donald 2000	2	3	1	3	1	1
Ebrahim 1997	3	2	1	2	1	1
Fabacher 1994	3	2	1	3	1	1
Fiatarone 1997	1	2	1	1	1	1
Gallagher 1996	1	1	1	3	1	1
Gray-Donald 1995	1	3	1	2	1	1
Hogan 2001	3	3	1	3	1	1
Hornbrook 1994	1	1	2	3	1	1
Jensen 2002	3	2	1	3	1	1
Jitapunkul 1998	1	1	1	2	1	1
Kenny 2001	1	2	1	3	1	1
Kingston 2001	1	1	1	2	1	1
Latham 2003	3	3	3	3	3	2
Lightbody 2002	2	2	1	2	1	1
Lord 1995	2	2	1	2	1	1
Mayo 1994	1	3	1	3	1	1
McMurdo 1997	1	2	1	1	1	1
McMurdo 2000	1	2	1	3	1	1
Means 1996	1	2	3	1	1	1
Mulrow 1994	3	2	3	2	2	1
Newbury 2001	3	1	1	1	1	1
Nikolaus 2003	2	3	3	2	1	1
Nowalk 2001	1	2	1	3	1	1
Pardessus 2002	2	3	1	3	1	1
Pereira 1998	1	2	1	1	1	1
Pfeifer 2000	2	2	1	3	3	2
Ray 1997	2	3	3	3	1	1
Reinsch 1992	2	2	1	1	1	1
Robertson 2001	3	3	1	3	1	1
Rubenstein 1990	3	2	1	2	1	1
Rubenstein 2000	2	3	1	2	1	1
Ryan 1996	1	1	1	1	1	1
Sato 1999	2	2	3	3	3	3
Schnelle 2003	2	1	1	3	1	1
Shaw 2003	3	3	3	3	1	1

Steinberg 2000	1	3	1	2	1	1
Stevens 2001	2	3	3	3	3	1
Tideiksaar 1993	1	1	1	1	1	1
Tinetti 1994	2	2	2	3	1	1
van Hastregt 2000	1	2	1	3	1	1
van Rossum 1993	3	3	2	2	1	1
Vassallo 2002	1	1	2	1	1	1
Vellas 1991	1	1	1	2	3	1
Vetter 1992	3	2	1	2	1	1
Wagner 1994	2	2	1	2	1	1
Wolf 1996	2	1	1	3	1	1

Quality assessment scores (continued)

Study id	Item G	Item H	Item J	Item K	Item L
Armstrong 1996	3	3	2	1	2
Becker 2003	1	3	3	3	3
Bischoff 2003	1	3	3	3	2
Buchner 1997	1	3	3	3	3
Campbell 1997	1	2	3	3	3
Campbell 1999	1	3	3	3	3
Carpenter 1990	1	1	1	2	1
Carter 1997	1	3	3	2	3
Carter 2002	3	3	3	3	2
Cerny 1998	1	1	1	1	2
Close 1999	1	3	3	3	3
Coleman 1999	1	2	1	1	3
Cornillon 2002	1	3	1	3	3
Cumming 1999	3	3	3	3	3
Dawson-Hughes 1997	2	3	3	3	3
Day 2002	3	3	3	3	3
Donald 2000	3	3	3	3	3
Ebrahim 1997	2	3	2	2	3
Fabacher 1994	1	3	2	1	3
Fiatarone 1997	3	2	1	2	2
Gallagher 1996	3	3	3	3	2
Gray-Donald 1995	1	3	3	2	2
Hogan 2001	1	3	3	3	3
Hornbrook 1994	1	3	3	3	3
Jensen 2002	1	1	3	3	3
Jitapunkul 1998	1	1	1	2	3
Kenny 2001	1	3	3	3	3
Kingston 2001	1	3	1	1	2
Latham 2003	1	3	2	3	2
Lightbody 2002	3	3	3	3	2
Lord 1995	1	2	3	2	3
Mayo 1994	1	3	3	3	3
McMurdo 1997	3	1	1	2	3
McMurdo 2000	1	3	3	3	3
Means 1996	1	2	1	2	2
Mulrow 1994	2	3	3	3	2
Newbury 2001	1	1	1	1	3
Nikolaus 2003	1	2	3	3	3
Nowalk 2001	3	3	3	3	3
Pardessus 2002	1	3	1	2	3
Pereira 1998	2	3	2	1	3

Pfeifer 2000	2	3	3	2	3
Ray 1997	1	3	3	2	3
Reinsch 1992	1	1	3	2	3
Robertson 2001	2	3	3	3	3
Rubenstein 1990	1	2	2	3	3
Rubenstein 2000	3	3	1	2	2
Ryan 1996	2	2	2	2	2
Sato 1999	1	3	3	2	3
Schnelle 2003	1	3	1	3	2
Shaw 2003	1	3	3	3	3
Steinberg 2000	1	3	3	3	3
Stevens 2001	3	3	3	3	3
Tideiksaar 1993	2	2	2	3	3
Tinetti 1994	1	3	3	3	3
van Haastregt 2000	3	3	1	3	3
van Rossum 1993	2	2	2	2	2
Vassallo 2002	1	1	2	3	3
Vellas 1991	1	2	2	1	2
Vetter 1992	1	2	1	1	3
Wagner 1994	1	2	3	1	3
Wolf 1996	1	3	3	3	2

Appendix G: Hip protectors; characteristics of excluded studies

Study	Reason for exclusion
Becker 2003	This was a randomised trial of 981long stay residents of six nursing homes in Ulm Germany. The homes were randomised (cluster randomisation) to have a multifaceted falls intervention programme (staff and resident education on fall prevention, advice on environmental adaptations, progressive balance and resistance training and hip protectors) or to act as controls. 138 of 509 residents allocated to the intervention group wore the hip protectors, with 108 of them wearing them as per the protocol, which was from arising in the morning to bedtime. 17 hip fractures occurred amongst the 509 allocated to the intervention group, as opposed to 15 hip fractures in the 472 residents in the control group. The study was excluded as it was an evaluation of multifaceted intervention programme and not just hip protectors. It will be reviewed in the Cochrane review on interventions for preventing falls in the elderly.
Jensen 2002	This was a randomised trial with 194 participants in residential care facilities. The facilities were cluster randomised to have a mulitfactorial fall and injury prevention intervention. General: staff education, environmental modification, post-fall staff conferences and ongoing staff guidance. Resident specific: exercises, supply and repair of aids, medication modification, hip protectors. 47/194 participants offered protectors; 34 agreed to wear them. The study was excluded as it was an evaluation of multifaceted intervention programme and not just hip protectors. It will be reviewed in the Cochrane review on interventions for preventing falls in the elderly.
Lauritzen 1996	This study was an open prospective case-cohort study with intervention cases at one hospital and controls from another hospital. It was excluded as it was not a randomised trial.
Ross 1992	This study was a report on assessing the feasibility of wearing hip pads for 30 elderly residents of long-term institutions. The report mentioned there was 'random' allocation of residents to one of six interventions but no numbers of patients in each group were given or outcomes. The individual interventions were not clearly defined. The study was intended as a preparation for a randomised trial. Additional information has been requested from the authors but not provided. The study was excluded because of inadequate information.
Woo 2003	Described as a randomised controlled trial in Current Controlled Trials.com (listed under Hong Kong Health Services Research Fund's contact Prof Johnston). The published article indicated it was a case control study with 302 subjects wearing hip protectors and 352 control subjects. The hip protectors were specially designed for Chinese build and tropical conditions. Mean follow-up was 18.6 + 10.8 days in treatment group. Compliance ranged from 55 to 70%. The relative risk for hip fracture was 0.18 (0.04 to 0.79), relative risk reduction 82% (2 versus 13 cases). The study was excluded as it was not a randomised control trial.
Wortberg 1998	This study involved 84 residents of five nursing homes in Ludenscheid, Germany. 47 were allocated to receive the protectors and 37 residents acted as controls. No fractures occurred for the 91 reported falls in the hip protector group, while seven hip fractures occurred in 28 falls without the protectors. The study was excluded, as there was no randomisation of patients into the two groups.

Appendix G: Interventions for prevention; characteristics of excluded studies

Study	Reason for exclusion
Abreu 1998	Not RCT. Divided into groups by convenience sampling. Intervention: group versus home fall prevention education. Falls outcomes.
Ades 1996	RCT. Intervention: weight training exercise. No falls outcome. Outcome: gait velocity and strength.
Allen 1986	RCT. Intervention: geriatric consultation team. No falls outcome. Outcome: compliance of hospital doctors.
Bean 2002	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.
Binder 1995	RCT. Intervention: exercise programme, randomised to vitamin D or not. Outcome balance. All participants demented. No falls outcome.
Bowling 1992	RCT. Intervention: randomised to nursing home or long stay hospital ward. No falls outcome. Outcomes: accidents, quality of life.
Buchner 1997b	RCT. Intervention: endurance training. MoveIT study. Same control group as included FICSIT study. No falls outcome.
Caplan 1999	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.
Charette 1991	RCT. Intervention: resistance exercise. No falls outcome. Outcome: cross section of muscle fibre.
Cheng 2001	RCT. Intervention: symmetrical standing training and repetitive sit-to-stand training using a standing biofeedback trainer. Falls outcome but all subjects had hemiplegic stroke.
Chin A Paw 2001	RCT. Intervention: exercise and enriched food regimen. Outcome: functional performance. No falls outcome.
Clark 1975	RCT. Exercise intervention. No falls outcome.
Crilly 1989	RCT. Intervention: exercise programme. Outcome: postural sway. No falls outcome.
Crotty 2002	RCT. Intervention: accelerated discharge and home-based rehabilitation after hip fracture. Not intervention to prevent falls; falls recorded but as adverse events.
Deery 2000	Not RCT. Controlled trial. Pre-post intervention analysis. Intervention: fall prevention programme consisting of peer presented education sessions. Falls outcomes.
Fiatarone 1994	RCT. Exercise/ nutritional intervention. No falls outcome. Outcomes muscle strength and mobility, gait, stair climbing and others. FICSIT trial.
Galindo-Ciocon 1995	Not RCT. Pre-post intervention design. Intervention: fall prevention counselling and gait and balance training. Falls outcomes.
Graafmans 1996	Sub-group of RCT testing daily vitamin D versus placebo. 2,578 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 is 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).
Green 2002	RCT. Intervention: physiotherapy for patients with mobility problems more than one year after a stroke. Falls outcomes but all stroke patients and 95% had left or right hemiparesis.
Greendale 2000	RCT. Intervention: use of a weighted vest (no vest, 3% of body weight or 5% of body weight) to be worn two hours per day, four 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.
Hagberg 1989	RCT. Intervention: exercise. No falls outcome. Outcome: new cardiovascular event.
Hall 1992	RCT. Intervention: nurse visit, individualised interventions. No falls outcome. Outcomes: psychological tests, care status.
Hansen 1992	RCT. Intervention: geriatric follow up after hospital discharge. Outcome: admission to nursing homes. No falls

Appendix G: Interventions for prevention; characteristics of excluded studies

	outcome.
Hebert 2001	RCT. Intervention: multifactorial assessment of community dwelling people aged 75 and above. 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.
Hendrich 1988	Not RCT. Hospital prevention plan. Falls outcomes.
Hendriksen 1984	RCT. Intervention: home visits and provision of aids. Outcome: GP visits, hospitalisation. No falls outcome.
Hendriksen 1989	RCT. Intervention: preventive home visits. Outcome: hospitalisation. No falls outcome.
Hofmeyer 2002	RCT. Intervention: training to improve the ability of disabled older adults to rise from the floor. Not fall prevention. No falls outcome.
Holmqvist 1998	RCT. Intervention: early supported discharge after stroke. Not fall prevention. Falls reported as a possible adverse effect.
Hopman-Rock 1999	RCT. Intervention: psychomotor activation programme for cognitively impaired elderly in institutional care. Not fall prevention. Falls monitored as a possible adverse effect.
Hu 1994	RCT. Not fall prevention. Falls artificially induced. Balance parameters measured.
Judge 1993	RCT. Outcome: static balance, muscle strength. No falls outcome.
Kempton 2000	Not RCT. Evaluation of non-randomised community fall prevention programme targeting eight risk factors. Geographical control.
Kerschan-Schindler 2000	Not RCT. Sample selected from controlled trial of home exercise programme. Falls outcomes.
Kilpack 1991	Not RCT. Pre-post intervention design. Nursing intervention. Outcome: falling.
Krishna 1983	Not RCT. Pre-post intervention design. Hospital-based, staff education programme. Outcome: falling.
Kuipers 1993	Controlled study. Pre-post intervention. Hospital-based risk assessment and intervention. Falls outcome.
Kustaborder 1983	Not RCT. Pre-post intervention design. Hospital-based. Outcome: accidents (not just falls).
Lamoureux 2003	RCT. Intervention: progressive resistance. Outcome: strength assessed using an obstacle course. No falls outcome.
Latham 2001	RCT. Hospital-based. Intervention: progressive resistance strength training. No falls outcome. Outcome: strength, gait speed, timed ‘up-and-go’, balance (Berg).
Lauritzen 1993	RCT. Intervention: hip protectors. Hip fracture outcome.
Lawrence 1992	Not RCT. Case series. Nursing intervention. Outcome: falling.
Lichtenstein 1989	RCT. Exercise intervention. No falls outcome. Outcome: balance and sway
Lord 1996a	RCT. Exercise intervention. No falls outcome. Outcome: gait related.
Lord 1996b	RCT. Exercise intervention. No falls outcome. Outcome: balance related.
MacRae 1996	Not RCT. Pre-post intervention. Walking programme for nursing home residents. Falls monitored as possible adverse events.
McCabe 1985	Not RCT. Nursing intervention. Falls outcomes.
McEwan 1990	RCT. Intervention: screening programme by nurses with general assessment. Outcome: health indices, ADL, morale. No falls outcome.
McMurdo 1993	RCT. Intervention: exercise. Outcome: sway, depression, ADLs, chair to stand time. No falls outcome.
Mills 1994	RCT. Low intensity aerobic exercise. No falls outcome.

Appendix G: Interventions for prevention; characteristics of excluded studies

Mohide 1988	RCT. Intervention: quality assurance programme in nursing homes. No falls outcome. Outcome: hazardous mobility and constipation.
Morganti 1995	RCT. Intervention; resistance training. Outcome: not falling, strength.
Morton 1989	Not RCT. Falls prevention programme. Hospital.
Naso 1990	RCT. Exercise intervention. No falls outcome. Outcome: 'training effect'.
Nichols 1993	RCT. Intervention: resistance training. No falls outcome. Outcome: strength.
Obonyo 1983	Not RCT. No untreated group. Falls outcomes.
Pathy 1992	RCT. Intervention: postal health screening by questionnaire. Outcome: mortality, quality of life, health service use. No falls outcome.
Plautz 1996	Not RCT. Pre-post intervention design. Falling outcome.
Ploeg 1994	RCT. Intervention: safety assessment. No falls outcome. Outcome: safety behaviour changes.
Pomeroy 1999	RCT. Intervention: physiotherapy to improve mobility in demented elderly people. No falls outcome.
Posner 1990	RCT. Intervention: aerobic exercise intervention. No falls outcome. Outcome: new cardiovascular diagnoses.
Poulstrup 2000	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.
Rainville 1984	Not RCT. Pre-post intervention. Hospital fall prevention programme.
Rantz 2001	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.
Reuben 1995	RCT. Intervention: geriatric assessment of hospital patients. No falls outcome. Outcome: functional and health status, mortality.
Robbins 1992	RCT. Balance outcomes. No falls outcome.
Robertson 2001c	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.
Robinson 2002	Not RCT. Controlled study of physiotherapy in community dwelling elderly people, but subjects self-selected to participate in intervention.
Sauvage 1992	RCT. Intervention: aerobic exercise programme. No falls outcome. Outcome: strength, gait, balance.
Schlicht 2001	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.
Schmid 1990	Not RCT (pre-post intervention design). Development of injury risk assessment tool in nursing home patients. Outcome falling.
Schnelle 1996	RCT. Intervention: exercise to improve mobility in physically restrained nursing home residents. No falls outcomes.
Sherrington 1997	RCT. Intervention: home exercise programme. No falls outcome. Outcome: improved mobility and strength, post hip fracture.
Shumway-Cook 1997	Not RCT. Quasi-experimental design. Exercise intervention. Non-equivalent control group. Logistic regression model of fall risk was an outcome, but not actual falls.
Simmons 1996	RCT. Intervention: exercise in water. No falls outcome. Outcome: functional reach as a measure of fall risk.
Sinaki 2002	RCT. Intervention: proprioceptive dynamic posture training in osteoporotic women with kyphotic posture.

Appendix G: Interventions for prevention; characteristics of excluded studies

	Outcome: spinal x-rays, back extensor, hip extensor, knee extensor and grip strength, balance tested by computerised dynamic posturography. No falls outcomes.
Skelton 1999	Not RCT. Pre-post test design. Describes falls management exercise (FaME) Programme and ongoing evaluation study that is not randomised.
Speltz 1987	Not RCT. Pre-post intervention. Hospital. Falls outcomes.
Svanstrom 1996	Not RCT. Quasi experimental, with non-randomised controls. Intervention: environmental risk control. Pre-post intervention design. Outcomes hip fracture (discharge data).
Sweeting 1994	Not RCT. Pre-post intervention. Hospital. Falls outcomes.
Tennstedt 1998	RCT. Intervention: to reduce fear of falling and increase activity levels. Not fall prevention. Falls reported as possible adverse effect.
Thompson 1988	RCT. Exercise intervention. No falls outcome.
Thompson 1996	Not RCT. Pre-post intervention. Environmental risk factor modification. Falls outcomes.
Tideiksaar 1990	Not RCT. Pre-post intervention. Falls outcomes.
Tideiksaar 1992	Not RCT. Community-based survey and falls prevention programme. Qualitative evaluation only. Falls outcomes.
Tinetti 1992	Not RCT. Prospective cohort study. Outcome: injurious falls.
Tinetti 1999	RCT. Intervention: home-based multicomponent rehabilitation after hip fracture. Not intervention to prevent falls; falls recorded but as adverse events.
Topp 1993	RCT. Intervention: resistance training classes. Outcome: change in gait and balance. No falls outcome.
Topp 1996	RCT. Intervention: home-based resistance training. Outcome: change in ankle strength, training intensity, postural control, and gait. No falls outcome.
Tynan 1987	Not RCT. Description of fall and fracture prevention programme.
Urton 1991	Not RCT. Description of falls prevention programme.
von Koch 2000	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.
White 1991	Not RCT. Description of intervention in rehabilitation unit.
Wolf-Klein 1988	Not RCT. Pre-post intervention (multidisciplinary falls clinic). Falls outcomes.
Wolfson 1996	RCT. Intervention: exercise. Outcome: balance, strength and gait velocity. No falls outcome. FICSIT trial.
Yates 2001	RCT. Intervention: multifactorial intervention to reduce fall risk (fall risk education, 10 week exercise programme, nutritional counselling 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.
Ytterstad 1996	Not RCT. Quasi experimental, with non-randomised controls. Pre-post intervention design. Outcomes include falling.

RCT: randomised controlled trial

Appendix G: Assessment tools; excluded studies

Study	Reason for exclusion
Alpini 2001	Detailed evaluation of postural control
Behrman 2002	In-patient
Bergland 2002	Self-reported walking information
Bloem 2000	Stop walking when talking small sample
Cho 1998	Balance performance, small sample
Conley 1999	In-patient
Di Fabio 1997	Small sample
Finlay 1999	Detailed footwear analysis
Goodgold 2001	FR, TUGT, small sample
Gunter 2000	Diagnosing fallers from non-fallers.
Harada 1995	Tool to identify those needing physiotherapy
Jannink-Nijlant 1999	Mobility control subscale of sickness impact profile, small sample
Kemoun 2002	Detailed gait analysis
Krishnan 2002	Reliability study with DGI, small sample

Appendix G: Assessment tools; excluded studies

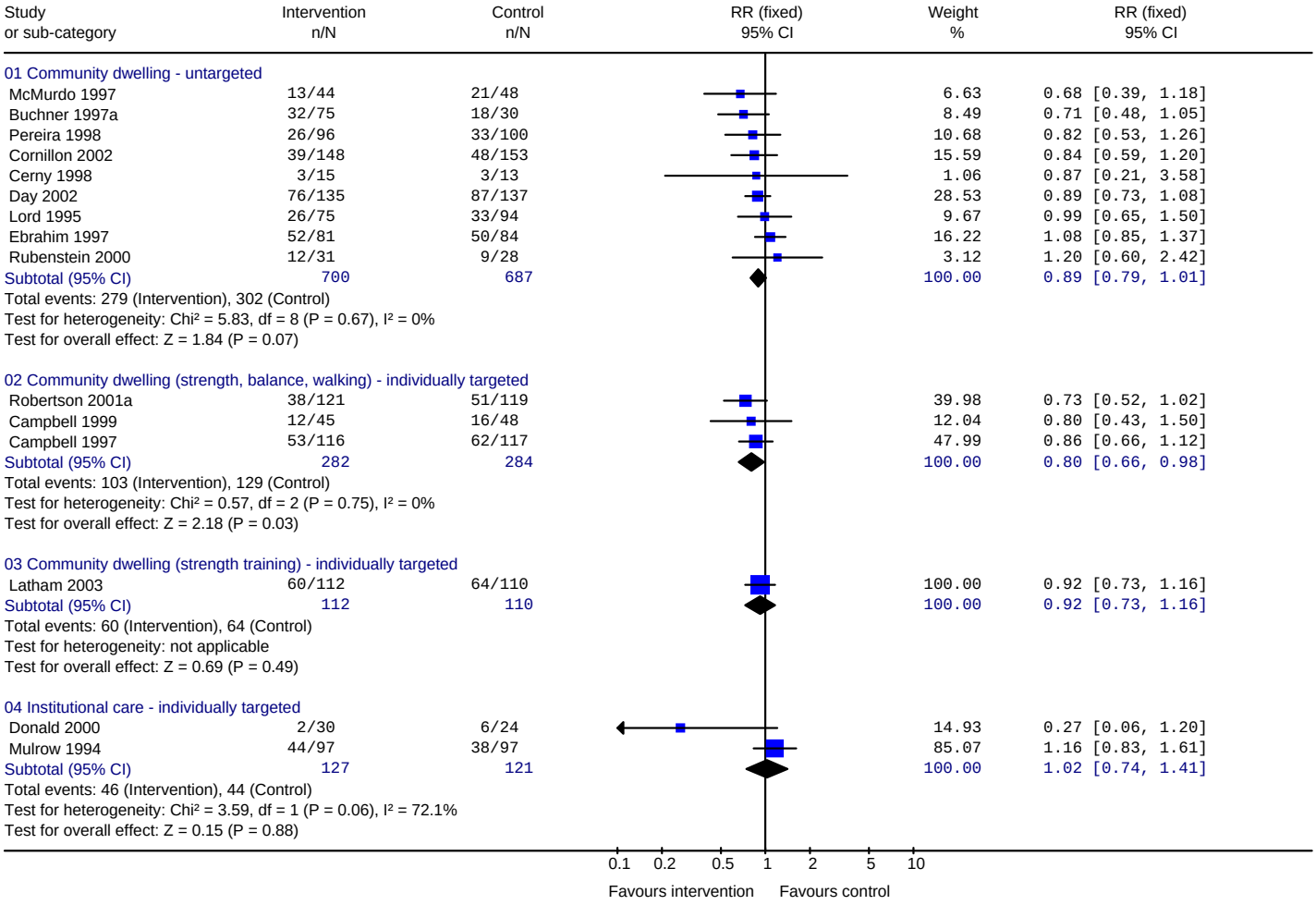
Lajoie 2002	Small sample
Lee 2001	No falls outcome data
Lord 2000	Choice step reaction time, too detailed and not pragmatic
Lundin 2001	Small sample
Maki 2000	Small sample and no falls data
Menz 2001	Footwear analysis
Najafi 2002	Detailed postural transition evaluation
Nyberg 1997	In-patient
O'Brien 1998	Small sample
Simpson 2002	180 degree turn test, no falls data
Thorbahn 1998	Small sample
Thorbahn 1996	Small sample
Van Swearingen 1996	Modified gait abnormality rating scale, small sample
Vassallo 2000	Not enough detail to extract
Verghese 2002	Walking while talking task, detailed attentional resources

Appendix G: Risk factors; excluded studies

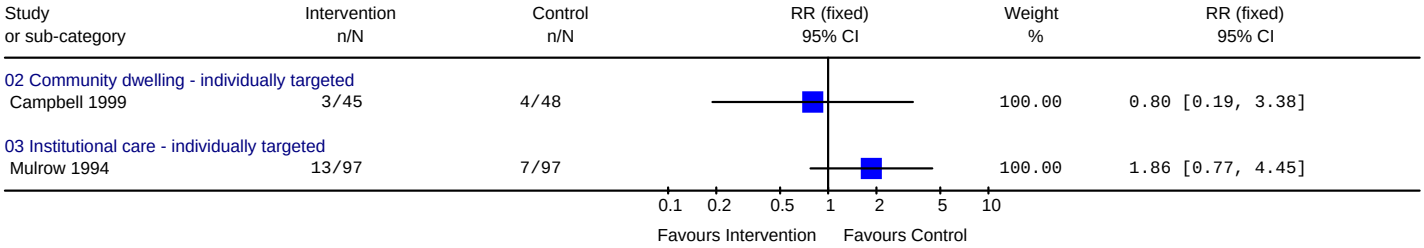
Study	Reason for exclusion
Hale 1992	Small sample
Joo 2002	Small sample
Laird 2001	Outcomes - hospital utilisation
Lipsitz 1994	Cross-cultural case series - fall rates
Lord 1994	Detailed analysis of vision and balance
Lord 2001	Detailed visual factors
Maki 1997	Detailed gait analysis
McCarty 2002	Detailed visual risk factors

Appendix H: Meta-analysis figures (reproduced from Gillespie et al. 2003)

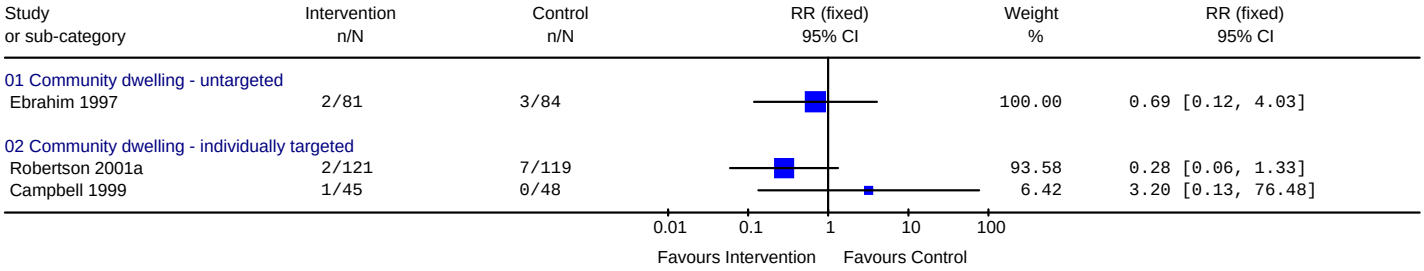
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 01 Number of participants falling



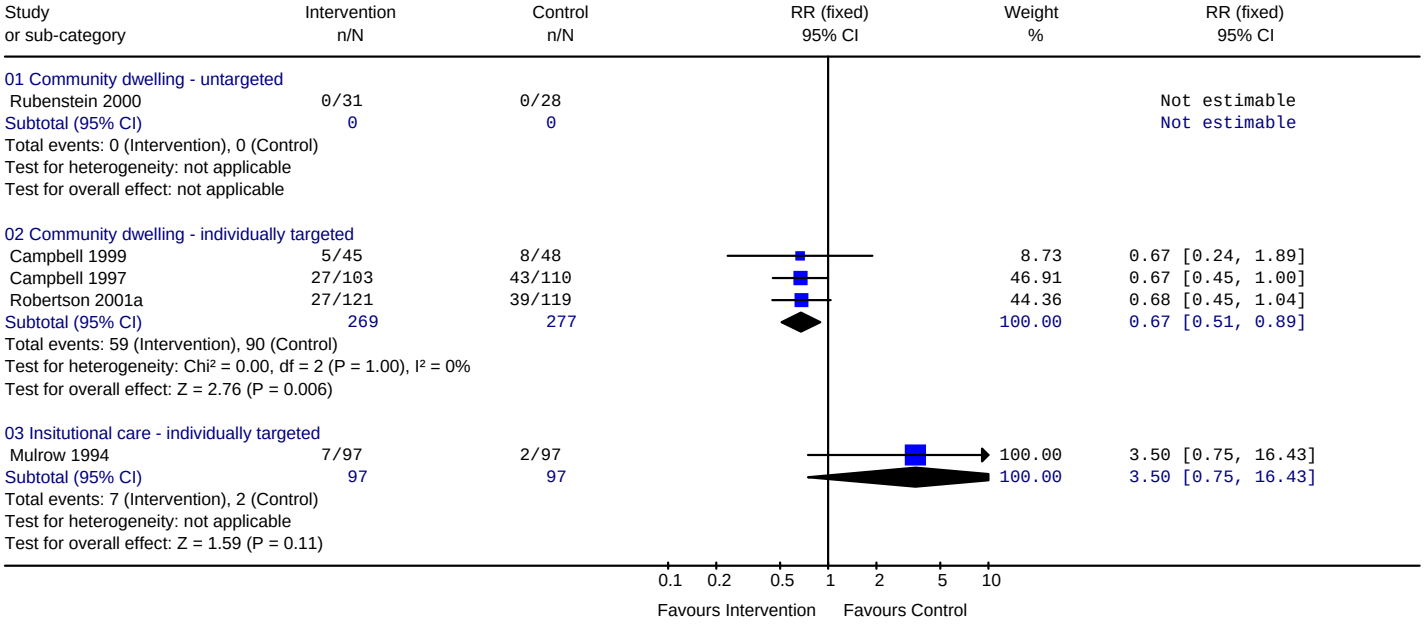
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 02 Number sustaining medical care fall



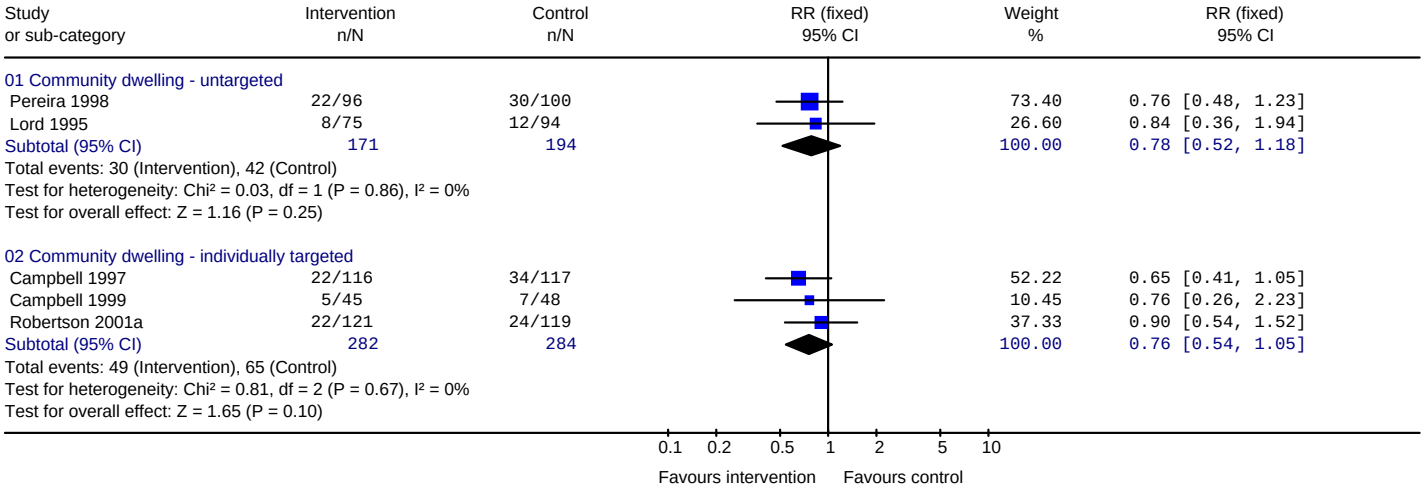
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 03 Number sustaining fracture fall



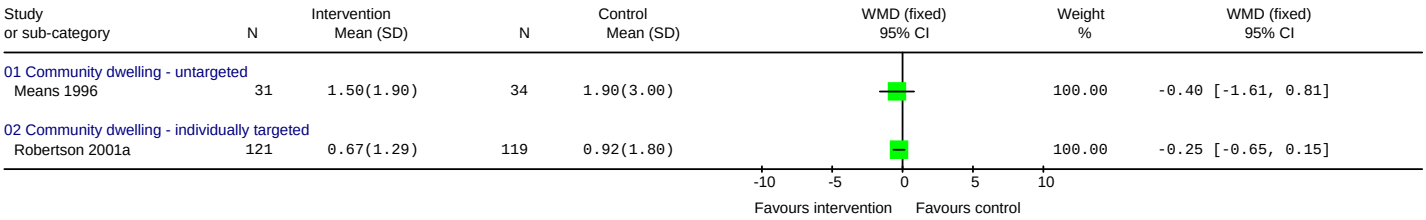
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 04 Number sustaining injury fall



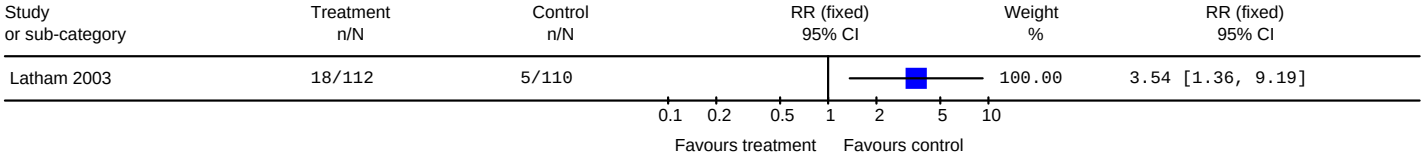
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 05 Number sustaining two or more falls



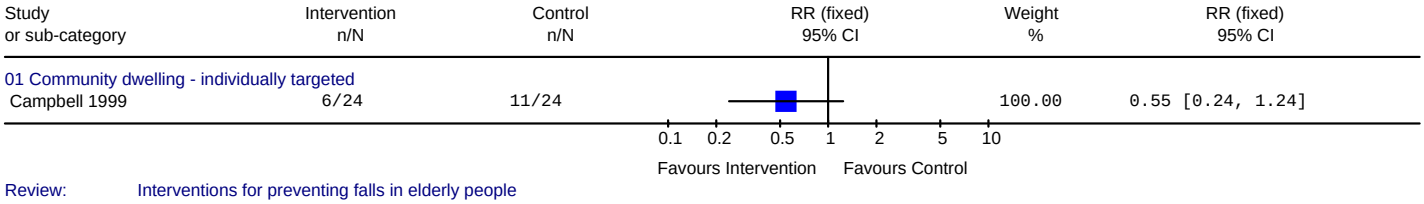
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 06 Mean number of falls



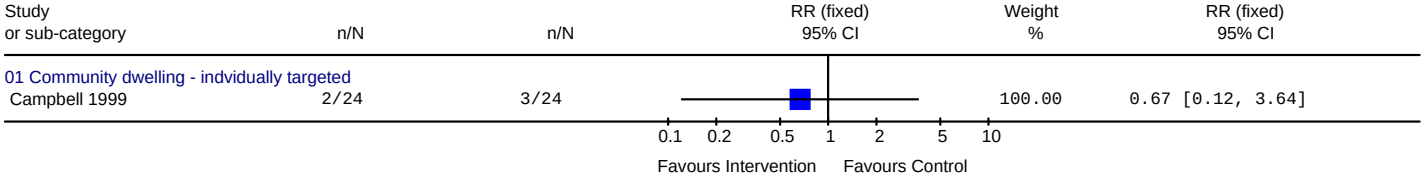
Review: Interventions for preventing falls in elderly people
Comparison: 01 Exercise/physical therapy alone vs control
Outcome: 07 Number sustaining musculoskeletal injury during study



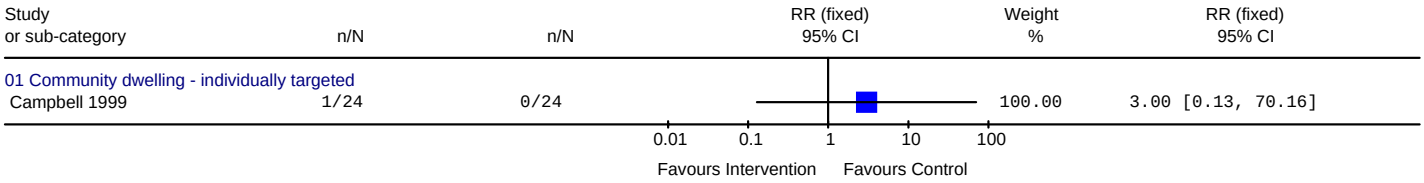
Review: Interventions for preventing falls in elderly people
Comparison: 02 Exercise plus medication withdrawal vs control
Outcome: 01 Number of participants falling



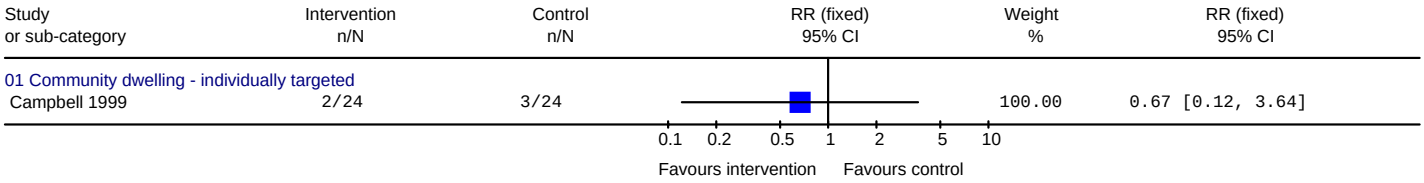
Review: Interventions for preventing falls in elderly people
Comparison: 02 Exercise plus medication withdrawal vs control
Outcome: 02 Number sustaining medical care fall



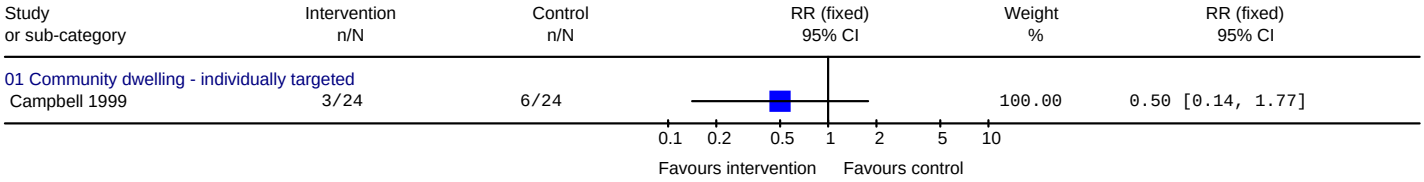
Review: Interventions for preventing falls in elderly people
Comparison: 02 Exercise plus medication withdrawal vs control
Outcome: 03 Number sustaining fracture fall



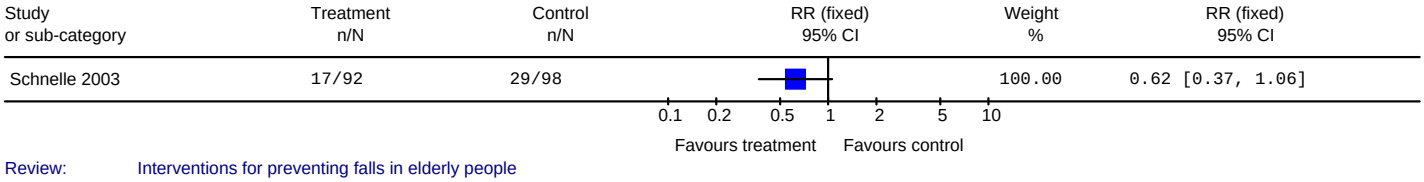
Review: Interventions for preventing falls in elderly people
Comparison: 02 Exercise plus medication withdrawal vs control
Outcome: 04 Number sustaining injury fall



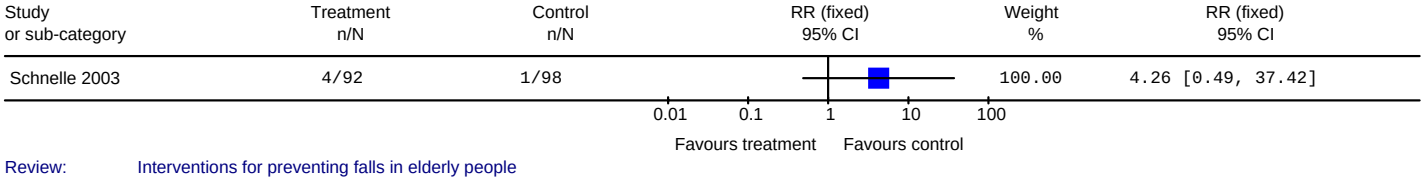
Review: Interventions for preventing falls in elderly people
Comparison: 02 Exercise plus medication withdrawal vs control
Outcome: 05 Number sustaining two or more falls



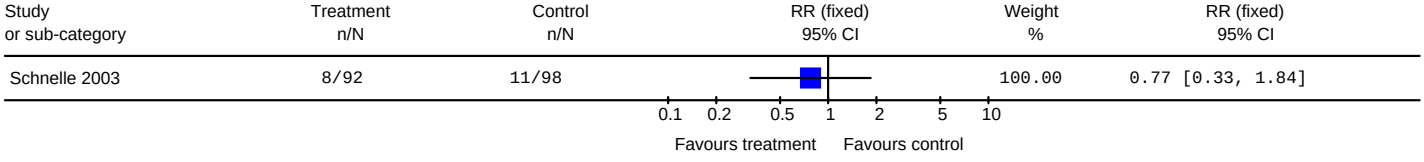
Review: Interventions for preventing falls in elderly people
Comparison: 03 Exercise plus incontinence management vs control
Outcome: 01 Number of participants falling



Review: Interventions for preventing falls in elderly people
Comparison: 03 Exercise plus incontinence management vs control
Outcome: 02 Number sustaining fracture fall

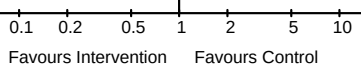


Review: Interventions for preventing falls in elderly people
Comparison: 03 Exercise plus incontinence management vs control
Outcome: 03 Number sustaining injury fall



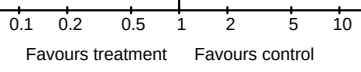
Review: Interventions for preventing falls in elderly people
Comparison: 04 Home safety intervention alone vs control
Outcome: 01 Number of participants falling

Study or sub-category	Intervention n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
01 Community dwelling - no falls in year prior to randomisation					
Cumming 1999	53/161	52/163		23.45	1.03 [0.75, 1.41]
Subtotal (95% CI)	161	163		23.45	1.03 [0.75, 1.41]
Total events: 53 (Intervention), 52 (Control)					
Test for heterogeneity: not applicable					
Test for overall effect: Z = 0.20 (P = 0.84)					
02 Community dwelling - one or more falls in year prior to randomisation					
Cumming 1999	43/103	67/103		30.40	0.64 [0.49, 0.84]
Pardessus 2002	13/30	15/30		6.81	0.87 [0.50, 1.49]
Subtotal (95% CI)	133	133		37.21	0.68 [0.54, 0.87]
Total events: 56 (Intervention), 82 (Control)					
Test for heterogeneity: Chi² = 0.94, df = 1 (P = 0.33), I² = 0%					
Test for overall effect: Z = 3.11 (P = 0.002)					
03 Community dwelling - falling status in prior year undefined					
Day 2002	78/136	87/137		39.34	0.90 [0.74, 1.10]
Subtotal (95% CI)	136	137		39.34	0.90 [0.74, 1.10]
Total events: 78 (Intervention), 87 (Control)					
Test for heterogeneity: not applicable					
Test for overall effect: Z = 1.04 (P = 0.30)					
Total (95% CI)	430	433		100.00	0.85 [0.74, 0.98]
Total events: 187 (Intervention), 221 (Control)					
Test for heterogeneity: Chi² = 6.06, df = 3 (P = 0.11), I² = 50.5%					
Test for overall effect: Z = 2.28 (P = 0.02)					



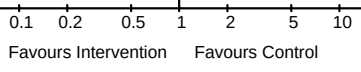
Review: Interventions for preventing falls in elderly people
Comparison: 04 Home safety intervention alone vs control
Outcome: 02 Number sustaining two or more falls

Study or sub-category	Treatment n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
01 Community dwelling - falling status in prior year undefined					
Nikolaus 2003	51/181	61/179		100.00	0.83 [0.61, 1.13]
02 Community dwelling - two or more falls in year prior to randomisation					
Nikolaus 2003	21/53	36/55		100.00	0.61 [0.41, 0.89]



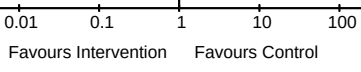
Review: Interventions for preventing falls in elderly people
Comparison: 05 Home safety intervention plus medication withdrawal vs control
Outcome: 01 Number of participants falling

Study or sub-category	n/N	n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
01 High intensity intervention					
Carter 1997	19/133	29/161		100.00	0.79 [0.47, 1.35]
02 Low intensity intervention					
Carter 1997	19/163	29/161		100.00	0.65 [0.38, 1.11]

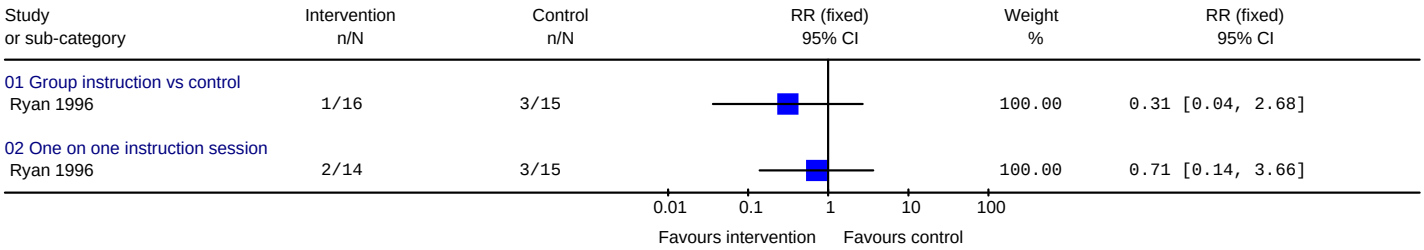


Review: Interventions for preventing falls in elderly people
Comparison: 05 Home safety intervention plus medication withdrawal vs control
Outcome: 02 Number sustaining two or more falls

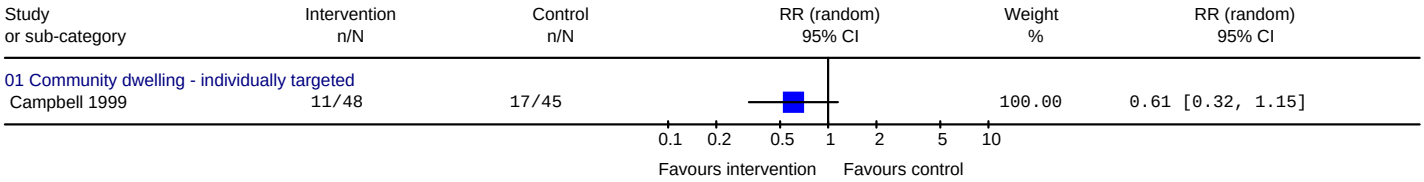
Study or sub-category	n/N	n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
01 High intensity intervention					
Carter 1997	2/133	11/161		100.00	0.22 [0.05, 0.98]
02 Low intensity intervention					
Carter 1997	3/163	11/161		100.00	0.27 [0.08, 0.95]



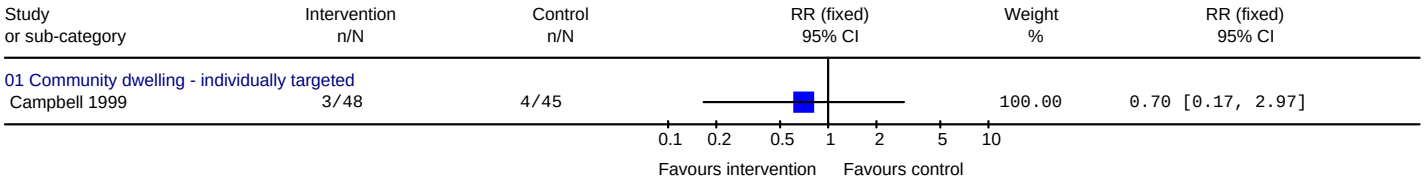
Review: Interventions for preventing falls in elderly people
Comparison: 06 Home safety intervention plus fall prevention classes vs control
Outcome: 01 Number of participants falling



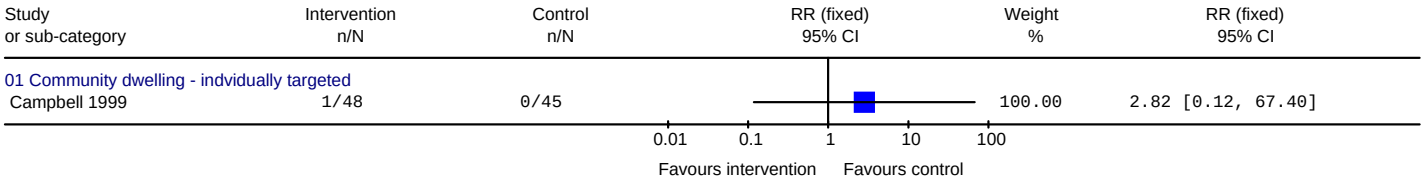
Review: Interventions for preventing falls in elderly people
Comparison: 07 Medication withdrawl vs control
Outcome: 01 Number of participants falling



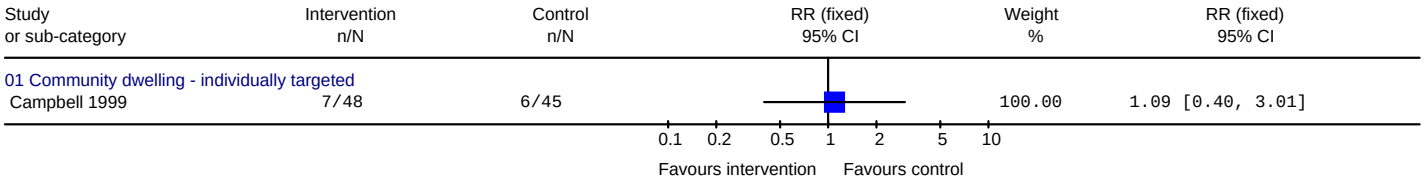
Review: Interventions for preventing falls in elderly people
Comparison: 07 Medication withdrawl vs control
Outcome: 02 Number sustaining medical care fall



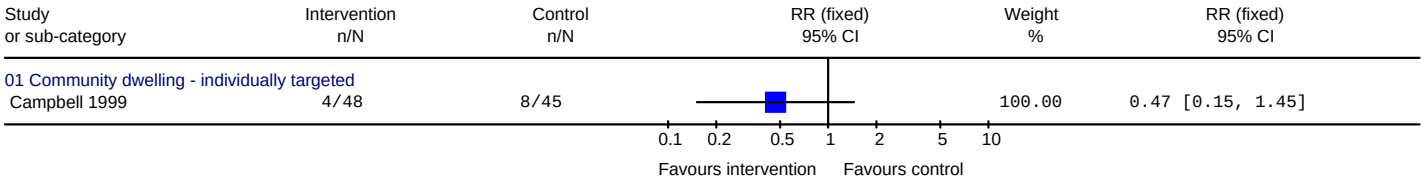
Review: Interventions for preventing falls in elderly people
Comparison: 07 Medication withdrawl vs control
Outcome: 03 Number sustaining a fracture fall



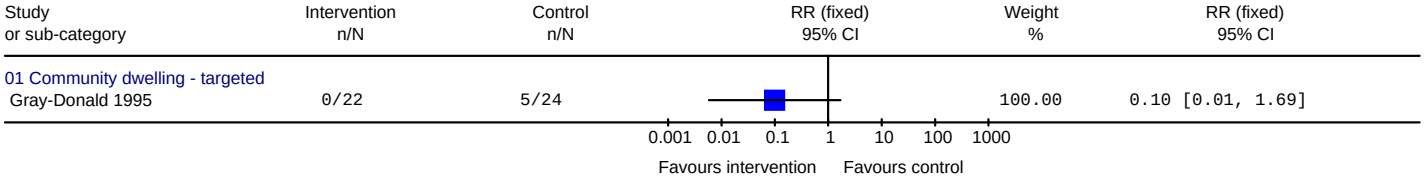
Review: Interventions for preventing falls in elderly people
Comparison: 07 Medication withdrawl vs control
Outcome: 04 Number sustaining an injury fall



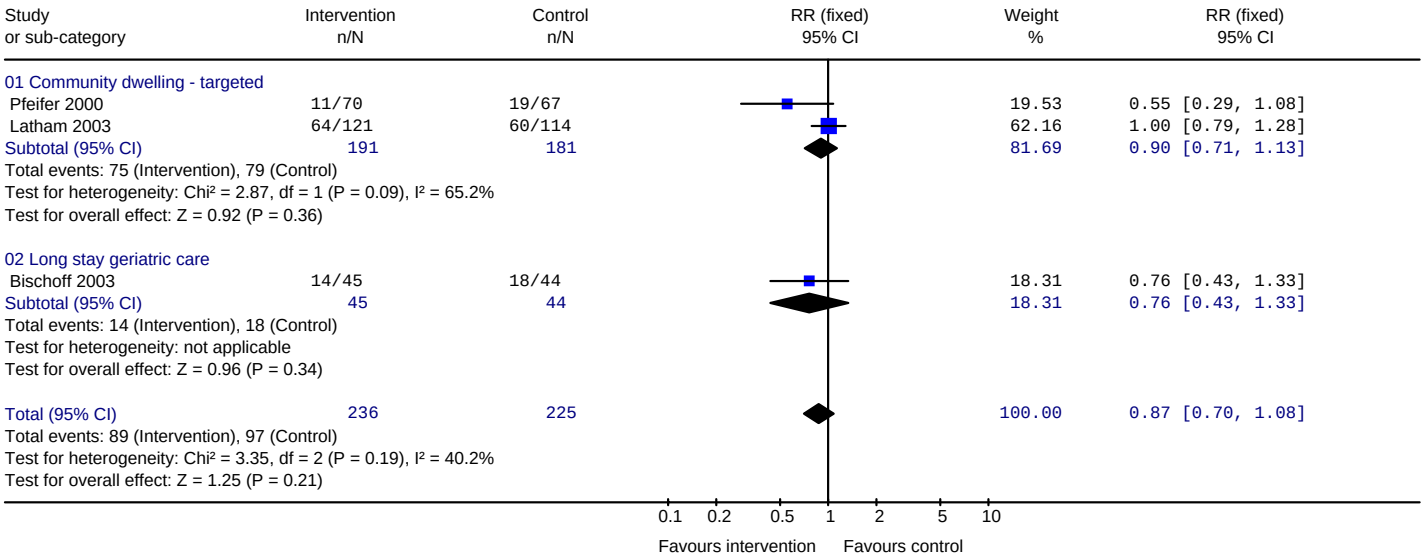
Review: Interventions for preventing falls in elderly people
Comparison: 07 Medication withdrawl vs control
Outcome: 05 Number sustaining two or more falls



Review: Interventions for preventing falls in elderly people
Comparison: 08 Nutritional supplementation vs control
Outcome: 01 Number of participants falling

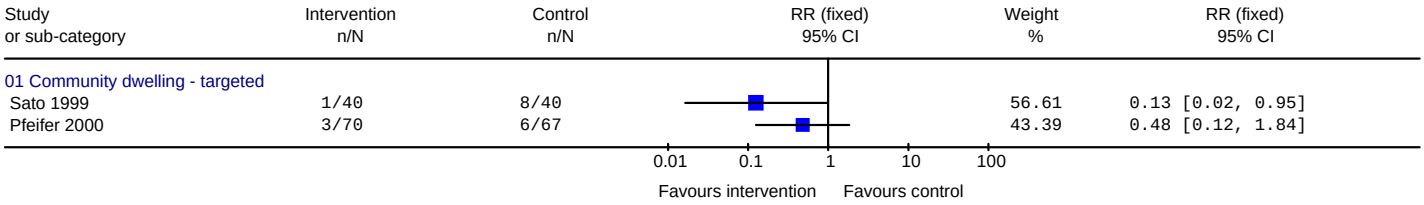


Review: Interventions for preventing falls in elderly people
Comparison: 09 Vitamin D vs control
Outcome: 01 Number of participants falling

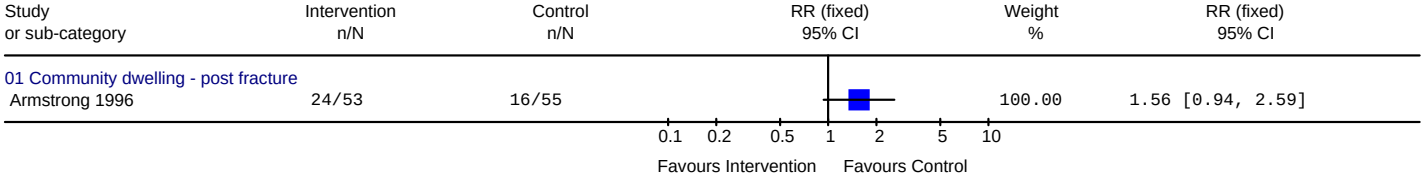


Review: Interventions for preventing falls in elderly people
Comparison: 09 Vitamin D vs control
Outcome: 02 Mean number of falls

Review: Interventions for preventing falls in elderly people
Comparison: 09 Vitamin D vs control
Outcome: 03 Number sustaining fracture fall

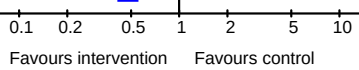


Review: Interventions for preventing falls in elderly people
Comparison: 10 HRT plus calcium vs calcium alone
Outcome: 01 Number of participants falling



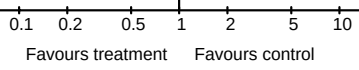
Review: Interventions for preventing falls in elderly people
Comparison: 11 Pharmacological therapies vs control
Outcome: 01 Number of participants falling

Study or sub-category	Intervention n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
Vellas 1991	14/45	28/43		100.00	0.48 [0.29, 0.78]



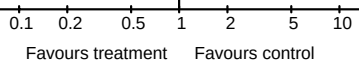
Review: Interventions for preventing falls in elderly people
Comparison: 12 Vision assessment and referral vs control
Outcome: 01 Number of participants falling

Study or sub-category	Treatment n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
Day 2002	84/139	87/137		100.00	0.95 [0.79, 1.14]



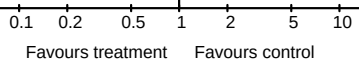
Review: Interventions for preventing falls in elderly people
Comparison: 13 Cardiac pacing vs control
Outcome: 01 Number of participants with syncope

Study or sub-category	Treatment n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
Kenny 2001	22/84	47/87		100.00	0.48 [0.32, 0.73]



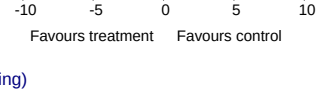
Review: Interventions for preventing falls in elderly people
Comparison: 13 Cardiac pacing vs control
Outcome: 02 Number sustaining fracture fall

Study or sub-category	Treatment n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
Kenny 2001	3/84	4/87		100.00	0.78 [0.18, 3.37]



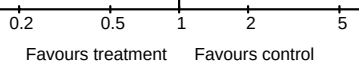
Review: Interventions for preventing falls in elderly people
Comparison: 13 Cardiac pacing vs control
Outcome: 03 Mean number of falls

Study or sub-category	N	Treatment Mean (SD)	N	Control Mean (SD)	WMD (fixed) 95% CI	Weight %	WMD (fixed) 95% CI
Kenny 2001	84	4.10(8.30)	87	9.30(18.10)		100.00	-5.20 [-9.40, -1.00]

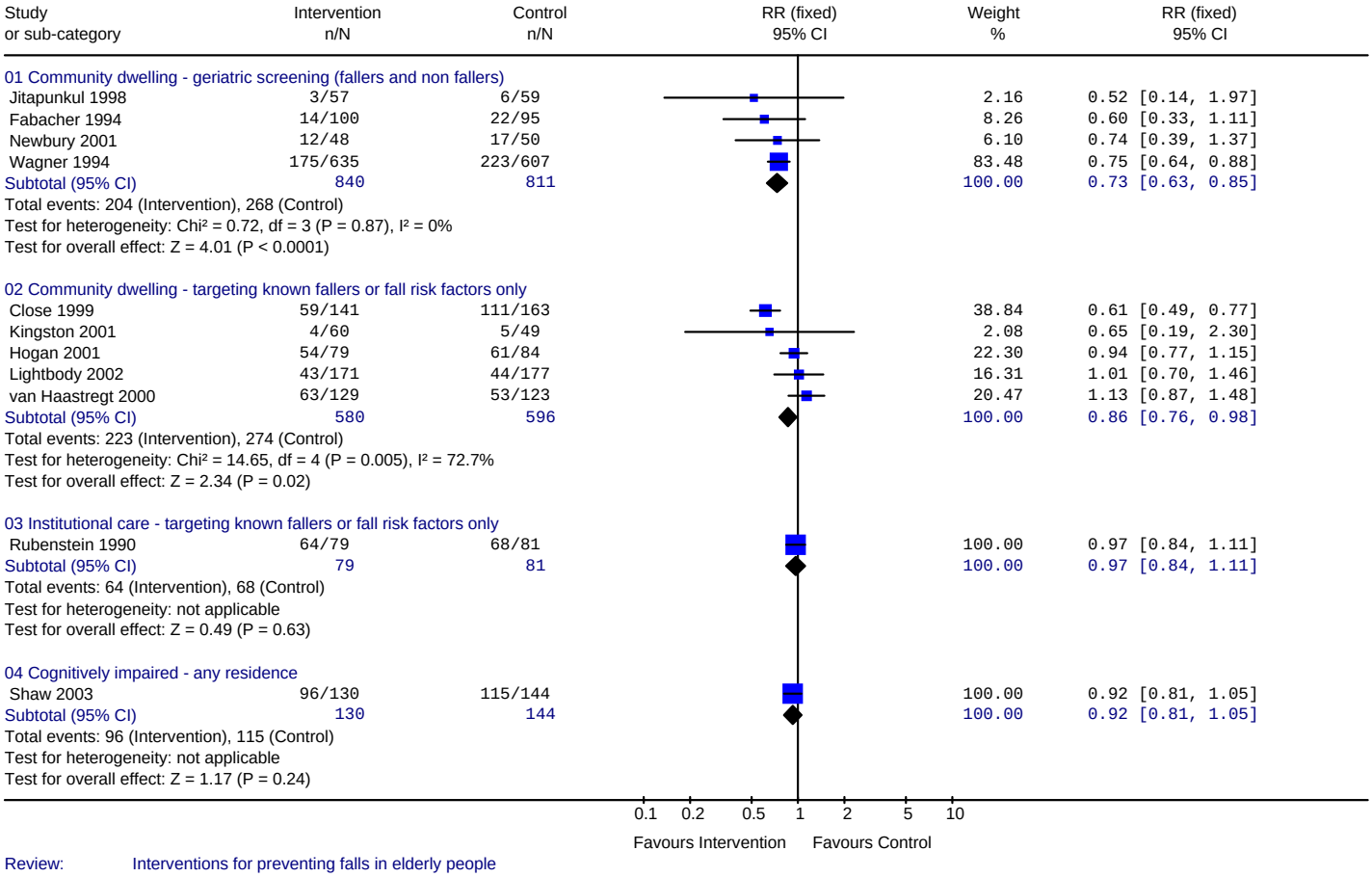


Review: Interventions for preventing falls in elderly people
Comparison: 14 Exercise, visual correction, and home safety intervention (community dwelling)
Outcome: 01 Number of participants falling

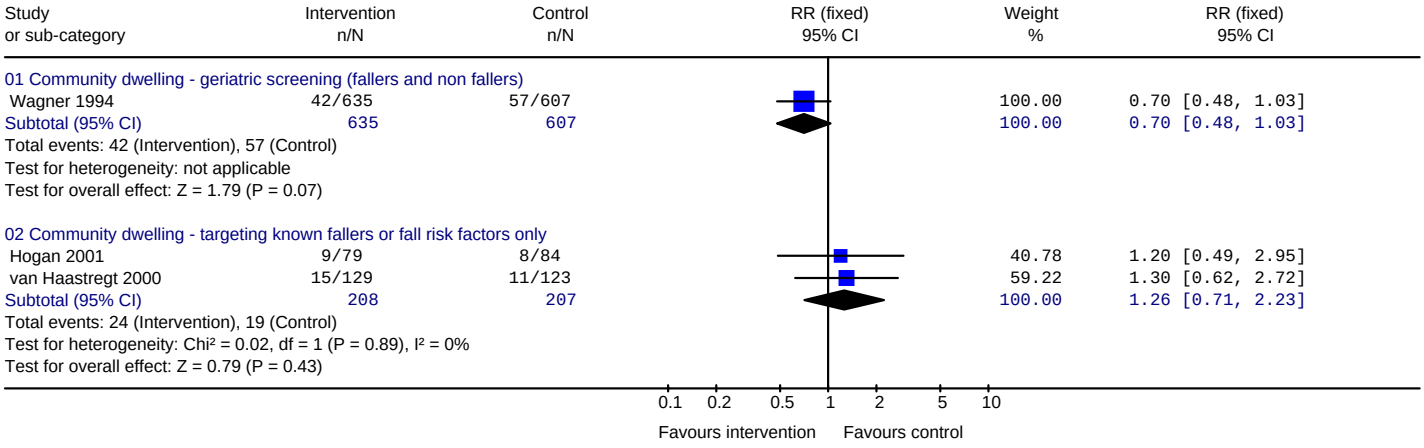
Study or sub-category	Treatment n/N	Control n/N	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI
01 Exercise, visual correction and home safety vs control					
Day 2002	65/135	87/137		100.00	0.76 [0.61, 0.94]
02 Exercise and visual correction vs control					
Day 2002	66/136	87/137		100.00	0.76 [0.62, 0.95]
03 Exercise and home safety intervention vs control					
Day 2002	72/135	87/137		100.00	0.84 [0.69, 1.03]



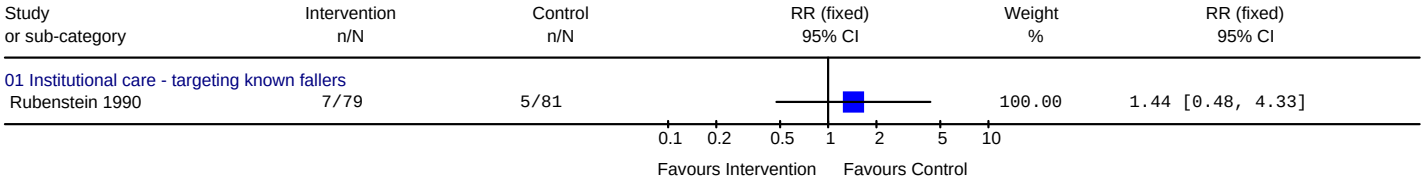
Review: Interventions for preventing falls in elderly people
Comparison: 15 Assessment followed by multifactorial intervention vs control
Outcome: 01 Number of participants falling



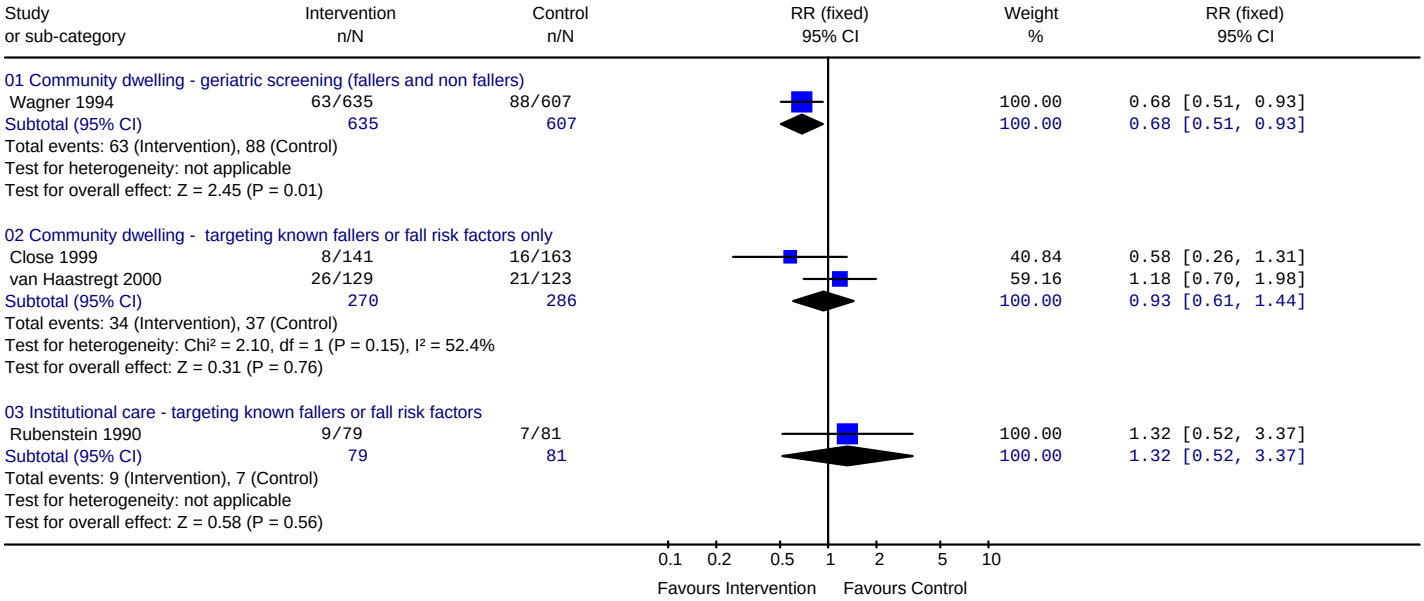
Review: Interventions for preventing falls in elderly people
Comparison: 15 Assessment followed by multifactorial intervention vs control
Outcome: 02 Number sustaining medical care fall



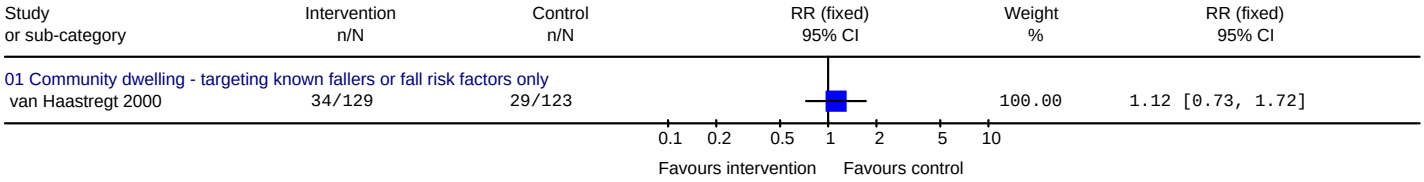
Review: Interventions for preventing falls in elderly people
Comparison: 15 Assessment followed by multifactorial intervention vs control
Outcome: 03 Number sustaining fracture fall



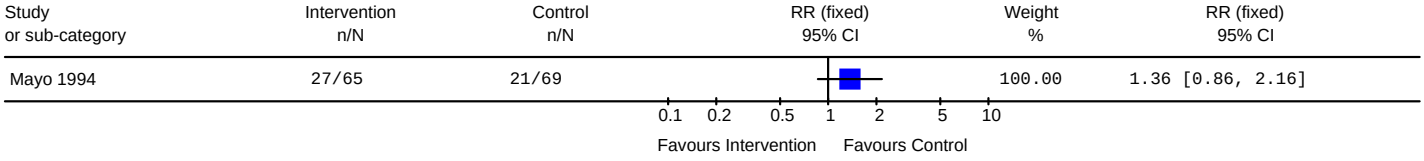
Review: Interventions for preventing falls in elderly people
Comparison: 15 Assessment followed by multifactorial intervention vs control
Outcome: 04 Number sustaining injury fall



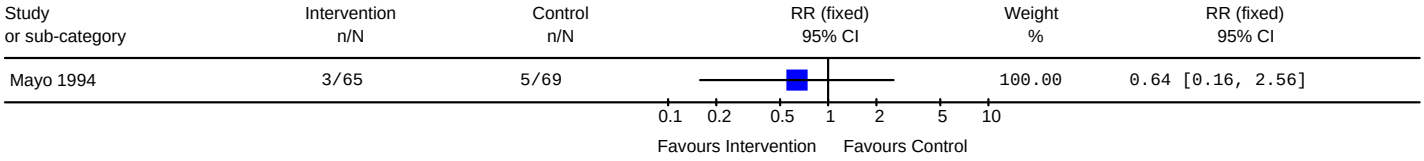
Review: Interventions for preventing falls in elderly people
Comparison: 15 Assessment followed by multifactorial intervention vs control
Outcome: 05 Number sustaining two or more falls



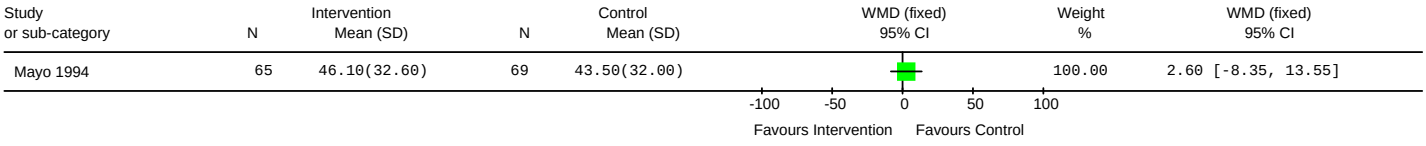
Review: Interventions for preventing falls in elderly people
Comparison: 16 Identification bracelets for high risk hospital patients vs no bracelet
Outcome: 01 Number of participants falling



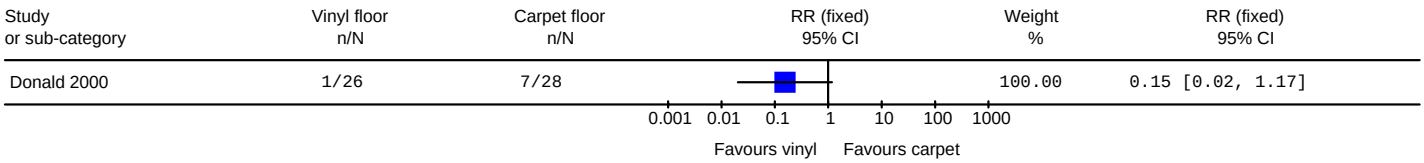
Review: Interventions for preventing falls in elderly people
Comparison: 16 Identification bracelets for high risk hospital patients vs no bracelet
Outcome: 02 Number sustaining injury fall



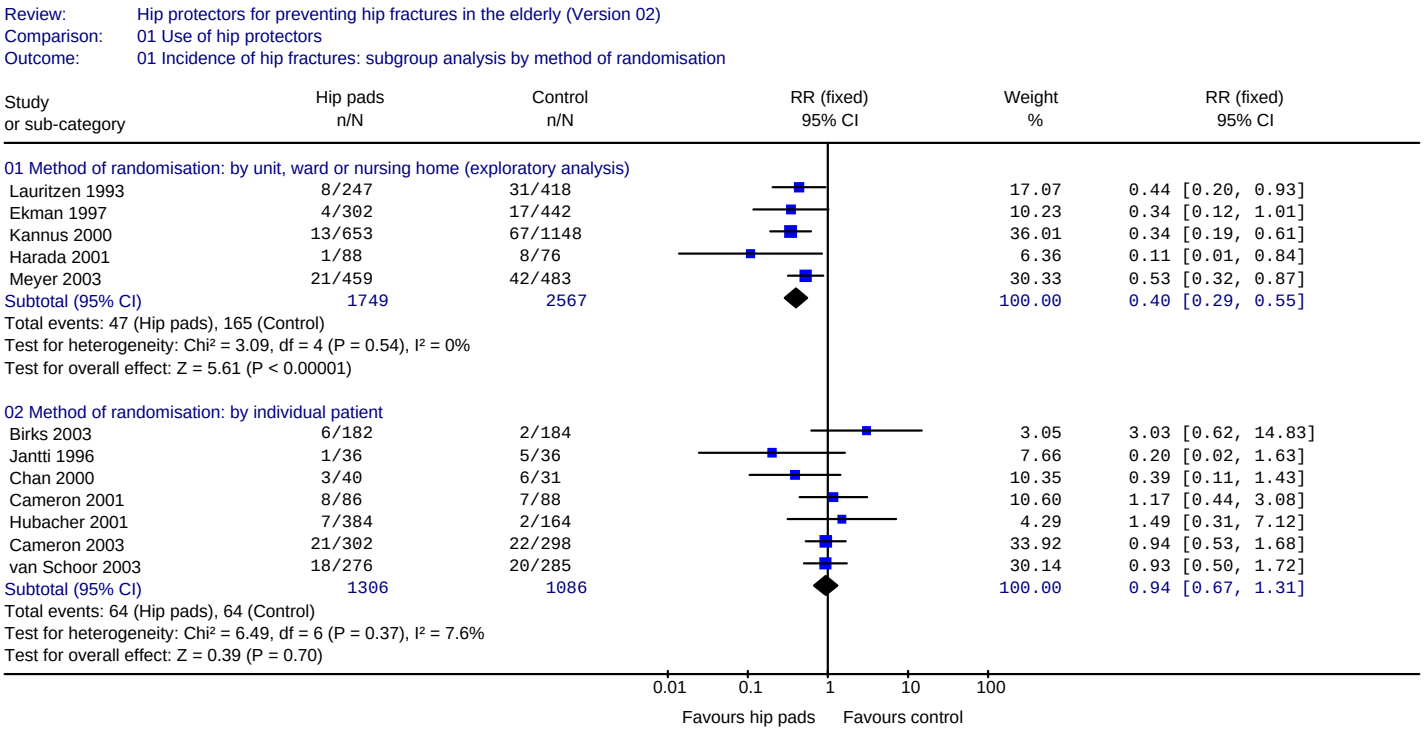
Review: Interventions for preventing falls in elderly people
Comparison: 16 Identification bracelets for high risk hospital patients vs no bracelet
Outcome: 03 Time to first fall

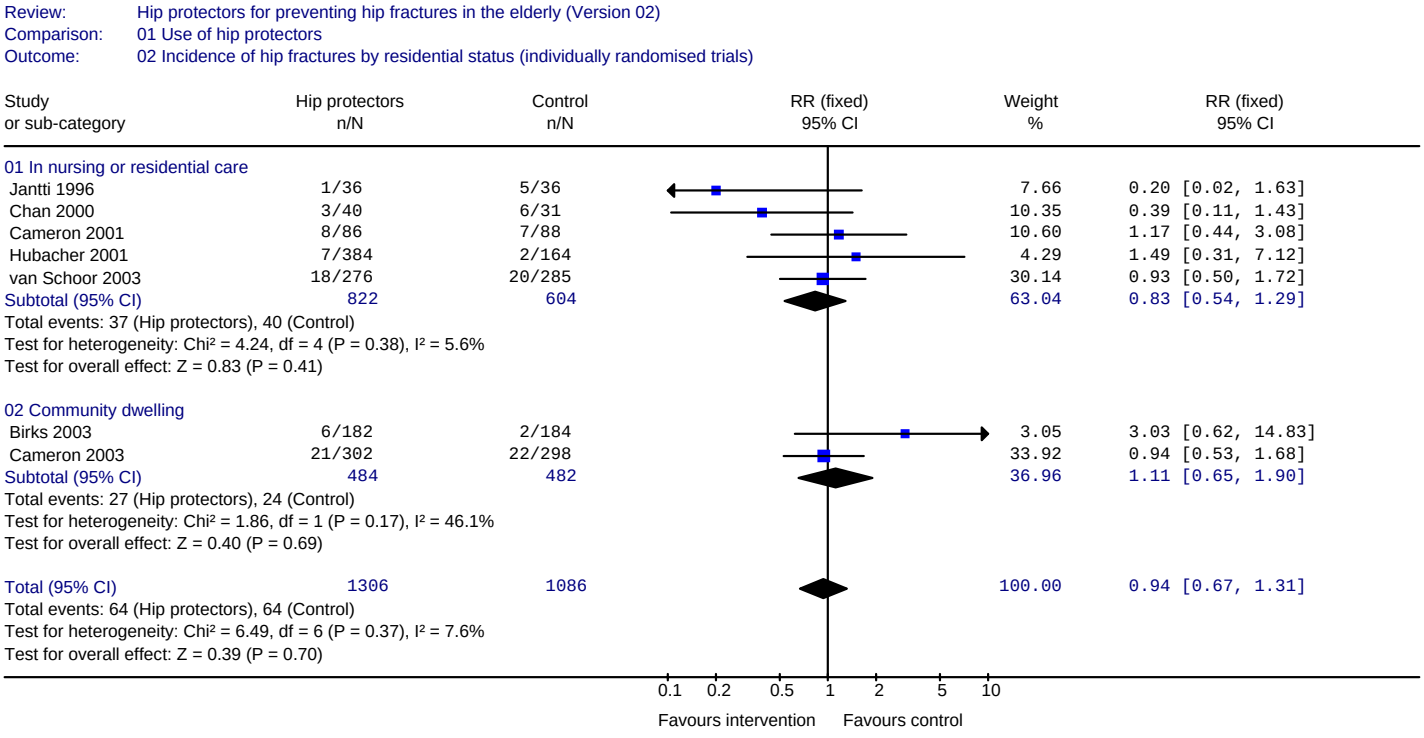


Review: Interventions for preventing falls in elderly people
Comparison: 17 Vinyl vs carpet flooring in rehabilitation wards
Outcome: 01 Number of participants falling

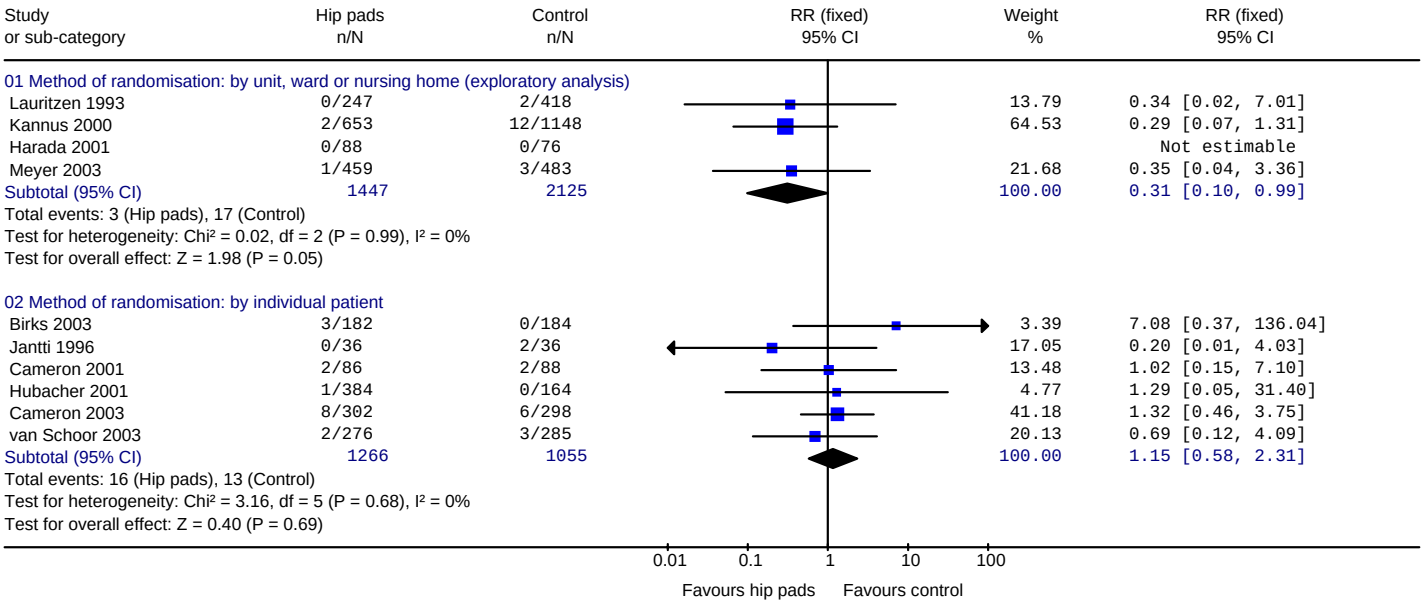


Appendix H: Meta-analysis figures (reproduced from Parker et al. 2003)

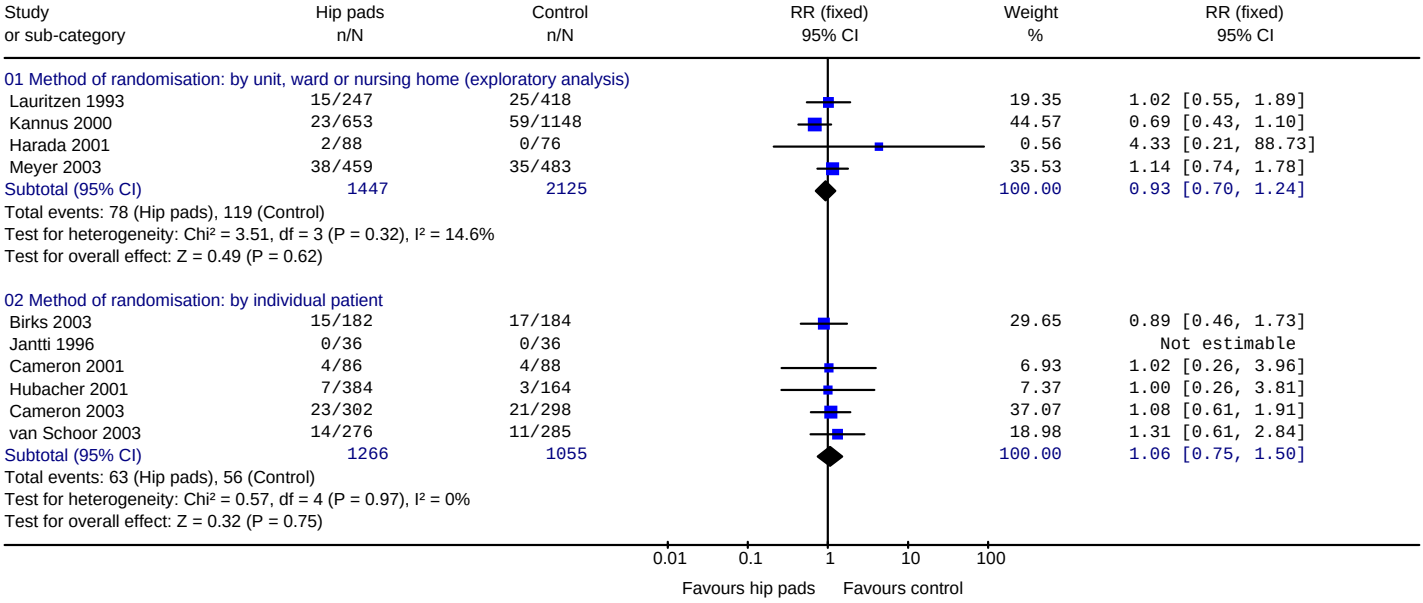




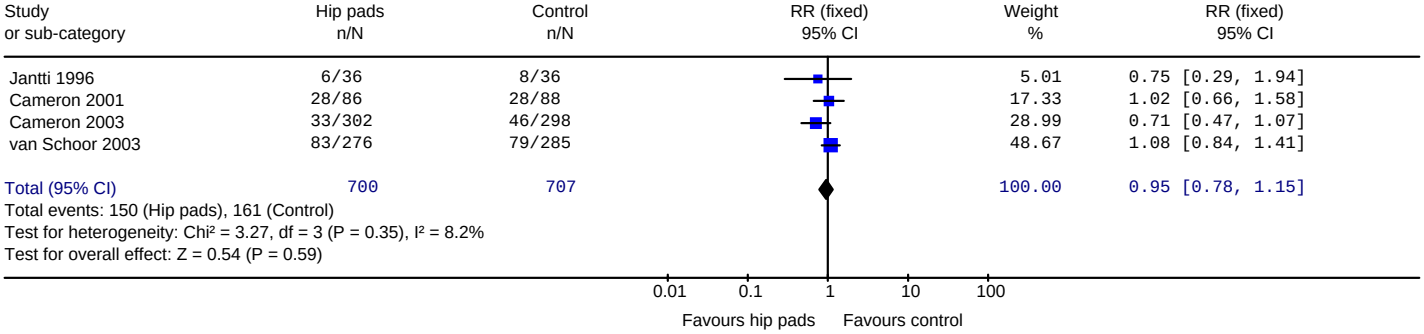
Review: Hip protectors for preventing hip fractures in the elderly (Version 02)
Comparison: 01 Use of hip protectors
Outcome: 03 Incidence of pelvic fractures



Review: Hip protectors for preventing hip fractures in the elderly (Version 02)
Comparison: 01 Use of hip protectors
Outcome: 04 Incidence of other fractures



Review: Hip protectors for preventing hip fractures in the elderly (Version 02)
Comparison: 01 Use of hip protectors
Outcome: 05 Mortality



NATIONAL INSTITUTE FOR CLINICAL EXCELLENCE

SCOPE

1 Guideline title

Falls: assessment and prevention of falls in older people.

1.1 Short title

Falls.

2 Background

a) The National Institute for Clinical Excellence ('NICE' or 'the Institute') has commissioned the National Collaborating Centre for Nursing and Supportive Care to develop a clinical guideline on the assessment and prevention of falls in older people for use in the NHS in England and Wales. This follows referral of the topic by the Department of Health and Welsh Assembly Government (see Appendix). The guideline will provide recommendations for good practice that are based on the best available evidence of clinical and cost effectiveness.

b) The Institute's clinical guidelines will support the implementation of National Service Frameworks (NSFs) in those aspects of care where a framework has been published. The statements in each NSF reflect the evidence that was used at the time the framework was prepared. The clinical guidelines and technology appraisals published by the Institute after an NSF has been issued will have the effect of updating the framework.

3 Clinical need for the guideline

a) Falls are a major cause of disability and the leading cause of mortality resulting from injury in people aged above 75 in the UK. One-third to one-half of people aged above 65 fall each year. Furthermore, more than 400,000 older people in England attend accident and emergency departments following an accident and up to 14,000 people die annually in the UK as a result of an osteoporotic hip fracture (*National service framework for older people,* 2001). Falling, therefore, has an impact on quality of life, health and health care costs.

4 The guideline

a) The guideline development process is described in detail in three booklets that are available from the NICE website (see 'Further information'). *The guideline development process – information for stakeholders* describes how organisations can become involved in the development of a guideline.

b) This document is the scope. It defines exactly what this guideline will - and will not - examine, and what the guideline developers will consider. The scope is based on the referral from the Department of Health and Welsh Assembly Government (see Appendix).

c) The areas that will be addressed by the guideline are described in the following sections.

4.1 Population

4.1.1 Groups that will be covered

The recommendations made in the guideline will cover the care of the following groups:

a) Older people who are at risk of falling or who have fallen.

b) Older people who attend primary or secondary care settings following a fall.

4.1.2 Groups that will not be covered

The following groups will not be covered by this guideline:

a) Hospitalised patients who sustain a fall while in hospital or who may be at risk of falling during hospitalisation. Currently no interventions have been proven to be effective in the prevention of falls in the acute setting.

b) People who are confined to bed for the long-term.

4.2 Health care setting

a) This guideline will make recommendations on the care given by health care professionals who have direct contact with and make decisions concerning the care of older people who have fallen or are at risk of falling.

b) It will also make recommendations on the care given by health care professionals, or carers where applicable, involved in the care of older people who have been taken to hospital following a fall.

c) This is an NHS guideline, but it may also address the interface with other services, such as those provided by social services, secure settings, care homes and the voluntary sector. It will **not** include services exclusive to these sectors.

4.3 Clinical management

a) This guideline will make cost effective recommendations on clinical management based on the best evidence available to the Guideline Development Group.

b) The recommendations will address both the identification and assessment of older people at risk of falling and those who have fallen.

c) The recommendations will also cover interventions for the primary prevention of falls and the management and rehabilitation after falls, such as:

- exercise (including balance training)
- multifactorial interventions (packages of care, for example, exercise, education and home modifications)
- podiatric interventions relating to footwear, mobility and gait
- vision assessment and correction of impaired vision
- home assessment and modification
- patient education
- medication review.

d) Recommendations will also take account of the psychosocial aspects of falling, including fear of falling and loss of confidence resulting from a fall.

e) When referring to pharmacological interventions, the guideline will normally recommend use of the intervention within its licensed indications. Exceptionally, and only where the evidence supports it, the guideline may recommend use outside the licensed indications. The guideline expects that prescribers will use the *Summary of product characteristics* to inform their prescribing decisions for individual patients.

f) The guideline will **not** cover:

- the prevention and treatment of osteoporosis specifically - it is anticipated that this will be the subject of a separate guideline
- the management of hip and other fractures

- the prevention of falls in acute settings.

4.4 Audit support within guideline

The guideline will provide level 2 audit review criteria and advice.

4.5 Status

4.5.1 Scope

This is the final version of the scope.

4.5.2 Guideline

The development of the guideline recommendations will begin in July 2002.

5 Further information

Information on the guideline development process is provided in:

- *The guideline development process – information for the public and the NHS*
- *The guideline development process – information for stakeholders*
- *The guideline development process – information for national collaborating centres and guideline development groups.*

These booklets are available as PDF files from the NICE website (www.nice.org.uk). Information on the progress of the guideline will also be available from the website.

6 Reference

Department of Health (2001) *National service framework for older people*, London: DH.

Appendix – referral from the Department of Health and Welsh Assembly Government

The Department of Health and Welsh Assembly Government asked the Institute:

"To prepare clinical guidelines for the NHS in England and Wales for the assessment and prevention of falls, including recurrent falls in older people; with an associated clinical audit system."

improving practice:
improving care

CLINICAL PRACTICE GUIDELINES

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